Development of Higher Order Thinking Skill (HOTS) Chemistry Module Based on Problem Based Learning (PBL) Model on Colligative Properties of Solutions

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Abstract. This study aims to develop a Higher Order Thinking Skill (HOTS) chemistry module which is integrated with the Problem Based Learning (PBL) learning model on the colligative properties of solutions in general chemistry courses. This research was conducted at the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Medan State University. The development of this chemistry module is carried out using a 4-D development model. Then validated by expert validators and see how students respond to the chemistry module. Based on the data analysis of the feasibility test carried out using the kappa-cohen test, the kappa moment value of 0.769 was included in the "high" category with a feasibility percentage of 83.3%. This is also supported by data on student responses to the chemistry module which received a positive response with an average percentage of 91.10% which was included in the very good category.

Keywords: Chemistry Module, Higher Order Thinking Skill, Problem Based Learning.

1 Introduction

Education in the age of advanced technology as it is today is very important for the next generation of the nation and one of the reasons for the importance of education is to be able to compete in the world of work and be able to create jobs so that it has a positive impact on the wider community. This is in line with the goals of national education as stated in Law no. 20 of 2003 which is to develop the potential of each individual to improve the quality of knowledge, skills, and personality. One of the potential developments can be done by developing high-level thinking skills so that students have the character to be able to independently and scientifically solve the problems they face. The high-level thinking skills in question include students who can think critically about all information received, students can come up with creative and innovative ideas in solving and solving problems they face correctly and precisely,are able to communicate well with anyone, and able to work with colleagues and confident [1,2]. To

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achieve this goal, Indonesia participates in international programs such as the Program for International Students Assessment (PISA), which one of the main objectives of the program is to improve students' thinking skills through the right education system. In the current era of globalization, students are expected to have globally competitive human resources. Therefore, it is necessary to develop higher-order thinking skills to meet these expectations [3]. Based on the results of the author's observations on Higher Order Thinking Skill (HOTS) chemistry teaching materials in general chemistry lecture activities, especially in the material colligative properties of solutions are still minimal. In general, students use teaching materials that are not integrated with Higher Order Thinking Skills (HOTS) and Problem Based Learning models. Therefore, there is still a need for additional Higher Order Thinking Skill (HOTS) chemistry teaching materials that are integrated with appropriate learning models such as Problem Based Learning. Previous research has been carried out [4] related to the application of problem based learning models in teaching and learning activities and obtained the results that the application of problem based learning models can improve students' Higher Order Thinking Skill (HOTS) abilities. This proves that the Higher Order Thinking Skill (HOTS) chemistry module requires appropriate learning models such as problem based learning models to improve students' higher order thinking skills. The basic concepts of chemistry are widely applied for the benefit of human life in the fields of health, technology, and science. One of the chemical materials that are very important in its application is the colligative property of the solution. Some of the benefits of the basic concept of the colligative properties of solutions are in the use of infusions in the world of health which focus on the right osmotic pressure so that intravenous fluids can flow into human blood vessels. This becomes a scientific capital for students to think at a high level regarding the colligative properties of this solution so that they can apply the concept, and analyze it to create something new that is useful for the life of living things. Based on this explanation, it is very necessary to do research "Development of Higher Order Thinking Skill (HOTS) Chemistry Module Based on Problem Based Learning Model on Colligative Properties of Solutions" so that it is expected to become a Higher Order Thinking Skill (HOTS) literacy and meet the availability of teaching materials related to skills. Higher Order Thinking Skills (HOTS) of students supported by the Problem Based Learning model.

2 Methods

The research method used in this study is the Research and Development (R&D) method with a 4-D model. Research and development [5] is a process for developing and validating products. Research and development is also a process to develop a new product or improve an existing product [6]. The 4-D development model consists of four stages, namely define, design, develop, and disseminate [7]. Data collection techniques in this study used non-test instruments such as eligibility sheets and student response questionnaires to the results of the development Higher Order Thinking Skill (HOTS) chemistry module based on Problem Based Learning on colligative properties solution. The data analysis technique for the feasibility test was carried out using the kappa formula.

