Innovative Journal of Curriculum and Educational Technology
8 (2) (2019) : 59 – 66

https://journal.unnes.ac.id/sju/index.php/ujet/article/view/31340

The Development of Chemical E-Module Based on Problem of Learning to Improve The Concept of Student Understanding

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Article Info

History Articles
Received:
May 2019
Accepted:
June 2019
Published:
November 2019

Keywords:
colloid,
e-modul,
learning of chemistry,
problem based learning,

DOI
https://doi.org/10.15294/ijcet.v8i2.31340

Abstract

Teaching materials are a set of learning facilities or tools that contain learning materials, methods, boundaries, and how to evaluate a systematic and attractive designed to achieve the expected goal, namely achieving competence or sub competence with all its complexity. This research aims to (1) analyzing the chemical materials used in the class of XI IPA, (2) to develop the teaching materials that should be used in chemical learning, (3) test the feasibility of e-module based on problem chemical, (4) to examine the effectiveness of the chemical e-module based on problem based learning. This research uses the model of Research and Development (R & D). The teaching materials used in chemistry learning in the classes of XI IPA are LKS and published books. The teaching materials are developed in the form of e-module of chemical based on problem-based learning. The steps include: Presenting the problem, organizing the students, investigation of the group, Development, and presentation of the work, and evaluation of the results of the investigation. The feasibility of an e-module based on the problem of chemical media experts and the materials and practitioner's validation. The validation is done in two stages. On the feasibility Validation e-module chemical based on problem-based learning in steps two, the result obtained e-modules based on the problem of chemistry that has achieved maximum score with the category is good that can be used in learning. Based on the effectiveness test that is using descriptive test, prerequisite test, and hypothesis test, it can be concluded that e-module of chemical based on problem-based learning can improve the concept of student understanding. The results of the study are expected to strengthen the theory of learning technology, especially on the development of chemical teaching materials. This Research as a means of procurement of educational products, i.e., e-module based on the problem-based learning that is flexible, efficient and effective, and can be used as a source of reading capable of providing an understanding of the enhanced student concepts mastery in learning of chemistry.

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p-ISSN 2252-7125
e-ISSN 2502-4558

INTRODUCTION

Colloid system material has some concepts that are abstract and some concrete concepts because it is close to everyday life and there are difficult terms to understand Rakhmadhani, Yamtinah, and Utomo (2013) and Sunyono and Maryatun (2006). Some material that is very difficult for students to understand in a chemistry learning material class XI Semester 2 is colloidal theory, with a presentation of 38% (Rachmayanti, and Amaria, 2013).

The difficulties experienced by the students are caused by several factors, namely: psychological factor, social aspect, facilities and infrastructure, learning methods, and teachers. Teachers, students, teaching methods, and the learning media are supportive unity in learning activities. Teachers need the right teaching methods and materials so that the information they want to convey can be more easily understood by students (Kusumam, Mukhidin, and Hasan, 2016)

Teaching materials are textbooks in certain fields of study which are compiled by experts in the field with instructional intent and purpose, which are equipped with teaching facilities that are compatible and easily understood by the wearer in schools and colleges so that they can support a teaching program. Teaching materials is one of the successful learning process (Lamb, and Annetta, 2013).

There are several types of teaching materials: printed teaching materials, audiovisual materials, and tools that are manipulating. Teaching materials are systematic, meaning arranged to facilitate students to learn. One of the sources of teaching materials that can be used is a module (Sugiyono, 2014). The development of important teaching materials is done by teachers to improve the quality and efficiency of learning.

One of the 2013 curriculum learning Models is learning problem-based learning. According to Daryanto (2014) learning problem-based learning is a learning approach that presents authentic problems that stimulate learners to learn. The problem is given in the form of real-world problems; the problem given is used to bind learners to the sense of likely know on the learning in question.

