Developing Problem-Based E-Module Using Moodle In Solubility And Solubility Product Constant Learning Material For High School

Siti Khodijah Dalimunthe[1], Nurfajriani[2], Murniaty Simorangkir[3]

{ sitikhodijahdlt@mhs.unimed.ac.id[1] , nurfajriani@unimed.ac.Id [2] , murniatykuliah@gmail.com[3] }

The Education Chemistry Study Program of Postgraduate School of Universitas Negeri Medan, Indonesia 20221[1],
Department of Chemistry, Faculty of Mathematics and Natural Sciences, Medan State University, Jl. Willem Iskandar, Psr V, Medan, North Sumatra, INDONESIA 20221[23]

Abstract. This study aims to determine the feasibility of a developed problem-based e-module using the Moodle application on Ksp learning material based on BSNP. This paper is a research and development (R&D) using the ADDIE model. The subjects are material expert lecturer, media expert, and chemistry teacher. The data were collected using questionnaires and a Likert scale. The data analysis technique used descriptive quantitative and qualitative descriptive analysis techniques. The results revealed that the developed e-module was valid, with an average score of 95% in material feasibility and 96% in media eligibility. It was classified as very feasible based on predetermined criteria and can be used for further research.

Keywords: research and development, e-model, moodle.

1 Introduction

The development of science and technology is the result of information and communication technology (ICT) development. ICT is the application of education [1]. As facilitators, teachers must be creative in innovating the teaching materials using technology to achieve learning objectives. One of the which to attain good learning conditions for students is by developing learning resources [2]. A module is a teaching material that is part of learning resources. Modules are so that students can learn independently without or with teacher guidance. Thus, a module must contain learning instructions, targeted competencies, content, exercise, work instructions, evaluation, and feedback. A module that utilizes technology is called an e-module [3].

E-module is a complete unit consisting of a specific learning sequence presented using electronic devices. They can contain images, text, videos, animations, and others. The use of electronic modules is not only practical but can improve critical thinking skills and give

AISTEEL 2022, September 20, Medan, Indonesia

DOI 10.4108/eai.20-9-2022.2324694

positive impressions to students [4]. Moreover, E-modules can boost motivation, reduce dependence and accomplish learning outcomes following the teacher's indicators of learning tools [5]. One of the platforms that can be used to develop e-modules is Moodle. Moodle is a learning management system that is gradually gaining popularity in education. Moodle software is designed to assist teachers in developing learning materials using technology. It has a flexible design, easy to use, and prioritizes student-centered learning. Using Moodle, educators can input images, text, graphics, animation, video, audio, and simulations to be accessed through the internet using a computer, laptop, or smartphone[6].

Besides media and teaching materials, various innovative learning models are also essential. One of the innovative learning models is a problem-based learning model. It requires students to be active through group discussions in finding and solving problems, making it easier for them to understand the subject and motivating them to learn [7].

This study aims to determine the feasibility of a problem-based e-module developed using the Moodle application on solubility and solubility product constant learning material.

2 Methodology.

2.1 Research Design

This study used the Moodle application to develop e-modules on problem-based solubility and solubility product constant learning material. The ADDIE model was used only until the development stage.

2.2 Population and Sample

The research population is Chemistry Lecturer, IT Expert, and Chemistry Teacher. The research sample is a chemistry e-module.

2.3 Research Procedure

The stages carried out in this study are: (1) Analysis stage, consisted of needs analysis, curriculum analysis, and textbook analysis on textbooks used in schools using the BSNP instruments. (2) Design stage, the design process of the developing e-module based on the results of the previous analysis. The design stage consisted of making a draft module and collecting reference materials for e-modules. Researchers also determined the instruments used to assess the developed e-modules by assessing the content feasibility, language feasibility, presentation feasibility, and media feasibility. (3) Development stage, the making process of the problem-based e-module using the Moodle application on the solubility and solubility product constant material following the previous stage's design. Expert validators then validated the e-module based on the feasibility aspect points and gave suggestions and comments regarding the e-module, which was then used as a benchmark for correcting and improving the e-module.

2.4 Data Analysis Technique

The analysis technique used in this study was descriptive quantitative and descriptive qualitative. Qualitative data were obtained from corrections and input from lecturers and expert teachers on the developed learning e-modules. Meanwhile, quantitative data was from the scores given by expert lecturers and teachers on e-modules through questionnaires. The overall product quality is reflected in the average score of all aspects of the assessment from all validators. This formula determines the percentage of product quality:

$$\text{Percentage} = \frac{total\ score\ of\ assessment}{highest\ score}\ x\ 100\% \quad (1)$$

The results were then analyzed using descriptive quantitative, presented as scores and percentages, then categorized following the predetermined rating scale.

