

Development of Electronic Module on Colligative Materials STEM Based Solutions (Science, Technology, Engineering, Mathematics) Using Kvisoft Flipbook Maker Application

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Abstract. This research is motivated by the increasingly rapid development of science and technology, which requires Indonesia to continue to race to not only improve its infrastructure, but also to improve the quality of its human resources. In addition, the teaching materials used in lectures are still in the form of printed materials (not yet using electronic modules) and have not been integrated into STEM. The results showed that the electronic module on the colligative properties of STEM based solutions using kvisoft flipbook maker application developed was declared very feasible with an average feasibility value of 92,34. While the practicality test was declared very practical by the lecture with an average practicality value of 94 and received a very good response from students with an average practicality value of 96,38 very practical category, without revision. In terms of effectiveness, it is declared effective with an N-gain value of 0,77 high criteria.

Keywords: Development, Electronic Module, STEM, Kvisoft Flipbook Maker

1 Introduction

rapid development of science and technology requires Indonesia to continue to race not only to improve its infrastructure, but also to improve the quality of its human resources. Efforts to get graduates who have superior characteristics in linking a scientific field of Science with real life can be done through comprehensive education. Science, Technology, Engineering and Mathematics (STEM) is a new approach in the development of the world of education that combines more than one discipline. According to [1] in the world of education, there are important issues that are re-warming in the form of Science, Technology, Engineering and Mathematics (STEM) issues. Based on observations in previous lectures, the teaching materials used have not been integrated into STEM and are still in the form of printed teaching materials

not yet using the Kvisoft Flipbook Maker application. The teaching materials used only focus on working on practice questions, so that students lack critical thinking skills and students' scientific literacy is not maximal. The STEM approach is not only focused on science, but also has learning that includes psychomotor aspects in the skills section. The field of engineering requires that existing skills be engineered so that they can be applied according to the environmental conditions of students. Mathematical calculations are also carried out in learning in this STEM approach [2]. In addition to using the right learning approach, the use of teaching materials must also be appropriate so that the thinking skills of students can be trained. Teaching materials play an important role in ensuring the effectiveness of teaching and learning activities [3]. This is in line with research [4] STEM-based learning modules on thermochemical materials can improve student learning outcomes and motivation. One of the teaching materials that can be used is the electronic module. An e-module (electronic module) is an electronic version of a printed module that can be read on a computer and designed with the required software. The Kvisoft Flipbook Maker application is one application that supports as a learning medium that will help in the learning process. Based on the described background, it is necessary to conduct research, namely "Development of Electronic Modules on Colligative Properties of STEM-Based Solutions (Science, Technology, Engineering, Mathematics) using the Kvisoft Flipbook Maker application". The purpose of this study is to produce an Electronic Module on the Colligative Properties of STEM-Based Solutions (Science, Technology, Engineering, Mathematics) using the Kvisoft Flipbook Maker application that is valid, practical and effective.

2 Method

This research is a research and development type. According to [5], research and development is a powerful strategy for improving practice. It is the process used to develop and validate educational products. This research was conducted at the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Medan State University. The population in this study were all students who took general chemistry courses which consisted of 5 classes. The sample in this study is one class from the population taken at random. This study uses a modified Borg and Gall model from Sugiyono with research procedures consisting of potential and problems, data collection, product design, design validation, design revision, and product testing. Data collection techniques in this study were carried out with instrument feasibility sheets, questionnaires and learning outcomes tests. The data analysis technique uses the feasibility and practicality formula for the results of questionnaire and N-Gain formula for learning outcome test.

3 Result and Discussion

Based on the researcher's observations in general chemistry lectures, the teaching materials used have not been integrated with STEM and are still in the form of printed teaching materials that have not used the Kvisoft Flipbook Maker application. The teaching materials used only focus on working on practice questions, so that students lack critical thinking skills and students' scientific literacy is not maximal. For this reason, the researcher took the initiative to develop a STEM-based electronic module using the Kvisoft Flipbook Maker application which is

expected to improve student scientific literacy and at the same time minimize the cost of purchasing teaching materials.

Observation activities are carried out to find out problems in the lecture process. Observations were made on learning resources, use of media, methods, and learning models. Based on these observations, it can be concluded that the lack of STEM-integrated electronic modules causes the lecture process to be less than optimal to direct students in relating the material to everyday life, so it is necessary to develop STEM-based electronic modules using the Kvisoft Flipbook Maker application on the colligative properties of solutions.

At the product design stage, initial product development is carried out in the form of a STEM-based module on the colligative properties of the solution. In this process, curriculum analysis, design of lecture activities, core competencies, basic competencies, and learning objectives are carried out, and prepare validation instruments, practicalities, student response questionnaires and test instruments. The systematics of the designed module consists of: cover, table of contents, foreword, introduction, instructions for using the module, STEM approach, core competencies, basic competencies, learning objectives, concept maps, material colligative properties of solutions (integrating material with science, technology, engineering, mathematics), the material is equipped with sample questions, practicum activities, competency tests, summaries, glossaries, evaluation questions, answer keys, and bibliography. After the initial draft of the module is compiled, then the module is converted into an electronic module using the kvisoft flipbook maker application.