The development of teaching materials can be developed with a learning model that is deemed able to improve the learning outcomes of students (Diantari, Damayanthi, Sugihartini, and Wirawan, 2018). Khotim, Nurhayati, and Hadisaputro research (2015) show that the problem-based of chemistry module is feasible and effective for enhancing the concepts of students understanding in learning materials. In other words, this problem-based module can improve students' activity and critical thinking skills in resolving authentic issues.

Integrating technology in education is especially related to online-based learning brings a new revolution and allows achieving high understanding and learning outcomes (Sujanem, Suwindra, and Tika, 2009). The research conducted by Putra, Wirawan, and Pradnyana (2017) and Bakri, Muliyati, and Nurazizah (2018) declaring the use of e-modules can enhance students' learning attractiveness because it provides interactive materials. Various components of electronic modules presented online (text and images, videos, simulations, and feedback questions) are considered effective by students as a learning experience (Suarsana, 2017).

The relevant research was conducted by Tania, and Susilowibowo (2017), i.e. e-module developed as a supporter of the customization learning services company, E-module developed using the application Adobe-flash CS6, and its development uses the ADDIE model.

E-module development research by Serevina, Sunaryo, Raihanati, Astra, and Sari (2018) stated that the e-modules developed can improve students' science process skills as evidenced by the results of N-gain is 0.6 which is in the medium category.

The results of the research module development by Aji, Hudha, and Rismawati (2017) revealed that the development of problem-based physics in high school. Nugroho Raharjo, and Masykuri research (2017) e-module development using Moodle on salt-based hydrolysis material problem-solving.

In the previous research revealed that the development of problem-based learning e-modules could improve critical thinking skills, problem-solving skills, and science process skills. In this research, e-modules are developed chemistry-based on problem-based learning to improve the concept of students understanding. Based on the study above, we need to do research and development of e-module based on the problem of learning to increase the concept of student understanding. The benefits of this research resulted in a product-based e-modules that are very efficient and effective and can be used as a source of reading that can provide understanding related to the improvement of the concept students understanding in the learning of chemistry.

METHODS

The types of research are research and development. The model development of E-Module in this research has been adopting the model of research 4-D (Define, Design, Development, Disseminate) (Thiagarajan, Semmel D. L., and Semmel, M. I., 1974). However, in this study carried out the simplification phase of the four stages into three stages. Phase disseminate is not done due to consideration of time and execution, as well as consideration that at the development Stage has produced a chemical-based module of problem-based learning good (Trianto, 2010).

The subject of this study is a grade XI IPA SMA Negeri 12 Semarang in years 2018/2019. The test subject amounted to 37 students. The data in this study was collected using interviews, questionnaire, and tests.

RESULTS AND DISCUSSION

In the define phase, there are research results in the form of the general idea of the chemical learning process, the use of teaching materials used, and the need for the students to study chemistry. The design stage obtained data in the form of the preliminary design of the e-module of chemical-based problem-based learning. Development phase obtained the research results on the feasibility of e-module based on the problem-based learning of the validity media Experts, material experts, practitioners, and the effectiveness tests e-module chemical based on problem-based learning, seen from the results of improvement the concept of students understanding.

The preliminary study results of chemical teachers revealed that the book the teacher used came from the publishers and LKS. But in fact, 100% of students have only LKS only, whereas for publishers' book students should borrow in the library. The results of a questionnaire that has been disseminating of 23 students answered which is no student involvement in the learning activities, 27 students answered chemistry is a tedious subject because of the lack of creative teachers in developing teaching materials, 29 students answering the chemical learning process has not attributed to the real problems in daily life, and all students always access the internet as a source of learning chemistry.

Based on findings in previous studies, researchers want to develop a fun learning process, not boring, and help students in teaching material that helps students understand very well the concepts of colloidal. The development of modules can answer or solve problems or difficulties in learning.

The problem-based chemical e-module is developed starting with the "Studi Kasus" in each subchapter. The problems presented are the problems that students often meet in daily life. The problem presented in the e-module is an illustration of events related to the real world.

Figure 1. The View of "Studi Kasus" on e-Module of Chemical Based on Problem-Based Learning

After students have given the problem to solve, the teachers organize the students by dividing students into groups and telling students to answer the questions in the "Ayo Cari Tahu" column in the e-module relate to the material to be studied. By answering these questions, students are directed to be able to solve the problems are presented.

