



A Validity and Effectiveness: PBL-Based Dilemma Story E-Module Colloid Topic to Improve Critical Thinking Ability

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Abstrak

Kemampuan berpikir kritis merupakan salah satu kompetensi yang dibutuhkan dalam pendidikan abad 21. Selain peran guru dalam meningkatkan kemampuan berpikir kritis, tentunya bahan ajar yang digunakan juga harus mendukung dalam meningkatkan kemampuan berpikir kritis siswa. Penelitian ini merupakan penelitian R&D dengan model pengembangan yang digunakan adalah model 4D yang terdiri dari 4 tahap yaitu 1) pendefinisian, 2) perancangan, 3) pengembangan, dan 4) penyebaran. Pengembangan bahan ajar e-modul cerita dilema berbasis PBL pada materi koloid bertujuan untuk menghasilkan bahan pembelajaran yang valid, praktis, dan efektif. Hasil penelitian menunjukkan bahwa e-modul yang dikembangkan memenuhi kriteria layak dengan indikator valid, praktis, dan efektif. Kesimpulannya adalah bahan ajar e-modul cerita dilema berbasis PBL merupakan sarana bagi guru dan khususnya siswa untuk meningkatkan kemampuan berpikir kritis.

Abstract

The ability to think critically is one of the competencies needed in 21st-century education. In addition to the role of teachers in improving critical thinking skills, of course, the teaching materials used must also support in improving the critical thinking skills of students. This research is an R&D research with the development model used as a 4D model consisting of 4 phases 1) define, 2) design, 3) development, and 4) disseminate. Development in the form of teaching materials for PBL-based dilemma story e-modules on colloidal materials aims to produce valid, practical, and effective learning materials. The results showed that the developed e-modules met the feasible criteria with valid, practical, and effective indicators. The conclusion is that the teaching material for the PBL-based dilemma story e-module is a means for teachers and especially students to improve critical thinking skills.

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INTRODUCTION

Critical thinking is the activity of thinking deeply by improving the quality of thinking about information (Saputra & Salim, 2020). According to (Astari & Sumarni, 2020) one of the abilities that must be achieved in 21st-century education is the ability to think critically in addition to creative abilities, collaboration, and information and communication technology. In chemistry learning, the ability to think critically is the main orientation so that it can be used in solving complex problems and becoming a resilient person (Ariyatun s& Octavianelis, 2020). In addition, according to (Saputra & Salim, 2020) chemistry learning also trains students' reasoning power in interpreting a problem including responding to answers to questions about what, why, and what with critical thinking skills. In the context of learning, the ability to think critically is very helpful for students in constructing knowledge, so that students have a scientific understanding of a phenomenon (Fajriani et al., 2021).

According to (Dewi et al., 2020) chemistry learning in schools should be connected to the surrounding environment so that students can solve chemistry problems related to daily life, and indirectly this condition trains students' critical thinking skills. This study is in line with the findings (Barke et al., 2012) that students do not fully have scientific concepts, so learning is still sensitive to the issue of misconceptions due to a lack of training in students' critical thinking skills. The presence of critical thinking skills not only supports students in the problem-solving process, but trains students' digital literacy, communication, and logic skills so that students have concrete competencies (Barke et al., 2009; Rahmawati et al., 2019; Stephenson & Sadler-Mcknight, 2016).

Facts in the field students tend to be passive in collecting information about the material taught, so students tend not to be in the context of critical thinking in solving problems (Saputra & Salim, 2020). Another research found that there are still students who are at a low level of critical thinking even though students have been given learning with a cultural approach (Suardana et al., 2018). Studies from (S. Astuti et al., 2018) also show that some cases of measuring students' critical thinking ability are still in the low category so this ability is considered important in chemistry learning. In addition, the low critical thinking ability of students is due to the learning model used by teachers being irrelevant to develop student's critical thinking skills (Muntari et al., 2021).

The results of observations made at SMAN 2 Banjarmasin, show that students still find it difficult to understand chemical materials in the application of daily life, especially colloidal materials. Most students only know the concept of colloidal material in a knowledgeable way but still lack connection with daily life. In addition, students also tend to be more interested in accessing learners through smartphones than the available package books. Based on observations, teachers still use learning media that are considered familiar to students.

The development of E-modules is an alternative way to improve students' critical thinking skills (Syahiddah et al., 2021). The developed e-module is in the form of a dilemma story E-Module. A dilemma story is an approach that is considered strategic in training students' thinking skills, especially in learning chemistry in the current era of the Covid-19 pandemic (Nguyen et al., 2020; Pandey, 2019; Rahmawati et al., 2020; Youmans, 2020). Learning chemistry with the concept of dilemma stories (dilemma stories) can help students in solving many problems, especially when the concept of this dilemma story collaborates with problem-based learning (PBL) (R. Astuti & Triyanto, 2021; Barke et al., 2012; Bodlalo et al., 2013; Rahmawati et al., 2020). That is, this research concept indirectly trains students' reasoning skills in solving a problem so that students can think critically (Alrubaie & Daniel, 2014; Cloonan et al., 2011; Facione, 2017; Sastrika et al., 2016).

Researchers are interested in researching the development of problem-based learning (PBL) dilemma story e-modules on colloidal materials to improve the critical thinking skills of students in class XI MIPA SMAN 2 Banjarmasin.

METHOD

Research and development is a research method used to produce certain products and test their effectiveness of these products (Sugiyono, 2016). The development of the dilemma story e-module is the purpose of this study, by using the canva web and utilizing fliphtml5 media as a platform to support research, which is carried out to improve the critical thinking skills of students.

