



Development of E-Module Based on Problem Based Learning by Using Adobe Flash Professional CS6 on the Material of Human Respiratory and Excretory Systems for Students of Class VIII SMPN 25 Padang

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ABSTRACT: Good results from education must be accompanied by effective learning. Effective learning one of which is influenced by the use of teaching materials. Preliminary investigation data at SMPN 25 Padang show that there is no teaching material in the form of an e-module that can visualize the subject matter as a whole. Based on the results of the questionnaire, it is known that 67.16% of students have difficulty understanding the concepts of the respiratory system and the excretory system. This causes the low learning outcomes for students, so teaching materials are needed that can assist in visualizing the subject matter as a whole. This study aims to produce an e-module based on problem based learning using adobe flash professional CS6 on the material of the human respiratory and excretory systems for students of class VIII that is valid, practical, and effective. This type of research is the Plomp model development research which consists of three phase, namely the initial preliminary research phase, the development or prototyping phase, and the assessment phase. The research subjects are students of class VIII SMPN 25 Padang Academic Year 2021-2022. The research data were obtained from validity, practicality, and effectiveness tests. The validity test data was obtained through a validation sheet by lecturers as validators. Practical test data was obtained from the results of the questionnaire response analysis of teachers and students. Effectiveness test data were obtained from multiple choice question sheets for assessing cognitive competence, observation sheets for assessing affective competence and psychomotor competence, and essay question sheets for assessing students creative thinking skills. The results of validation by validators on the e-module based on problem-based learning show an average value of 86.35% (very valid). The results of the practicality assessment by science teachers showed an average of 90.87% (very practical) and the results of the practicality assessment by students obtained an average value of 89.25% (very practical). The results of the effectiveness test from the cognitive, affective, and psychomotor aspects of students showed that the problem based learning based e-module was very effective and the value of creative thinking skills obtained an average of 74.24 (creative). Thus, it can be concluded that the problem based learning based e-module developed is very valid, very practical, very effective, and can train creative thinking skills.

KEYWORDS: Adobe flash professional CS6, Development, E-module, Problem based learning.

1. BACKGROUND OF THE PROBLEM

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual, religious, self-control, personality, intelligence, morals, and skills needed by themselves, society, nation, and state. Ministry of National Education, 2003). Education is obtained both formally and non-formally through learning activities. So to get good results from education must be accompanied by effective learning.

Effective learning has a very significant influence on producing quality students. Formation of an effective learning process, many factors influence it such as educators, the use of interesting and varied learning methods, student learning behavior, conducive learning conditions, and atmosphere, and the use of appropriate teaching materials (Puspridayanti, et al., 2018).

The use of appropriate teaching materials has an important role in the learning process. The success of teachers and students in achieving learning objectives cannot be separated from the teaching materials used. Learning will take place effectively and efficiently if quality teaching materials are available. One of the teaching materials that can be used in the learning process is a



module. Modules are teaching materials in complete units which consist of a series of learning activities that are structured to help students achieve a learning goal and can provide effective learning outcomes (Rizki, et al., 2020).

Along with the development of technology in the field of education, modules began to be developed in the form of computer/electronic-based learning media, namely e-modules. E-module is an interactive technology, information, and communication-based module to facilitate navigation that can display audio, video, images, and animation and is equipped with evaluation tests that allow for direct feedback (Suarsana & Mahayukti, 2013).

Based on the results of observations, by conducting interviews with Mrs. Lola Hayati Roza, S.Pd. as a science teacher at SMPN 25 Padang on October 16, 2021, it was known that the learning process was still teacher-centered. The learning process uses the lecture and assignment methods, as well as the lack of student creativity such as an attitude of asking questions, doing assignments or exercises, and lack of understanding of concepts. It is proven that as many as 67.16% of students have difficulty understanding the concept of the respiratory system and excretory system material.

Mrs. Lola Hayati Roza, S.Pd. further added that the teaching materials used in the learning process were in the form of textbooks and student worksheets. The teacher has difficulty visualizing the material for the respiratory system and the excretory system as a whole. This is because the respiratory system and the excretory system take place physiologically so it is difficult to explain, while the organs can be observed morphologically. It is proven that as many as 64.18% of students express not being able to understand the subject matter only by reading explanations from textbooks.