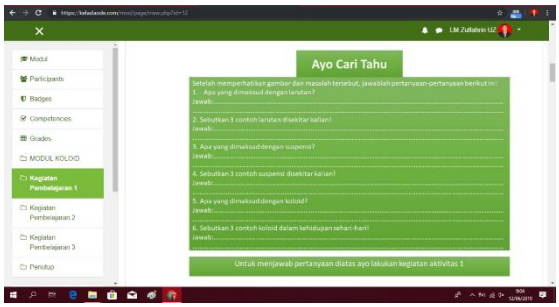

Figure 2. The View of "Ayo Cari Tahu" Column on e-Module of Chemical Based on Problem-Based Learning

The third stage of problem-based learning is a group investigation; students discuss with their pairs to study or find out and gather information to answer problems are presented. Then the fourth stage is the development and presentation of works. At this stage, it helps students to develop and present their discussion results. The last phase of problem-based learning is the evaluation of research results. At this stage, students will present the results of the discussion of each group. The three stages above are presented in the "*Aktivitas*" column.

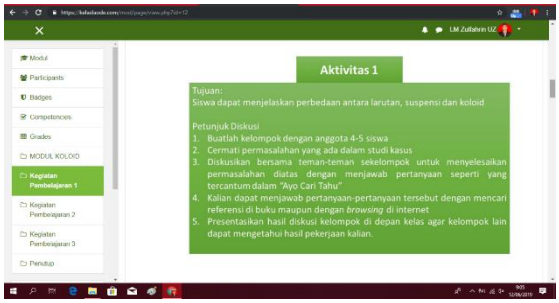

Figure 3. The View of "Aktivitas" Column on e-Module of Chemical Based on Problem-Based Learning

The e-module of the PBL-based chemistry comes with a formative test at each end of the subchapter aimed at knowing the ability of the students after studying the materials of each subchapter. The formative test consists of 10 double-choice questions and is equipped with assessments so that students can measure their abilities related to the subchapters that have been studied. In other words, a formative test in an e-module is a condition that students must meet to see if the student has mastered the material being taught and can proceed to the material in the next subchapter.

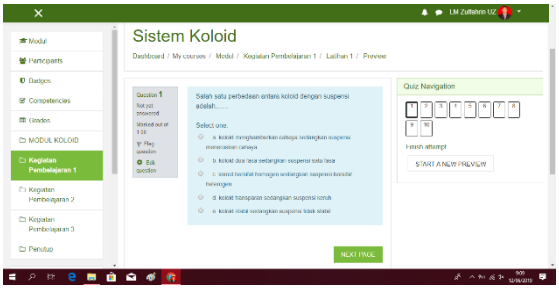

Figure 4. The View of Formative Test on e-Module of Chemical Based on Problem-Based Learning

The result of the validity of the 1st material is obtaining a score of 63 with a maximum score of 95 the average validator value gained from the whole aspect is 66.3% that is insufficient categories. The results of the media validation phase 1 gained a score of 36, with a maximum score of 80, the presentation was 51, 4% with the category less. Based on the result of material and media feasibility test at stage one, revised according to the advice of the expert team.

The results of the feasibility test of the material have obtained a score of 81, and the percentage is 98.9% with the category very well. Percentage of media validation results is 97.1%. Based on the results of material and media validation shows that the e-modules developed are on the excellent criteria so that it deserves to be applied in learning.

Based on the Independent sample t-test through SPSS 24 with a 5% level is obtained that the understanding data of the concept of students taught using e-module chemical based problem-based learning with students who are taught using LKS acquire Significance level 0.009 < 0.05 then

H0 rejected. This indicates that the data understanding of the concept of students taught using the e-module of chemical-based problem based learning with students taught using the LKS has a significant difference.