Table 1. Category of Product Quality Assessment

Average	Validity Criteria
3.26 – 4.00	Valid and does not need correction (very feasible)
2.51 – 3.25	Sufficiently valid and does not need revision (feasible)
1.76 – 2.50	Invalid, some of the module contents need to be corrected (less feasible)
1.00 – 1.75	Invalid and need a total correction (not feasible)

3 Results and Discussion

3.1 Analysis Stage

The analysis in this stage used Moodle regarding the use of printed textbooks that still has many abstract concepts. Some sources believe that technology-based teaching materials must be applied in schools because students do not always have to learn using printed textbooks and must keep up with the technologies. Several researchers have proven that technology in education can improve teaching and learning[1].

Besides, Ksp material can be arranged following the curriculum and syllabus by implementing problem-based learning. Based on the analysis of teaching materials, the textbooks used in class XI SMA are suitable for use (valid and do not need to be corrected). However, the material contained in the book is limited and does not contain multimedia links as additional references that can enrich student's insight and make them understand the material easier.

3.2 Design Stage

At this stage, the researchers designed the e-module by making Moodle a learning medium.

Designing Teaching Material

At this stage, the e-module design has been analyzed beforehand. The problem-based e-module design stage used Moodle on the solubility and the solubility product constant material.

The problem-based KSP e-module design followed the problem-based learning syntax, where the problems were presented as a case study after a brief description of the material. The syntax of problem-based learning was included in the description of the case studies in the developed e-module. The illustration of the problem and its stages can be seen in Figure 2.

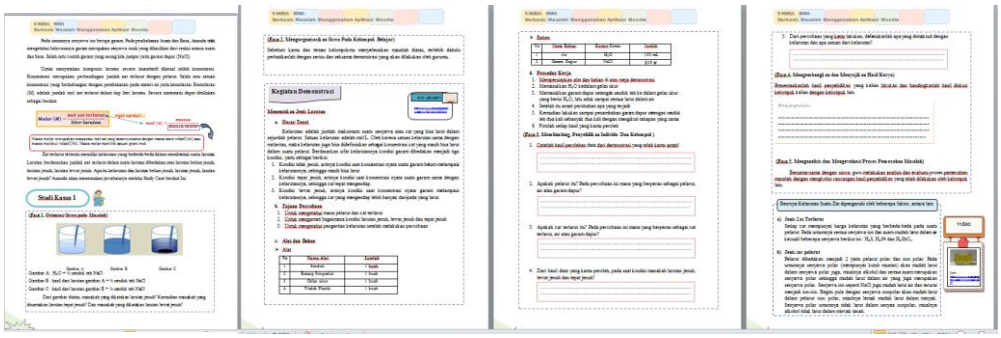

Figure 2. Problem presentation in the case study

Then, the developed e-module also consists of comprehensive material content with additional URLs or sources that can be accessed, chemistry info, crossword puzzles, independent exercises, assessment criteria, self-reflection, summaries, evaluations, glossary, index, and other appendices. The display of the design of teaching materials is shown in Figure 3.