The learning process above causes students to tend to only act as recipients of information provided by the teacher. Student learning outcomes are still relatively low. The low learning outcomes of students can be seen from the results of daily test scores for respiratory and excretory system materials that have not reached the minimum completeness criteria (KKM).

Table 1. Students' Daily Test Values

No	Name Class	Grade Average Daily Test	
		Respiratory System	Excretion System
1	VIII-6	60,62	59,37
2	VIII-7	56,56	52,81
3	VIII-8	57,81	53,75
Average Value		58,33	55,31

Source: Science Subject Teacher at SMPN 25 Padang

The data in Table 1 shows that the average daily test score of students on the respiratory system material is 58.33 and the excretory system is 55.31. The learning outcomes have not reached the minimum completeness criteria set by the school, which is 80. This is due to the lack of students' understanding of the material taught by the teacher and the unavailability of IT-based teaching materials such as problem-based learning e-modules.

In responding to the problems or obstacles experienced by teachers and students in the learning process, it is necessary to have teaching materials that can visualize the subject matter as a whole, one of which is an e-module. E-module in terms of its benefits can make the learning process more interactive, the learning process becomes more interesting and can improve the quality of learning (Nurmayanti, et al., 2015). E-module is supported by the right learning model capable of making students learn effectively. One of the learning models that can improve creative thinking skills and learning outcomes is problem based learning (Swestyani, et al., 2014).

Problem based learning is one of the recommended learning models in the 2013 curriculum. The problem based learning model was developed based on constructivist learning theory so that in the learning process, students construct their own knowledge and ultimately develop their thinking skills. The problem-based learning model is carried out by exposing students to real problems in everyday life so that students can construct their own knowledge in solving problems and seeking various solutions. This trains students to think creatively (Purnamaningrum, et al., 2012).

In line with the research of Widiyarti, et al., (2018), it shows that problem based learning is to improve students' creative thinking skills. Based on this research, it can be concluded that problem based learning can improve students' skills in creative thinking so that it affects student learning outcomes that increase.



Problem based learning models can also affect student learning outcomes. The use of problem based learning will involve all students in solving a problem, so that it can develop students' thinking skills, practice problem solving skills, and improve mastery of learning materials. Through the problem based learning model, cognitive learning outcomes will increase such as the ability to know, understand, evaluate, and interpret a certain object from the senses (Mardiana, et al., 2016).

Teaching materials in the form of e-modules based on problem based learning models are expected to train creative thinking skills and improve student learning outcomes. This combination of models and teaching materials will be an alternative that can be used by teachers in developing and innovating creative and innovative learning. E-module is an electronic version of a printed module that can be read on a computer and designed with the necessary software (Suwasono, 2013).

The software used in making problem based learning based e-modules is Adobe Flash Professional CS6, with the advantage of having many features so that it can connect images, sounds, and animations, and can be stored on a cellphone/android to make it more practical. The use of problem based learning based e-modules makes the learning process run effectively because the learning process will be interesting and not boring (Darmawan, 2012).

Based on the problems that have been raised, research was conducted on the Development of Problem Based Learning-Based E-modules Using Adobe Flash Professional CS6 on the Materials of Respiratory and Human Excretion System for Students of Class VIII SMPN 25 Padang.

2. RESEARCH METHOD

This type of research is design and development research. The development model used in the problem-based learning-based e-module development is the Plomp development model. The Plomp development model consists of three stages, namely the preliminary research phase, the development or prototyping phase, and the assessment phase. The type of formative evaluation that will be used is described in the following details of the development and prototyping activities.

1. Prototype I

The prototype I begin with is the design of an e-module storyboard based on problem based learning based on the results obtained in the preliminary research phase, followed by the manufacture of an e-module product based on problem based learning using the Adobe Flash Professional CS6 program and several other applications. The prototype I was evaluated by self-evaluation, which was to revise the problem based learning based e-module itself that had been designed using a checklist to check for errors that might still be found in prototype I and then revised it. Furthermore, the prototype II development stage was carried out.