E-modules make it easier for students to understand the abstract chemical material into concrete so that students understand the material more easily (Mansur, 2012). E-modules are made to be practical, simple, language easy to understand, applicative, and accompanied by examples of problems and support images of interesting illustrations (Sudarwati, 2013). E-modules can assist the school in realizing quality learning and can provide better-planned learning activities (Parmin, and Peniati, 2012).

The problem-based chemical E-modules are designed to use the characteristics of a problem-based learning model. The first step in learning problem-based learning is to orient the students to problems. The problems presented in these e-modules are the problems that students often encounter in their daily lives. Giving the problem at the beginning of the stage trains the students to think so that students are challenged to understand the concepts of colloids. In line with the research conducted by Serevina, Sunaryo, Raihanati, Astra, and Sari (2018), which reveals that the giving of problems in e-modules will train students in thinking. The more experience students gain learning-oriented problem-based learning, the more it enhances the concept of students understanding and builds thought to be more effectively used in problem-solving (Whitcombe, 2013). If the students are accustomed to such learning conditions, do not close the possibility of attitudes and activities, students will grow and qualified (Prayitno, Wijayati, and Mursiti, 2017).

The feasibility of e-modules based on the problem of physical and material media experts and the practitioner's validation results. Validation is done in two stages. At stage one can be known that the chemical e-module based problem is learning yet worthy of being used as a learning resource. Researchers conducted a revision stage to improve the product-based chemical modules for the problem of learning to be better. The revision of the e-chemical module of problem-based learning refers to the results of validation and feedback, according to the suggestions and comments. On the feasibility validation e-module chemical based on problem based learning Phase Two, the result obtained e-module of chemical-based on problem of learning has achieved maximum score with very good categories so it can be used in learning.

In the phase of the effectiveness, the test showed a positive response to the students' interest in the problem-based chemistry e-module developed. The student's response to an e-chemical module based on problem-based learning demonstrates in good criteria. The factors that affect students' interest in the teaching materials developed are the use of a problem-oriented learning model that provides examples of real problems in everyday life. Also, the e-chemical module of problem-based learning is very flexible to use because it can be accessed using android or laptop/computer. The interesting e-module in the presentation can increase students' desire to learn. This is because learning with the help of innovative media, and appropriate learning models can increase the interest of learning and thinking students to influence the student learning achievement (Sugihartini, and Jayanta, 2017).

The last step of the development of the e-module based on the problem of learning chemical is implementing it. The implementation was conducted on 37 students. Based on the effectiveness test that is using descriptive test, prerequisite test, and hypothesis test, it can be concluded that e-module of problem-based in learning chemistry can improve the concepts of students understanding. The use of e-module of the chemical-oriented problem-based learning in the chemical learning process allows students to better understand the concept of the subject matter by studying the text better because the e-module provides student opportunities for independent study. Thus, students can know the concept or information that is and directly apply to the test of understanding (Kusuma, and Siadi, 2010).

CONCLUSION

The teaching materials used in chemistry learning in the classes of XI IPA are LKS and publisher books. To teach colloidal material, teachers usually give assignments to memorize and conduct presentations in front of the class. Based on the results of the questionnaire to the subject of research shows that students need adequate teaching materials, can make them not bored, stimulate students to think in understanding the concepts of colloids — the teaching materials developed in the form of e-modules based on a problem-based learning chemical. The steps include, (1) presenting the problem, (2) student organizing, (3) group investigation, (4) the development and presentation of the work, (5) evaluation of the results of the investigation. The results of the feasibility test of the material have obtained a score of 81, and the percentage is 98.9% with the category very well. Percentage of media validation results is 97.1%.

Based on the results of material and media validation shows that the e-modules developed are on the excellent criteria so that it deserves to be applied in learning. Based on the Independent sample t-test through SPSS 24.0 with a 5% level is obtained that the understanding data of the concept of students taught using e-module chemical based on problem-based learning with students who are taught using LKS acquire significance level 0.009 < 0.05 then H0 rejected. This indicates that the data understanding of the concept of students taught using the e-module of chemical-based on problem-based learning with students taught using the LKS has a significant difference.

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