The test instrument is also structured to determine the effectiveness of the modules used in the lectures later. The test instrument used was a multiple choice test which was originally composed of a test grid of 30 questions according to the indicators and learning objectives. The test has high validity if the results match the criteria, in the sense of having parallels between the test and the criteria [6]. After that, validation tests were carried out to experts and the tests were piloted to students who had taken general chemistry courses. The test results obtained 16 valid questions with a reliability of 0.76, and an average level of difficulty.

At the design validation stage, the validity of the module was tested on 3 validators (material and media experts) using a validation instrument. The purpose of this validation is to see the feasibility of a STEM-based electronic module using the Kvisoft Flipbook Maker application that has been developed. The results of the assessment of each validator were analyzed using feasibility formula. The resulting feasibility data can be seen in Table 1 below.

Table 1. Material Expert feasibility recapitulation

Assessment Aspect	feasibility			Average	Category
	Exp 1	Exp 2	Exp 3		
Curriculum Suistability	100	95	95	96,7	very high
Material accuracy	95	100	80	91,7	very high
Clarity of evaluation in the module	95	95	85	88,3	very high
Material presentation accuracy	96	96	96	96	very high
Conformity with language rules	100	88	80	89,3	very high
Conformity with the development of critical thinking skills and scientific literacy	100	100	90	96,7	very high
Conformity with Socio-Scientific Issues	100	100	100	100	very high

In the table, it can be seen that from the seven assessment criteria assessed by each material expert, an average value of 93.30 was obtained in the very feasible category. This shows that the STEM-based electronic module using the Kvisoft Flipbook Maker application developed is feasible to use with a very feasible eligibility category.

At the next stage, media expert validation is carried out by 3 lecturers. The assessment aspect consists of cover, layout, images and illustrations and colors. the results of the questionnaire assessment were analyzed using the feasibility formula. The resulting data on the feasibility of media experts can be seen in Table 2 below.

Table 2. Media Expert feasibility recapitulation

Assessment Aspect	Feasibility			Average	Category
	Exp 1	Exp 2	Exp 3		
Cover	93	93	80	88,7	very high
Layout	91	96	87	91,3	very high
Pictures and illustrations	96	100	84	93,3	very high
Colour	80	100	100	93,3	very high

In the table, it can be seen that from the four assessment criteria assessed by each medial expert, an average value of 91.38 was obtained in the very feasible category. This shows that the STEM-based electronic module using the Kvisoft Flipbook Maker application developed is feasible to use with a very feasible eligibility category. Based on the results of the material and media expert assessment, suggestions and input were also obtained for the developed module. researchers make revisions on the advice of experts. The suggestions include revising images with less resolution, spaces between words, several tables, sentences adapted to scientific rules. Before the trial was conducted, 5 general chemistry lecturers were asked to evaluate the STEM-based electronic module using the Kvisoft Flipbook Maker application that was developed. This aims to determine the practicality of the module. The results obtained from the questionnaire were then analyzed using the practicality formula. the three criteria for practicality statements by general chemistry lecturers obtained an average practicality value (Rg) of 94 with a very practical category, without revision. This shows that the STEM-based electronic module using the Kvisoft Flipbook Maker application developed is practical to use with categories practicality is very practical.

Before the researcher conducts learning using electronic modules based on STEM (science, technology, engineering, mathematics) first, a pretest is carried out on students taking general chemistry courses, namely the PSPM 21E class. Then the learning was carried out and after that the posttest was carried out. based on the test results of 20 students, the average pretest score was 54.65 and the posttest average was 89.25 so that the N-Gain average value was 0.77 with high criteria. This means that the developed electronic module is effectively used in learning. After the electronic module is used in learning then the researcher gave a response questionnaire to the students. The results obtained from the questionnaire were then analyzed using the practicality formula and obtained practical value. of the three criteria for practicality statements for student responses, the average practicality value (Rs) is 96.38 with a very practical category, without revision. This shows that the STEM-based electronic module using the Kvisoft Flipbook Maker application developed is practical for users used with practicality category very practical.

After the validation, revision and product testing stages have been carried out, the results show that the STEM-based chemistry module developed is valid, practical and effective. This is in accordance with the results of research [7] which states that e-modules using the Kvisoft Flipbook Maker application can increase students' interest and cognitive learning outcomes.

4 Conclusion

Based on the results and discussions that have been described, the authors can draw the following conclusions: (1) test the validity of the STEM-based electronic module using the Kvisoft Flipbook Maker application on the colligative properties of the solution which is declared very feasible with an average feasibility value (P) of 92.34 , with an average feasibility value (P) of material experts 93.30 with a very decent category and a feasibility value (P) of media experts 91.36 with a very decent category (2) The practicality test of STEM-based electronic modules using the Kvisoft Flipbook Maker application on the colligative properties of the solution is stated to be very practical, without revision with an average practicality value (Rg) or a general chemistry lecturer response of 94 and an average student practicality value (ρ) of 96.38 (3) Test the effectiveness of the STEM-based electronic module using the Kvisoft

Flipbook Maker application on the colligative properties of the solution, which is declared effective with an N-gain value of 0.77 high criteria.

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