2. Prototype II

At this stage, consultation with experts or experts (expert review) is carried out to obtain a valid problem-based learning-based e-module. Aspects that are validated include aspects of constructs, aspects of content, aspects of graphics, and aspects of language. Next, a one-to-one evaluation was conducted, namely by asking three students who had different levels of learning outcomes (high, medium, and low) to provide their comments on the problem-based learning-based e-module that had been designed.

3. Prototype III

Prototype III was evaluated using a small group evaluation, namely an evaluation of six students who had different learning outcomes (high, medium, and low). This small group evaluation was conducted to determine the practicality of the products that have been designed.

4. Prototype IV

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

3. RESULTS AND DISCUSSION

3.1 Research Results

The results obtained from the preliminary research stage are used as guidelines for developing problem-based learning-based e-modules on the respiratory system and excretory system materials. The e-module is made using the Adobe Flash Professional CS6 program. The activities carried out at this stage of development are as follows.

1) Development and Prototyping Stage

a. Prototype I Development Results

In the development of the prototype I begin with the design of the storyboard. At this stage, it begins by designing a systematic presentation of the material and the learning objectives to be achieved which are divided into several learning activities and are guided by KD 3.9 and KD 3.10. After that, it was continued by making products using the Adobe Flash Professional CS6 program.



Figure 1. Display of an E-Module Cover Based on Problem Based Learning

b. Prototype II Development Results

Problem based learning based e-module that has been self-evaluated on a prototype I then tested for validity with experts (expert review). Expert review (expert review) is carried out based on the assessment of construct aspects, content aspects, graphic aspects, and language aspects. The formative evaluation used is an e-module validation sheet based on problem based learning. Experts validate the problem-based learning-based e-module developed by four lecturers as validators. The results of the validity of the problem-based learning-based e-module can be seen in Table 2.

Table 2. Results of E-module Validity Based on Problem Based Learning

No	Rated aspect	Validity Value (%)	Criteria
1	Construct aspects	81,25	Very Valid
2	Content aspects	85,42	Very Valid
3	Graphic aspects	85	Very Valid
4	Language aspects	93,75	Very Valid
Total		345,42	Very Valid
Average		86,35	

Table 2 shows that the requirements to meet the criteria for the validity of the problem-based learning-based e-module have been met. This can be seen from the overall average value of the validity of the e-module based on problem based learning, which is 86.35% with very valid criteria. Therefore, the e-module based on problem based learning on the respiratory and excretory system materials developed can be used for the next stage.

After the revision process from the expert review stage or validation assessment by expert lecturers, in the development of the prototype stage II, a one-to-one evaluation was also carried out by three students with different levels of learning outcomes, namely high, medium, and low. Based on the results of a one-to-one evaluation with students, it is known that the problem-based e-module is based on the excretory system material developed. The material presented in the e-module is complete and clear so it



helps in the learning process. The language is PUEBI compliant and easy to understand. The appearance of this e-module is very attractive so students are eager to learn.

c. Prototype III Development Results

Furthermore, a practicality test was carried out by a small group (small group). At this stage, an evaluation of six students with different learning outcomes was carried out, namely high, medium, and low. Practicality test by small group aims to see the practicality of e-module based on problem based learning material on the respiratory system and excretory system. Practical results in small groups can be seen in Table 3.

Table 3. Small Group Practicality Test Results (Small Group)

No	Assessment Aspect	Average (%)	Criteria
1	Ease of use	89,29	Very practical
2	Learning time efficiency	87,50	Very practical
3	Benefit	89,88	Very practical
Total		266,67	Very practical
Average		88,89	

The data in Table 3 shows that the results of the practicality test in the small group are an overall average of 88.89% with very practical criteria. This shows that the problem-based learning-based e-module that has been developed can be used and is very practical to use during the learning process. So that it can proceed to the assessment phase by conducting a large group trial (field test).

d. Results of Development of Prototype IV

Prototype IV is the same as prototype III. This is because at the practical test stage in the small group there is no revision and the results of the practical test show that the e-module is based on practical problem based learning so that it can be used for the large group trial stage (field test).