3 Result and Discussion

The chemistry module developed was validated by two expert validators to determine the feasibility of developing the chemistry module. In addition, an analysis of the results of the responses of students who have used the developed chemistry module was also carried out. The results of the feasibility test of the developed chemical module can be seen in table 1. as follows.

Table 1. Results of Data Analysis of Chemistry Module Material Validation

		Value	asymp. Std. Error [a]	Approx. T [b]	pprox.Sig.
Measure of Agreement	Kappa	.769	.218	3.354	.001
N of Valid Cases		18			

The results of the analysis in table 1. above use the kappa Cohen formula and the kappa moment results are 0.769. It means that the level of agreement of the expert validators in assessing the developed chemistry module belongs to the high category. While the percentage of the feasibility of the chemistry module can be seen in table 2. as follows.

Table 2. Percentage of Eligibility of Chemistry Module

rater2					
			Not Feasible	Feasible	Total
rater1	Not Feasible	Count	2	1	3
		% of Total	11.1%	5.6%	16.7%
	Feasible	Count	0	15	15
		% of Total	.0%	83.3%	83.3%
Total		Count	2	16	18
		% of Total	11.1%	88.9%	100.0%

Based on the data in table 2. above, shows that the percentage of the feasibility of the chemistry module developed is 83.3% and is included in the very feasible category to be usedin the learning process. After conducting a feasibility test on the developed chemistry module, then an analysis of student response data was carried out on students who had used the module as many as 152 students with aspects assessed including language, writing clarity, image clarity, module cover, color composition, and accuracy of the material on the subject. Student response data to chemistry module can be seen in Figure 1. as follows.

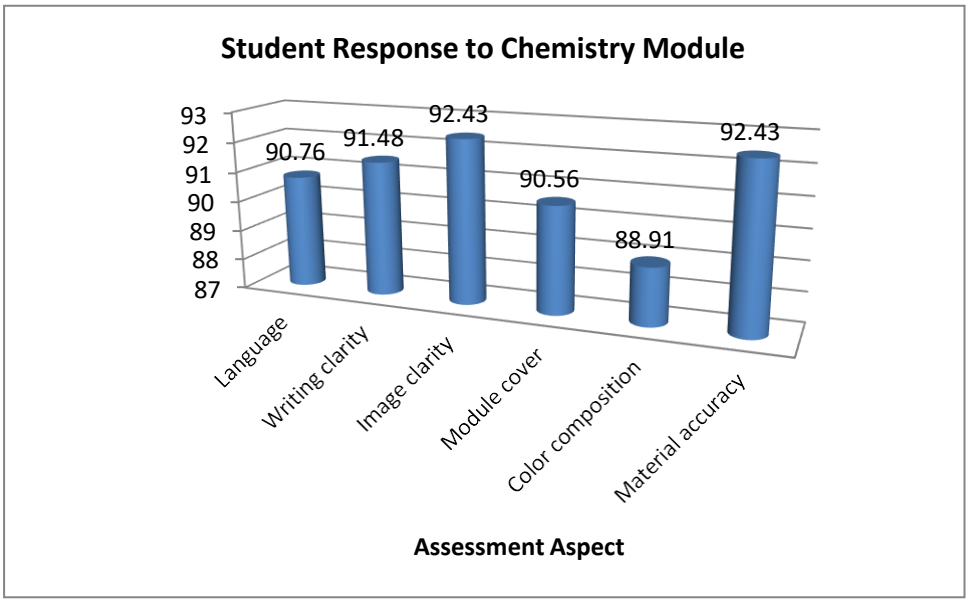

Figure 1. Student response to chemistry module

Based on the student response data, the average percentage of all aspects assessed was 91.10% which was included in the very feasible category for use in the learning process of students.

4 Conclusion

Based on the results and discussions that have been described, the authors can conclude that: (1) The results of the data analysis of the media validation of the Higher Order Thinking Skill chemical module based on the Problem Based Learning Model on the Colligative Properties of Solutions obtained the Kappa Cohen moment value of 0.769 with a feasibility percentage of 83.3% which included the high category and very feasible to be used in the learning process, (2) The results of the data analysis of student responses to the Higher Order Thinking Skill chemistry module based on the Problem Based Learning Model on the Colligative Properties of Solutions obtained on average the percentage of 91.10% which is included in the very feasible and interesting category to be used in the learning process.

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