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DEVELOPMENT OF CHEMISTRY MODULE OF ACID-BASE SOLUTION MATERIALS BASED ON PROBLEM-BASED LEARNING

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Abstract: Modules are very important developed in chemistry learning. Modules as teaching materials are very minimal so that they become obstacles in chemistry learning, especially acid-base solution materials. Therefore, this study aims to develop and validate the feasibility of chemical modules on acid-base solution materials through a problem-based learning approach, as well as to examine the responses of students and teachers to the developed products. The method in this study uses research and development (R&D) methods and ADDIE is a development model applied as a methodology. The sample in this study was 25 students. The sampling technique is saturated samples. The module is validated by the material and media validators then validated by the teacher and asked for feedback from students. The data was processed using SPPS acid-base solution as the subject of this study. The module was developed because it is very feasible to be applied in chemistry learning to acid-base solution materials, based on the results of data analysis. The material validator gave an average score of 92% (very decent), the media validator 95% (very decent), the teacher's response to 96% (very good) and the students' response to the developed module was 98% (very good) and the average was 94% (very decent).
Keywords: Module, Problem Based Learning, Acid-Base Solution

1. INTRODUCTION

The online and offline learning process requires skills that require students to be active in solving problems innovatively and creatively. Face-to-face learning receives full guidance for students from educators. However, in distance learning, students must be accustomed to independent learning. Increasing students' independence in learning can occur due to stimulus factors from within and outside (Siregar, 2021). Online or distance learning requires a teacher to master science and technology so that online or distance learning can run efficiently and effectively. The implementation of online and offline learning must pay attention to the role of the world of education in improving the quality of human resources to face the era of society 5.0. Entering the era of society 5.0 at this time, students are given the freedom to choose their learning style and style, where students can determine when and where they will learn. A person's desire or emotional atmosphere for learning can arise anytime and anywhere, so that if this happens, students need to be accommodated so that they can learn immediately, including in terms of providing learning resources, learning media and learning environments. In these conditions, students can learn in various scenarios, both formal and informal, in the classroom and outside the classroom, individually or in groups. Digital and non-digital media, as well as physical and virtual environments (Sudarmanto et al., 2021). The implementation of

the 2013 curriculum based on problem-based learning can use several strategies such as contextual learning. Therefore, in the learning process, students are taught to find out from various sources through observing, asking, trying, processing, presenting, concluding, and creating for all subjects (Sudarwan, 2013). One of the subjects that must be taught in the 2013 curriculum at the high school level is chemistry. Chemistry subjects study the science that studies the properties of substances and how they react with other substances. One of the objectives of chemistry subjects is to apply the concept of chemistry to solve problems in daily life and technology (Ministry of Education and Culture, 2013). A teacher should be total in the process of learning chemistry that is conveyed. Teachers must be totality in the learning process shown by the use of varied teaching materials. Varied and appropriate teaching materials can increase learning motivation in the learning process (Islamiyah et al., 2022; Asmi et al., 2023; Tiurlina Siregar., 2023). Today's technological developments have affected all areas of life, including education. Technological developments can be used to improve the quality of education by providing teaching materials that are easy to obtain, easy to understand and attract the interest of readers such as modules. Modules are teaching materials in the form of modules that are presented which are expected to increase students' interest and motivation to learn (Vaino et al., 2012; Fitri et al., 2023). This is because the e-module has a display in the form of images, audio, video and animations. In addition, e-modules can be used as teaching materials by students independently at school or at home. The use of teaching materials in the form of modules will be very helpful in the student-centered learning process. Teaching materials can allow students to learn a basic competency systematically so that they are cumulatively able to master all competencies comprehensively and integrally (Sudjana, 2010). Modules can be used by educators and students to facilitate the learning process and understanding of chemistry subjects, especially acid-base solution materials. Teaching materials that can make students learn independently are needed in addition to classroom learning. Such self-learning can be achieved by using problem-based electronic e-modules (Munthe et al., 2019; Asmi et al., 2023). One of the important chemical materials to teach is acid-base solution material. Acid-base solution material at the high school education level is given in the odd semester in grade XII in the odd semester. Based on the results of the analysis, acid-base solution material is a difficult material that requires high analysis because students not only understand concepts but also calculations. Chemistry learning on acid-base solution materials in the classroom is good. Teachers during the learning process use various methods. One of the methods used in learning chemistry about acid-base solutions is the practicum method, because according to the teacher himself, the practicum method can make students active and this practicum method can make it easier for teachers to convey abstract material. The module has not been used as teaching material at the Christian Education Foundation (YPK) Kotaraja Jayapura Diaspora High School.

YPK Diaspora Jayapura High School, chemistry learning has not used modules as teaching materials in the form of printed books, worksheets, slides and videos optimally and consistently. This is because these teaching materials are not always used by teachers in every subject. In addition, the printed books used do

not display problem-based learning steps, so they are less interested in students to learn independently in finding concepts.

2. RESEARCH METHODS

The method in this study uses a type of development research or known as Research and Development (R&D) which is adapted from Dick and Carry (Sugiyono, 2019). This development research method uses ADDIE (Analysis, Design, Development, Implementation, Evaluation). The focus of the research is design, feasibility assessment, teacher response and student response to module development. The subject of this study is acid-base solution material. The module is a product of this research which has been validated by 3 material validators and 3 media validators from lecturers from Cenderawasih University (UNCEN) from chemistry teachers at YPK Diaspora High School Kotaraja Jayapura and student responses. Instruments in the form of questionnaires were distributed to 3 chemistry teachers and 25.