2) Assessment Stage

The results of the assessment phase are data obtained from the results of the practical e-module test based on problem based learning for students in the large group test and practicality for teachers. In addition, effectiveness test data were also obtained which included data on cognitive, affective, psychomotor, and creative thinking skills.

a. Practicality Test by Students in Large Groups (Field Test)

The average results of the analysis of the e-module practicality test based on problem based learning by students can be seen in Table 4.

Table 4. Practicality Test Results in Large Groups (Field Test)

No	Assessment Aspect	Average (%)	Criteria
1	Ease of use	89,50	Very practical
2	Learning time efficiency	88,64	Very practical
3	Benefit	89,61	Very practical
Total		267,75	Very practical
Average		89,25	

Table 4 shows that the practical results of problem-based learning-based e-modules by students in large groups (field tests) are an overall average of 89.25% with very practical criteria.

b. Practical Test of E-module Based on Problem Based Learning by Teachers

The results of the practical data analysis of problem-based learning-based e-modules by teachers can be seen in Table 5.



Table 5. Results of PBL-Based E-module Practical Test by Teachers

No	Assessment Aspect	Average (%)	Criteria
1	Ease of use	89,29	Very practical
2	Learning time efficiency	87,50	Very practical
3	Benefit	95,83	Very practical
Total		272,62	Very practical
Average		90,87	

The data in Table 26, shows that the results of the practicality of e-modules based on problem based learning by teachers are an overall average of 90.87% with very practical criteria.

c. E-module Effectiveness Test Results Based on Problem Based Learning

Effectiveness data were obtained by assessing students' learning competencies which included cognitive competence (knowledge), affective competence (attitudes), psychomotor competence (skills), and creative thinking skills.

1. Assessment of Cognitive Competence (Knowledge)

The average results of the analysis of students' cognitive competence values during the learning process can be seen in Table 6.

Table 6. Average Results of Cognitive Competence

No	Class	Minimum Value	Maximum Value	Amount	Average
1	Experiment	68	96	2804	84,97
2	Control	60	96	2556	79,88

In Table 6, it can be seen that the average value of cognitive competence in the experimental class is higher than the value of the control class. The experimental class is a class that is given treatment in the form of using an e-module based on problem based learning, while the control class is without treatment. The average value of the experimental class was 84.97 using an e-module based on problem based learning, while the average value of the control class was 79.88 using an e-module based on problem based learning. The results of the hypothesis test (T-test) are known that the significance value of the cognitive competence of students is 0.021. This indicates that the significance value is $0.021 < 0.05$, which means that H1 is accepted.

2. Assessment of Affective Competence (Attitude)

The average results of the analysis of students' affective competence values during the learning process can be seen in Table 7.

Table 7. Average Results of Affective Competency Analysis

No	Class	Amount	Average	Criteria
1	Experiment	2787,50	84,47	Very good
2	Control	2552,08	79,75	Good

In Table 7, it is known that the average value of the affective competence of the experimental class students is higher than the control class. The result of average value of the experimental class was 84.47, while the average value of the control class was 79.75. The results of the Mann-Whitney test are known that the significance value of the assessment of the affective competence of students is 0.002. This indicates that the significance value is $0.002 < 0.05$, which means that H1 is accepted.

3. Psychomotor Competency (Skills)

The average results of the psychomotor competency analysis of students during the learning process can be seen in Table 8.



Table 8. Average Results of Psychomotor Competency Analysis

No	Class	Amount	Average	Criteria
1	Experiment	2730,56	82,74	Very good
2	Control	2536,11	79,25	Good

In Table 8, it can be seen that the average value of the psychomotor competence of the experimental class students is higher than the control class. The result of the average value of the experimental class is 82.74 while the average value of the control class is 79.25. The results of the Mann-Whitney test are known that the significance value of the psychomotor competence assessment of students is 0.035. This indicates that the significance value is $0.035 < 0.05$, which means that H1 is accepted.

