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DEVELOPMENT OF TEACHING MATERIALS INTEGRATED WITH GENERIC SCIENCE SKILLS ON ACID-BASE SUBJECT

Ani Sutiani[1], Hanna Maria Siahaan[2*], Zainuddin Muchtar[3], Ratu Evina Dibyantini[4], Marudut Sinaga[5]
[1 2345]Faculty of Mathematics and Natural Sciences, Medan State University, 20221, Indonesia
*hannamariasiahaan060501@gmail.com

ABSTRACT
The use of textbooks owned by the teacher is still too dense in material and also lack of explanation with the addition of pictures so it is more difficult for students to understand what is being learned. Student success can also be measured from the basic abilities of students in undergoing the learning process. This basic ability is known as generic skills. The purpose of this research was to find out how the feasibility of the teaching materials being developed and to find out students' responses to the teaching materials being developed. This research was conducted at the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Medan State University, and at SMAN 1 Percut Sei Tuan. The object of this study is chemistry teaching materials integrated with generic science skills in acid-base materials. The subjects in this study were acid and base materials. The type of research used is Research and Development (R&D) by giving a questionnaire to determine the feasibility of the module and to find out the response. The model used in this study is the 4-D development model which consists of 4 stages of development, namely Define, Design, Develop, and Disseminate. Based on the results of validation by media experts and material experts, an average media validation of 82.52% and material validation of 84.90% was obtained. (The student response was 95.4% with a very high response criterion, where the integrated module of generic science skills on acids and bases was appropriate for use.

Keywords: *Teaching Materials, Generic Science Skills, Acids and Bases.*

1. INTRODUCTION
Chemistry is seen as a science that is quite difficult to understand, and not interesting to study (Ulya et al., 2018). The cause of students experiencing difficulties in learning chemistry is the lack of interest and attention of students during the learning process in chemistry. The learning process at school looks less attractive, so students feel bored and lack interest in chemistry lessons. In addition, learning difficulties for high school students in understanding chemistry subject matter require various boundary criteria so that with these criteria limits are set where students can be expected to experience difficulties in learning (Ulya et al., 2018).

The use of teaching materials such as textbooks owned by teachers is still in the form of makeshift textbooks, textbooks owned are too dense in material, and also lack explanation with the addition of pictures so students find it more difficult to understand what is being learned. There are three reasons to consider the development of teaching materials, namely: First, the availability of teaching materials in accordance with the demands of the curriculum. Second, the availability of teaching materials is based on the characteristics of students. Third, the availability of teaching materials is based on the demands of solving learning problems (Sihombing et al., 2018).

Student success can also be measured from the basic abilities of students in undergoing the learning process. These basic abilities are known as generic skills. In addition to the mastery of the concepts in the material, we can measure how students' generic skills are in the material. With generic measurements, we can know that students have made a difference in the learning process. This means that students have experienced a learning process that changes their understanding. Generic science ability is the result of a combination of intellectual abilities and complex interactions between knowledge and skills of (Rosnita, 2016).

2. LITERATURE REVIEW
2.1 Generic Science Skills
Rosnita (2016) suggested nine aspects of generic science skills, namely (1) direct observation, objects that are directly observed, for example, observations of the sun, earth, moon, and other celestial objects in the sky; (2) Indirect observation, namely certain objects that require tools, due to the limitations of the senses. (3) Awareness of the magnitude scale can be developed through investigative trials in reading earthquake seismograph scales; (4) Symbolic languages, such as information from graphs, pictures, charts, or diagrams, understanding coordinate systems and symbols. (5) logical inference, namely concluding activities or guessing using logical data or observations; (6) The logical framework of obeying the principle is the ability to think systematically based on the regularity of natural phenomena. (7) Causal relationship, the belief that natural phenomena are interrelated in a pattern of cause and effect. (8) Modeling, which is an effort to simplify something that is expected to help understand it better. (9) Develop concepts, namely the ability to interpret laws, rules, concepts based on observational data, and others (Rosnita, 2016).

2.2 Development of Teaching Materials
Teaching materials given to students must be quality teaching materials. Quality teaching materials can produce quality students because students consume quality teaching materials. According to F (Nurdyansyah & Mutala'liah, 2015), good teaching materials must meet the following criteria: The substance discussed must include a body figure of the competency or sub-competence that is relevant to the graduate's ability profile. The substance discussed must be correct, complete and actual. The substance includes the

concept of facts, procedures, terms and notations and is arranged based on a hierarchy or competency mastery step.