The development model used is a 4D model, namely, define, design, develop, and disseminate. The sampling technique used is the random sampling technique. The instruments used are test instruments in the form of critical thinking ability test instruments, and non-test instruments consisting of validation questionnaires, readability questionnaires, teacher response questionnaires, student response questionnaires, and observation sheets. The research subjects consisted of development subjects (validators) and product trial subjects were students of class XI MIPA 3 SMA Negeri 2 Banjarmasin. The object of the study is the - module story dilemma.

The data obtained were analyzed to test the validity, practicality, and effectiveness of the developed dilemma story e-module. This research uses a 4D development procedure that starts with the define stage and to the disseminated stage according to the purpose of the development research, namely floating a dilemma story e-module.

RESULT AND DISCUSSION

The defining stage begins with an early-end analysis, where an interview process is carried out with the subject teacher and preliminary observation. The results of the initial analysis show the need for teaching materials developed in chemistry learning. Furthermore, the distribution of questionnaires for the need for teaching materials to be developed in the form of PBL-based dilemma story e-modules was carried out. The results of the distribution of the needs questionnaire are as follows:

1. Students feel the importance of using e-modules in the learning process
2. Students think that teaching materials affect critical thinking skills
3. Students feel that the use of smartphones can facilitate learning, especially chemistry learning
4. Students are interested in chemistry learning is in the form of a dilemma story
5. Students agree that PBL-based dilemma story e-module teaching materials are developed on colloidal materials

The design stage is carried out by designing e-modules using the canva web. The content of the PBL-based dilemma story e-module consists of a front cover page, a start page (foreword, table of contents, a list of images, a list of tables, instructions for using the e-module, basic competencies and indicators, and learning objectives), a content page (learning materials, examples of dilemma story questions, dilemma story questions, summaries, evaluation questions), and the final page, consist of bibliography, glossary, and developer biodata (Figure 1).



Figure 1. ModuleCover and dilemma story questions

The validity of the e-module story dilemma is known based on the assessment of the results of the validation questionnaire test by 5 validators. The results of the questionnaire assessment are shown in Table 5. next.

Table 5 Dilemma story e-module validation results

Assessment aspects	Validators					Average	Validation Score	Information
	I	II	III	IV	V			
Fill	36	35	33	36	33	34,6	96,11%	Highly Valid
Serving	8	8	8	8	7	7,8	97,50%	Highly Valid
Language	24	23	24	24	22	23,4	97,50%	Highly Valid

The content feasibility aspect has 8 assessment indicators from 9 assessment items. The results of the content feasibility assessment fall into the category of highly valid. The research (Zhafirah et al., 2020) stated that the development of e-modules with a PBL model with a percentage of 84.89% in the content aspect was declared to be a very valid category. Product development is also said to be feasible if the components of the product developed are systematically arranged and refer to clear learning objectives (Sugiyono, 2019).

The feasibility aspect of the presentation has 2 assessment indicators and 2 assessment items. The results of this presentation feasibility assessment fall into the category of very valid. This is in line with research (Arsal *et al.*, 2019) that the development of e-modules is declared very valid in the aspect of presentation with minor improvements based on suggestions and input from validators.

The language feasibility aspect has 6 assessment indicators and 6 assessment items. The results of this language feasibility assessment fall into the category of very valid. The study (Zhafirah *et al.*, 2020) stated that the development of e-modules received a percentage of 82.78% with a very valid category, indicating that e-modules are under the rules of Indonesian. Based on the results of this percentage, PBL-based pomegranate story e-module teaching materials on colloidal materials are included in the very valid category used as teaching materials.

The practicality of the dilemma story e-module is known from the results of filling in individual readability questionnaires, small group readability, and limited trials (teacher and student response questionnaires, and teacher observation sheets in using PBL-based dilemma story e-modules). Individual trials were given to 5 learners and small group trials were given to 10 learners. The results of the practicality of the e-module story dilemma are presented in Table 6. next.

Table 6 *Results of individual and small group readability trials*

Readability Trial	Average Score	Average Percentage	Information
Individual	33,2	83%	Very practical
Small Groups	33,4	83,5%	Very practical

According to (Akbar, 2013) the results of the scores showed that the dilemma story e-module belongs to the category of very practical to use as teaching material.

Table 7 *Limited trial results*

Limited Trial	Average Score	Average Percentage	Information
Student Response	32	80,91%	Practical
Teacher's Response	37	92,5%	Very practical
Observation of E-module Usage	3,555	88,88%	Very practical
Observation of Teacher Abilities	3,471	86,79%	Very practical

It can be concluded that limited trials belong to the category of very practical. So that it can be concluded that the e-module of the dilemma story can be used as teaching material in chemistry learning. The effectiveness of the dilemma story e-module is known from the results of the assessment of the work on the critical thinking ability test instrument carried out by 33 students. The test assessment results are presented in Table 8. next.

Table 8 *Average pretest and post-test scores of students' critical thinking ability*

Value	Pretest	Post Test
Lowest	6	56
Highest	17	89
Average	13	75
Average N-gain	0,71 (high)	

N-gain is in the high category, so it can be concluded that the dilemma story e-module is effective in improving students' critical thinking skills.

CONCLUSION

Based on the results of research and discussion, it can be concluded: 1) The Problem-Based Learning (PBL)-based dilemma story e-module developed has met the very valid category of being used as teaching material in learning; 2) PBL-based dilemma story e-modules developed to meet the practical category of being used as teaching materials in learning, based on the results of individual trials, small group trials, questionnaires for teacher and student responses, teacher observations using e-modules, and teacher observations managing classes; 3) The PBL-based dilemma story e-module developed has met the criteria for effectiveness as teaching material in learning because there is an increase in students' critical thinking

ability based on N-gain between pre-test and post-test. The N-gain result of 0.71 with a high category, shows that the developed PBL-based dilemma story e-module is effectively used.

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