4. Creative Thinking Skills

The results of the average value of creative thinking skills can be seen in Table 9.

Table 9. Average Results of Creative Thinking Skills

No	Class	Minimum Value	Maximum Value	Amount	Average
1	Experiment	40	95	2450	74,24
2	Control	20	95	1900	59,38

In Table 9, it can be seen that the average value of creative thinking skills in the experimental class is higher than the score in the control class. The average value of the experimental class is 74.24, while the average value of the control class is 59.38. The results of the hypothesis test (T-test) are known that the significance value of students' creative thinking skills is 0.001. This indicates that the significance value is $0.001 < 0.05$, which means that H1 is accepted.

3.2 Discussion

The results of the validation data analysis show that the e-module based on problem based learning has a validity value of 86.35% with very valid criteria. Analysis of data from the e-module validity assessment sheet based on problem based learning that was developed in terms of the constructed aspect, content aspect, graphic aspect, and language aspect. According to Arikunto (2013), if the data generated from a product is valid, it can be said that the product developed has provided an overview of the development objectives correctly and in accordance with the realities and circumstances.

The result of the validity of the problem-based learning-based e-module in the constructed aspect is 81.25% with very valid criteria. Based on the criteria in the constructed aspect, it is known that the e-module developed is an e-module based on problem based learning, the e-module can be operated properly, the instructions for use are correct, and the substance of the material is described sequentially (systematically) adapted to the concept, and the e-module can facilitate the improvement of learning outcomes and train students' creative thinking skills. The learning activity sheets in the e-module are presented systematically and in accordance with the stages of the problem based learning model. The activity sheet on the e-module consists of stages of orienting students to the problem by presenting a discourse that has been adapted to the topic of the material. According to Saidah, et al., (2014), the problems presented raise the curiosity of students in learning.

The results of the validity of the problem-based learning-based e-module on the content aspect are 85.42% with very valid criteria. Problem-based learning-based e-module with very valid criteria in the content aspect because it meets the material criteria adjusted to the expected learning indicators, contains important concepts in the respiratory system material and the excretory system, and concepts that are difficult to visualize are made in the form of images and videos. In line with the research of Munawaroh, et al., (2019) that the developed e-module does not only contain material concepts but also contains pictures and videos.

The result of the validity of the problem-based learning-based e-module in the graphic aspect is 85% with very valid criteria. Problem-based learning-based e-modules are very valid in the graphic aspect because they meet the criteria, namely pictures and videos that are by the explanation/concept of the material, and the right type and size of letters so that they are easy to read. Furthermore, the layout and function of the buttons are appropriate to the material of the human respiratory system and excretory system and already have an attractive overall design. Thus, the graphic aspect is expected to be able to clarify concepts that are still abstract as a whole and can be visualized, so that students can understand the material. The opinion of Widyanita., et al., (2012) stated that with easy to read the writing, pictures, attractive designs, and learning videos that overcome the limitations of distance



and time, the message conveyed is fast and easy to remember, and the video can be repeated to add clarity. material and foster student interest and learning outcomes.

The results of the validity of the problem based learning based e-module in the language aspect are 93.75% with very valid criteria. Problem-based learning-based e-modules are very valid in the language aspect because they meet the criteria, namely using good and correct Indonesian language rules, and using communicative, straightforward, and simple language so that they are easy to understand. In line with Hamdani's opinion (2011) language is one aspect that needs to be considered in the preparation of teaching materials and the language used should be simple and easy to understand.

The assessment of the practicality of the problem-based learning-based e-module by 33 students in the large group test (field test) got an average score of 89.25% with very practical criteria. Practical aspects include ease of use, the efficiency of learning time, and benefits.

The results of the practicality of the problem-based learning-based e-module on the ease of use aspect are 89.50% with very practical criteria. This shows that problem-based learning-based e-modules are easy to use, easy to follow commands in e-modules, navigation buttons work well, easy of understanding the instructions for use, use easy-to-understand language, easy-to-read font type and size, and easy of understanding the images and videos presented. Clear images on the e-module support the description of the material contained in the e-module and serve to facilitate students in understanding learning (Prastowo, 2014).