Table 1. Eligibility validation results criteria (Rohmad et al. 2013)

Interval % score	Criterion
75% < score ≤ 100%	Highly feasible
50% < score ≤ 75%	Qualify
25% < score ≤ 50%	Less worthy
0% < score ≤ 25%	Not eligible

Table 2. Criteria for Teacher Response and Student Response Score Percentage (Sari and Alarifin, 2016)

% Score interval	Criterion
81% < score ≤ 100%	Excellent
62% < score ≤ 81%	Good
43% < score ≤ 62%	Bad
0 % < score ≤ 43%	Bad

The data obtained are quantitative data from the distribution of questionnaires on the feasibility of the chemistry module of acid-base solution materials based on problem-based learning that have been developed, then a descriptive percentage analysis was carried out. If the total percentage meets the eligibility criteria, then the chemistry module of acid-base solution material through base learning is suitable to be used as teaching material in learning. Validation carried out by validators, namely material validation and media validation, is also carried out by teachers and students. The assessment criteria for the module are a score range of 2, 1 and 0.

The data obtained were analyzed using descriptive percentage analysis, with the following equations (Sudjana, 2005):

$$P = \frac{n}{N} x\ 100\%$$

Remarks: P = percentage of scores obtained, n = total scores obtained, N = total maximum scores in each aspect. The validation criteria from the validators are in accordance with Table 1 and the data of teacher responses and student responses to the module using the criteria in Table 2.

3. RESULTS AND DISCUSSION

Chemical assessment of the acid-base solution is carried out by the validator. The recapitulation of the results of the assessment by the validator can be seen in Table 3.

Table 3. Product and Validator Assessment Recapitulation Results

No.	Assessment Indicators	Score			Average
		Validator I	Validator II	Validator III	
Eligibility Aspects of Content					
1	Material suitability with CP and TP	83%	100%	100%	94%
2	Material accuracy	89%	89%	96%	92%
3	Supporting learning materials	100%	92%	96%	96%
4	Updating of the material	100%	88%	100%	96%
Average		93%	92%	98%	94%
Aspects of Presentation Eligibility					
5	Presentation technique	88%	100%	100%	96%
6	Presentation support	92%	83%	71%	82%
7	Learning Presentation	100%	100%	100%	100%
8	Completeness in presentation	94%	88%	88%	90%
Average		93%	93%	90%	92%
Language Assessment Aspects					
9	Businesslike	83%	100%	100%	94%
10	Communicative	75%	75%	100%	94%
11	Dialogical and Interactive	100%	75%	88%	88%
12	Suitability with the level of development of students	100%	100%	100%	100%
13	Collapse and integration of the mindset	100%	75%	100%	92%
14	Use of terms, symbols or icons	100%	75%	100%	92%
Average		93%	83%	98%	91%
Average Presentation		93%	89%	95%	92%
Average overall percentage		92%			
Criterion		Highly Worth It			

Based on Table 3. The average percentage of the overall feasibility aspect of the module (material) was obtained of 92%. The average result of the overall percentage of the feasibility aspect of the module falls under the very feasible criteria, which is in the range of 76%-100%. A summary of the average percentage of feasibility of chemistry learning modules on problem-based learning acid-base solution materials carried out by media validators can be presented in Table 4. as follows:

Table 4. Summary of Average Aspects of Module Eligibility (Media)

No.	Aspects	Validator I	Validator II	Validator III	Average	Information
1	Graphic qualification	100%	96%	86%	95%	Highly Worth It
Average		100%	96%	86%	95%	Highly Worth It

Based on Table 4, it can be seen that the results of the feasibility assessment of the reaction material chemistry module obtained an average of 95% have very feasible assessment criteria. The module is very feasible to use in the field without revision, but there are a few things that need to be improved based on some feedback from validators.

The response of science teachers to the development of chemistry learning modules on problem-based learning acid-base solution materials can be seen in Table 5. As follows:

Table 5. Recap of the Teacher's Response Questionnaire

No.	Respondents	Statement										Score	Percentage
		1	2	3	4	5	6	7	8	9	10		
1	Biology Teacher	4	4	4	4	4	4	4	4	4	4	40	100%
2	Chemistry Teacher	4	4	4	3	4	4	3	4	4	3	37	93%
3	Chemistry Teacher	4	4	3	4	4	3	4	4	4	4	38	95%
Score		12	12	11	11	12	11	11	12	12	11	115	
Average		4	4	3,7	3,7	4	3,7	3,7	4	4	3,7	38	
Percentage		80%	80%	87%	87%	80%	87%	87%	80%	80%	87%		96%

Based on Table 5. The average response of science teachers at YPK Diaspora High School Kotaraja Jayapura was 96% with the very good category.

Table 6. Results of the Student Questionnaire Assessment Recapitulation

No.	Assessment Indicators	Score					Average
		Res 1	Res 2	Res 3	Res 4	Res 5	
1	Interest	100%	88%	95%	83%	92%	92%
2	Material	98%	88%	95%	88%	88%	91%
3	Language	100%	92%	92%	100%	92%	95%
	Average Percentage	99%	89%	94%	90%	91%	94%
Overall average		98%					
Criterion		Excellent					

Based on Table 6. It can be seen that the average percentage of student respondents to the module from all aspects is 98%, thus according to the students all aspects in the module obtained a very good

category. This is in line with the research of Tiurlina Siregar (2024) and (2023) the use of chemistry e-modules can improve student learning outcomes.

4. CONCLUSIONS AND SUGGESTIONS

CONCLUSIONS

The chemistry module on acid-base solution materials based on problem-based learning is very suitable for use as a teaching material module in schools. This is based on the average assessment of 92% material validators with the category of very feasible, 95% media validators are very feasible and 96% of teachers' responses are very good. After being implemented in the classroom, 98% of the students' response was very good.

SUGGESTIONS

The chemistry module on acid-base solution material based on problem-based learning is very feasible to use in chemistry learning.

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