2.3 Acid and Base

Acids and bases are two important classes of electrolyte compounds. The definitions of acids and bases have evolved to include all substances that are acidic or basic in nature. The definitions of acids and bases that we usually use are taken according to the Arrhenius definition. Broader definitions of acids and bases were given by Bronsted-Lowry and subsequently by Lewis (Sumarni, 2013).

1. METHODS

1.1 Research Locations and Time

This research was conducted at the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Medan State University which is located at Jl. William Iskandar Pasar V Medan, North Sumatra and at SMAN 1 Percut Sei Tuan. This research was conducted from September to December 2022.

1.2 Object and Subject

The object of this study was chemistry teaching materials integrated with generic science skills in acid-base material. The subjects in this study were acids and bases.

1.3 Research design

The type of research used is Research and Development (R&D). An important part of the research using the R&D method is developing research instruments. The instruments in this study were: 1) non-test instruments in the form of a research questionnaire from the National Education Standards Agency (BSNP) consisting of components of content eligibility, language feasibility, and presenter eligibility. Where is the questionnaire given to the validator of media experts and material experts, as well as a questionnaire to find out the response of teachers and students.

1.4 Research Procedures

The development model and learning tools used in this study are the 4-D model. As for the 4-D part, namely: Define, at this stage, there are 3 activities, namely: (1) concept analysis, (2) analysis of student skills, and (3) analysis of objectives. Where at this stage found materials for the manufacture of teaching materials. Second Design, at this stage there are 4 activities, namely: (1) selection of teaching materials, (2) selection of student skills, (3) selection of module formats, and (4) preliminary design. Where at this stage a component framework of chemistry teaching materials was obtained which was developed and integrated with generic science skills. Thirdly, Development, at this stage there are 2 activities namely: (1) validity test by media experts and material experts as well as chemistry teachers, and (2) student responses to teaching materials. Where at this stage the integrated teaching materials for generic science skills will be revised if necessary to obtain integrated teaching materials for generic science skills that are ready to be used. Fourth, Disseminate, at this stage the research will disseminate the final product in the form of chemistry teaching materials integrated with generic science skills on acid-base material.

1.5 Data analysis technique

The research data were analyzed in stages to determine the feasibility (validity) and effectiveness of the developed module. The rating scale used is 1 to 5, where a score of 1 is the lowest score and a score of 5 is the highest score. The feasibility level of teaching materials is calculated by the equation: P= (Score obtained)/ (Total score) X 100.

3. RESULTS & DISCUSSION

The data validation results by experts and the responses of teachers and students are presented in the following tables and graphs:

1.6 Media Expert Validation Result Tabulation

Table 1. Results of Validation by Media Experts

No	Assessment Aspects	Average Percentage (%)		Average (%)
		Validators 1	Validators 2	
1	Cover	80	73.33	76.6 7
2	Material Accuracy	91.43	91.43	91.43
3	Pictures and Illustrations	92	72	82
4	Benefit	100	60	80
Average (%)				82.52
Validation Criteria Percentage analysis				Proper to use

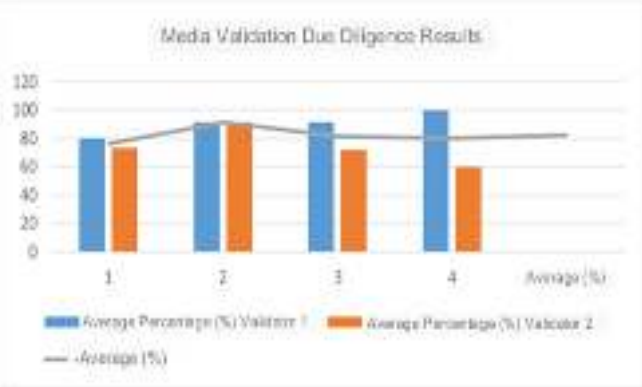


Figure 1. Results of Validation by Media Experts

1.7 Tabulation of Material Expert Validation Results

1. Table 2. Results of Validation by Material Experts

2.