The results of the practicality of the problem-based learning-based e-module in the aspect of time efficiency are 88.64% with very practical criteria. This shows that by using an e-module based on problem based learning, students can understand the respiratory system and excretory system more quickly, and save time in the learning process of students in class. Sapitri (2017) argues that with the e-module, learning time becomes more efficient and students can learn according to their respective learning speeds.

The results of the practicality of the problem-based learning-based e-module in the aspect of benefit are 89.61% with very practical criteria. This shows that problem-based learning-based e-modules can help students understand the subject matter, make learning more fun, increase enthusiasm for learning with an attractive e-module display, and help understand the material through pictures and videos as well as animations that are presented to help visualize the material, make learning not boring with background, and are practically used as a means in the learning process.

The assessment of the practicality of the problem-based learning-based e-module by the teacher gets an average value of 90.87% with very practical criteria. Practical aspects are ease of use, the efficiency of learning time, and benefits. All of these aspects have met the practicality criteria to achieve the practicality of problem-based learning-based e-modules for teachers. Based on this, it can be concluded that the practicality test for e-module teachers based on problem based learning is very practical to use in the learning process activities. According to Plomp and Nieveen (2013), what is meant by the practical category is that the product developed can be used, can be used, is easy to use, and is by research objectives.

The results of hypothesis testing conducted on the value of cognitive competence in the experimental class and control class showed that there were significant differences in the cognitive learning outcomes of the two classes. This shows that the use of problem-based learning-based e-modules in the learning process has a positive impact on the learning outcomes of students' cognitive competencies. According to Aryawan, et.al., (2018) that interactive e-modules can be used to significantly improve student learning outcomes.

The results of the Mann-Whitney test conducted on the value of affective competence in the experimental class and control class showed that there was a significant difference in the affective learning outcomes of the two classes. This shows that the use of problem-based learning-based e-modules in the learning process has a positive impact on the learning outcomes of learners' affective competencies. In line with Aziz, et al., (2014) explaining that the implementation of problem-based learning models, one of which is the problem-based learning model, can make students participate in independent learning to solve problems and be able to work well together.

The results of the Mann-Whitney test conducted on the value of psychomotor competence in the experimental class and control class showed that there was a significant difference in the psychomotor 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 impact on the learning outcomes of students' psychomotor competencies. This is because the learning process that uses e-module-based problem-based learning guides and directs students in carrying out discussion tasks so that students can develop their psychomotor skills. Israfidin, et al.,



(2016) states that the problem based learning model can stimulate students' communication skills so that students are more active and enthusiastic in responding to lessons.

The results of hypothesis testing conducted on the value of creative thinking skills in the experimental class and control class showed that there were significant differences in the learning outcomes of creative thinking between the two classes. This shows that the use of problem-based learning-based e-modules in the learning process has a positive impact on students' creative thinking learning outcomes. According to Purnamaningrum (2012), Problem based learning (PBL) is learning that is carried out by exposing students to real problems in everyday life so that students can develop their own knowledge in solving problems and seeking various kinds of solutions, as well as encouraging students to creative thinking.

4. CONCLUSION

Based on the results of the study, the following conclusions were obtained.

- 1) Problem based learning based e-module has a validity value of 86.35% with very valid criteria in terms of construct, content, graphics, and language aspects.
- 2) Problem based learning based e-module has a practical value of 90.87% by teachers and 89.25% by students with very practical criteria in terms of ease of use, the efficiency of learning time, and benefits.
- 3) Problem based learning based e-module has effectiveness with very effective criteria in terms of the assessment of students' cognitive, affective, psychomotor, and creative thinking competencies. The results of the assessment of cognitive, affective, psychomotor, and creative thinking competencies showed that the average score of the experimental class students was better than the control class. This shows that there is an effect of using problem based learning based e-modules on cognitive, affective, psychomotor competencies, and can train students' creative thinking skills.

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