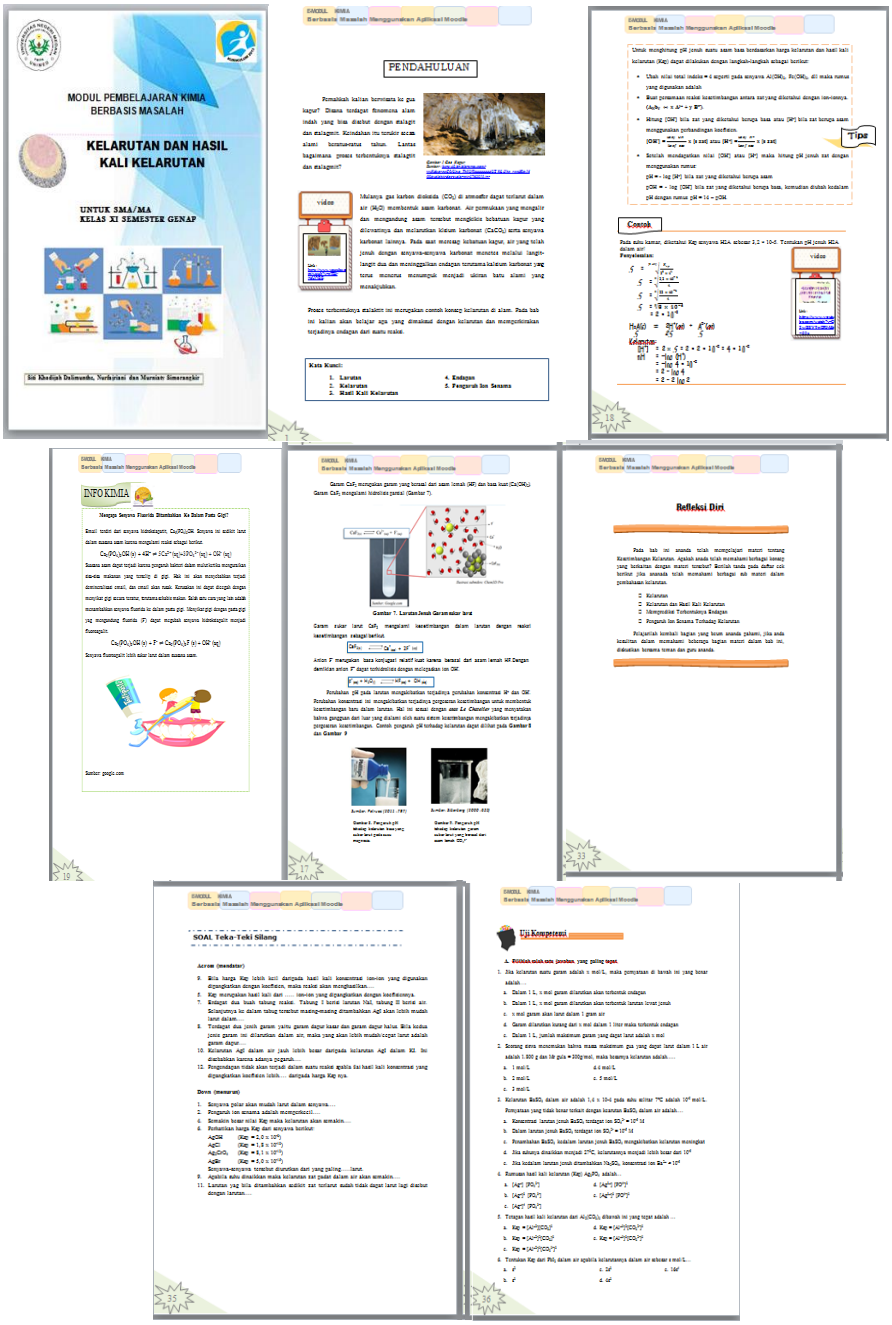

Figure 3. Display of Teaching Materials

Moodle Web Design

In addition to teaching materials in modules, researchers also made e-learning-based learning media using Moodle. Moodle is software that can be installed. It needs hosting and a domain to be accessed online. The user can make a personalized Moodle link to be accessed easily and quickly. The Moodle link for the e-module is maribelajarikimia.online. After the link is created, students can log in by entering their username and password. It can be accessed through Google Chrome using electronic devices by downloading the app on Playstore. After that, enter the link, and students can learn easily and practically. Moodle web display and Moodle app are presented in Figure 4 below.

Figure 4. Moodle Homepage

3.3 Development Stage

This stage develops problem-based e-modules (products) on Ksp material. The developed e-module can be seen in Figure 4:

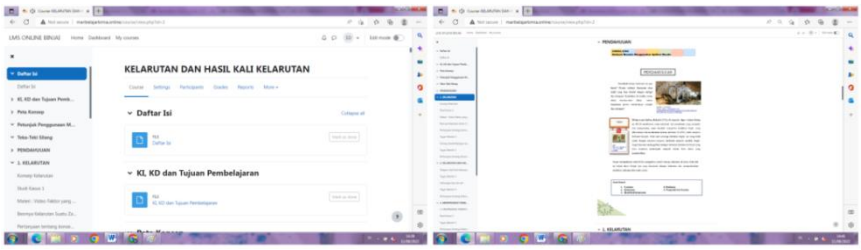

Figure 5. Problem-based electronic module using the Moodle application

Moodle-based teaching materials were validated using the modified National Education Standards Agency (BSNP) eligibility standards at this stage. The assessment was carried out by three validators, a material expert lecturer, a chemistry teacher, and a media expert lecturer from educational technology. The developed e-module that must be assessed for feasibility based on BSNP are content feasibility, language feasibility, and presentation feasibility. The results of the e-module assessment by material expert validators can be seen in Figure 6:

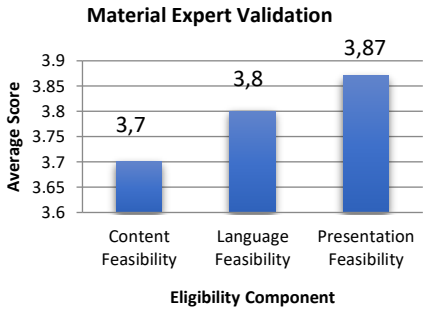

Figure 6. Feasibility of Materials in E-Module

The evaluation of the e-module revealed a result of 95%, which indicates that the developed e-module is very feasible. The result was acquired from the average value of e-module validation on content feasibility (3.7), language eligibility (3.8), and presentation feasibility (3.87), with an average (3.74) with valid criteria and does not need correction. The assessment of e-module media using the Moodle application can be seen in Figure 7.

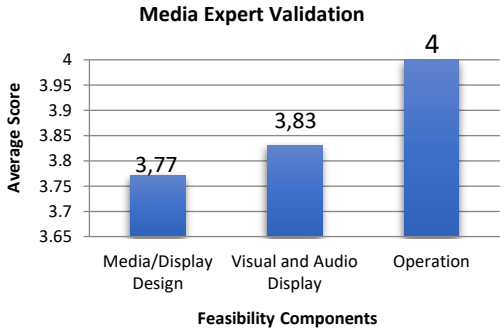

Figure 7. Eligibility of E-Module Media

The percentage of e-module assessment is 96%, showing that the developed e-module using Moodle web media is very feasible. It means the developed e-module, both in material and media, is suitable for use and continued for the following research stage.

Likewise, the research conducted by Santosa et al. (2017) showed promising results in developing the e-module based on a problem-based learning model using the Moodle application on network administration subjects for class XII of computer and network engineering at the Bali Global Singaraja IT Vocational School. It can be concluded that problem-based e-modules using the Moodle application are effective in learning [8].

4 Conclusion

Based on the research, it can be concluded that: this research and development produced a product of a problem-based electronic module of solubility and solubility product constant using Moodle. The development used the research and development (R&D) with the ADDIE model (analysis, design, development, implementation, and evaluation). The developed e-module went through the validation stage by two experts as validators, a chemistry lecturer, a teacher, and a media expert, with a score of 95% for material validation and 96% for media validation. Thus, the problem-based e-module using the Moodle application on the solubility product constant and solubility product learning material developed is very feasible to use and does not need revision.

Acknowledgments. Thank you to the supervisor for the advice and direction. Thank you to the organizers of Aistel for having me contribute to the international seminar.

References

[1] Copriady, J., Iswandari, S. N., Noer, A. M., & Albeta, S. W.: development of e-modul based on moodle in hydrocarbon topic. EDUSAINS. 12(1), pp. 81–88 (2020)

[2] Lestari, S.R.P.: Development e-Teaching Material Based Moodle Web. IOP Publishing. 18811(1), p. 012062 (2021)

[3] Daryanto.: Compiling E-modules. Gava Media, Yogyakarta (2013)

[4] Suarsana, I. M.: Problem solving oriented e-module development. JIP (Indonesian Journal of Education). 2(2), pp. 264-275 (2013)

[5] Hasibuan, V. R, Simorangkir, M., & Sudrajat, A.: The development of E-module biomolecules for enzyme integration of project based learning models in accordance with the KKNI curriculum. In The 5th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2020). pp. 36-41 Atlantis Press (2020)

[6] Sari, I.P., & Zainul, R.: Preparation of E-learning Learning Content Based on Moodle Applications on Acid-Base Materials. Chemistry Education Enthalpy. 2(2), pp. 1-7 (2021)

[7] Wiznia, D., Korom, R., Marzuki, P., Safdieh, J., & Grafstein, B.: PBL 2.0: enhancing problem-based learning through increased student participation. Medical education online. 17(1) (2012)

[8] Santosa, A. S. E., Santyadipura, G. S., & Divayana, D. G. H.: Development of e-modules based on problem based learning models in network administration subjects for class XII computer and network engineering at SMK TI Bali Global Singaraja. KARAMPATI. 6(1), pp. 62-72 (2017)