No	Assessment Aspects	Average Percentage (%)		Average (%)
		Validators 1	Validators 2	
1	Curriculum suitability	100	86.67	93.33
2	Material Accuracy	83.33	80	81.67
3	Clarity of Evaluation in Teaching Materials	90	75	82.5
4	Accuracy of Presentation of Material	86.67	83.33	85
5	Compatibility With Language Rules	96	68	82
Average (%)				84.90
Percentage Analysis Validation Criteria				Proper to use

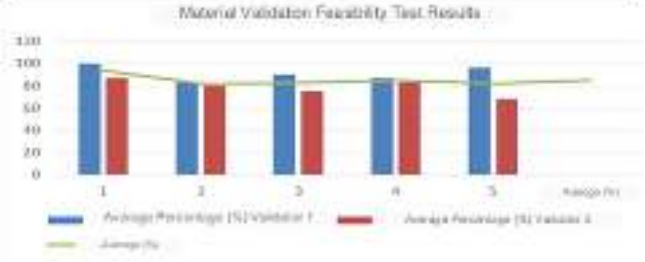
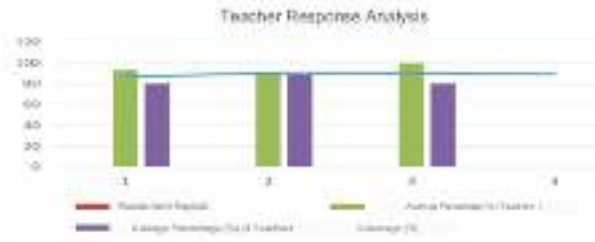


Figure 1. Results of Validation by Material Experts

1.8 Teacher Response Analysis Results

Table 3. Results of Teacher Response Analysis

No	Assessment Aspects	Average Percentage (%)		Average (%)
		Teacher 1	Teacher 2	
1	Design and Content	93.33	80	86.67
2	Benefit	91.43	88.57	90
3	Learning Time Efficiency	100	80	90.00
Average (%)				88.89
Criteria for Interpretation of Numerical Results				Proper to use



1.

Figure 3. Results of Teacher Response Analysis

1.9 Student Response Analysis Results

3. Table 4. Results of Student Response Analysis

No	Assessment Aspects	Average Percentage (%)
1.	The language used in teaching materials	94.4
2.	Clarity of writing on teaching materials	94
3.	Clarity of images on teaching materials	98
4.	Teaching material covers	94
5.	Color composition on teaching materials	95.2
6.	Benefit	96.8
Average		95.4
Criteria for Interpretation of Questionnaire Results		Proper to use

4. Figure 4. Results of Student Response Analysis

Research is done by developing a product. The product produced in this study is an integrated E-Module of generic science skills on acid-base material. The initial step in the research is to analyze the syllabus and teaching materials as the basis for making modules. Analysis of Class XI high school chemistry books by researchers was carried out by conducting research on 3 books of handbooks. In analyzing the researchers used the BSNP questionnaire which consisted of 4 aspects, namely content feasibility, language feasibility, presentation feasibility, and graphic feasibility. From the results obtained, books with codes B1, B2, and B3 have different average eligibility values, namely book code B1, average

feasibility of 84.05 is obtained with criteria suitable for use, books with code B2 have an average eligibility of 87, 77 with criteria suitable for use, and codebook B3 has an average eligibility of 83.39 with criteria suitable for use.

The steps taken after the analysis are the design and development of an integrated module of generic science skills on acid-base material. After the module has been compiled, the next stage in development is to validate the module. Based on the validation results carried out by media experts and material experts, it was found that the average media validation was 82.52% and the material validation was 84.90%. The rating score is in the range of 80-100 which means that the chemistry learning module on acid-base topics is valid and feasible to use.

After this module is valid and suitable for use, the module is made in 2 forms, namely in print and electronic form which can be accessed at the following link: https://online.fliphtml5.com/bbamo/wmga/. Then it was distributed to students as many as 10 students to find out the response of these students to the module being developed. The average student response analysis obtained was 95.4% with valid criteria. So based on the results of the research that has been done, it can be concluded that the integrated module of generic science skills in acid-base material is valid with very high student response criteria. In this section, the research results are presented as the findings of the researchers. Discussions do not use a numbering system.

4. CONCLUSION

The chemistry learning e-module developed on acid-base material is in accordance with the criteria set by the National Education Standards Agency (BSNP). This can be seen from the average assessment results based on the BSNP instrument by the Lecturer in Chemistry Education, Faculty of Mathematics and Natural Sciences, Medan State University as a media expert of 82.52, Lecturer in Chemistry Education, Faculty of Mathematics and Natural Sciences, Medan State University as a material expert of 84.90 and the Chemistry Teacher at SMA Negeri 1 Percut Sei Tuan at 88.89. An average overall module rating of 85.44 states that the module is valid and feasible to use. Based on the responses of class XI students of SMA Negeri 1 Percut Sei Tuan to the developed module, a percentage of 95.4% was obtained with a very high response criterion, with the E-Module integrated with generic science skills on acid-base material being developed can be used as one of a teaching material for supporting learning.

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