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Validity and Practicality of Molecular Shape E-Module Based on Guided Discovery Learning

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Abstract:- This research aims to develop an electronic module based on guided discovery learning for class X senior high school students, as well as determine the level of validity and the practicality of the developed e-module molecule shape. The e-module development is carried out through the plomp development model stage which consists of 3 stages, namely the preliminary research stage, the prototyping phase, and the assessment phase. The assessment instrument used was a questionnaire to determine the level of validity and practicality of the e-module. To calculate the validity of the e-module using the Aiken's v formula, the content validity value was 0.85 in the valid category, while for technical validity it was 8.86 with the valid category. For the calculation of the practicality level of the e-module by the teacher, the practicality value was 89.46% with the very practical category and the practicality test results by the students was 87.6% with the very practical category.

Keywords:- *E-Module; Molecular Shape; Guided Discovery Learning; Plomp Development Model.*

I. INTRODUCTION

Molecular shape material is a subject that must be taught to students in class X of senior high school based on the 2013 high school chemistry syllabus. Molecular shape is classified into chemical learning materials related to the structure of substances because molecular shape is a three-dimensional arrangement of atoms which is determined by the number of bonds and the angle of bonding around the central atom [1]. In this study of molecular shapes, related concepts are abstract concepts [2]. This abstract concept is generally quite difficult to teach students, because it is impossible to provide an explanation or information about this concept by direct observation [3]. So that the existence of abstract concepts makes students less interested and not actively involved in the learning process. They are also more likely to learn by rote to be able to understand these types of concepts [1].

Developments in technology and information have influenced many fields, one of which is education. Government Regulation Number 37 of 2018 mandates the development of an educational information system based on technology and information, in order to support the fulfillment of the basic needs of students so that it is necessary to add and integrate informatics content in the learning process. The existence of technology can provide a better learning experience for students, especially in molecular shape learning materials. Molecular shape material whose concept is abstract can be better described if it involves technology-based teaching materials that can meet the needs of students, namely e-modules. E-Module is a set of digital or non-printed teaching media that is systematically arranged which is used for self-study purposes in electronic format [4]. E-module is part of electronic-based learning which in the learning process utilizes information and communication technology, especially electronic devices. That is, it does not only involve the internet, but also all electronic devices such as films, video tapes, OHPs, slides, LCD projectors etc. [5]. Where this electronic module can be accessed with the help of a computer / smartphone that has been integrated with software that supports accessing the e-module. The use of e-modules in learning can help students to learn independently. In addition, an attractive e-module display is expected to increase students' interest and motivation to learn.

The e-module development has several advantages. First, the concepts contained in molecular shape material can be visualized in an animated form. With this animation, it can increase the attractiveness and motivation of learners in the learning process. This e-module is also equipped with items of evaluation questions so that teachers and students know the achievement of learning outcomes which later students will find out which parts of the material have not been understood. Both e-modules are presented in an attractive appearance, equipped with images, text, videos, and others [6]. Third, the presentation of the material is more interactive and more dynamic, the element of verbality that is too high in the print module can be reduced by presenting visual elements using video tutorials. The fourth can be used repeatedly at any time, and can be accessed anywhere and anytime supported by complete facilities [7]. One application that can be used to develop electronic modules is the Sigil application. This sigil application is a software that can be used to create an e-book file in epub format. The choice of the epub format in the preparation of this e-module is due to several reasons, namely, the large number of supporting devices available to open this format not only via a computer or laptop but can also be opened using a smartphone, it is easier to use and also makes it easier to pack learning materials, as well as in This format can also be inserted audio, animation or video into the designed e-module [8].

In developing this molecular shape of e-module, the author uses a learning model that can improve students' understanding of concepts and thinking skills, namely the guided discovery learning model [9]. Not only improving thinking skills, the use of this model can also improve student learning outcomes when compared to conventional learning.

The guided discovery learning model is a mixture of two types of teaching, namely teacher-centered learning and student-centered learning. This model applies the scientific method in which students are presented with questions and experiences so that they are able to find their own concepts which of course will be guided by the teacher. Students are also encouraged to think based on the teaching materials that have been provided by the teacher, so that these students can find principles / concepts / theories from the teaching materials that have been provided [10]. In applying the guided discovery learning model, the teacher only acts as a facilitator and motivator. So that the teacher acts as a guide to guide and make it easy for students to develop ideas, concepts and skills that have been learned. In addition, the teacher also plays a role in guiding students by giving questions that stimulate students to produce appropriate thoughts on the material being studied. To support the application of this model in the learning process, the teacher needs to provide a complete teaching material that is useful for assisting students in learning [11]. E-Module based on guided discovery learning is expected to be an alternative in improving students' critical thinking skills. Based on this, the authors are interested in developing E-Module Molecular Shape Based on Guided Discovery Learning for Class X of Senior High School Students.

II. RESEACH METHOD

A. Type of Research

In this research, the type of research used is research and development or known as Research and Development (R&D). This research was conducted to create a product in the form of a Guided Discovery Learning-based Molecular Shape e-module and then assess the validity level and practicality of the e-module being developed. The development model used in this research is the Plomp model developed by Tjeerd Plomp. Meanwhile, meta-analysis research is a type of literature review research by combining two or more similar research results to obtain a quantitative combination of data.

B. Development Model

In developing teaching materials in the form of e-module based on guided discovery learning using the Plomp development model. The Plomp development model is based on the model developed by Tjeerd Plomp. There are 3 stages in this Plomp Model, namely preliminary research, prototyping stage, and assessment phase.

C. Type of Data

The data in the research on the development of e-module molecular shape based on guided discovery learning originated from interviews, student questionnaires, and test descriptions for the initial investigation stage, validation test questionnaires and practicality tests. This type of data is classified as primary data because it is obtained directly through the provision of a validity test questionnaire, a practicality test on the research subject. The validity test data were obtained from the results of the e-module validation. Practicality test data obtained from the implementation of the e-module trial.

D. Data Collection Instrument

The instruments used to collect data in this study were as follows: (a) Guidelines for teacher interviews and student questionnaires (Initial Investigation), which were used in initial investigations with the aim of knowing teacher and student problems in the learning process and determining characteristics e-modules needed by teachers and students. Interviews were conducted by giving questions based on interview guidelines that had been prepared, but other questions usually appeared during the interview process. (b) the validation sheet*instruments*, serves to validate the instruments used in the study. Among them are self-evaluation instrument validation sheets, e-module validity, individual evaluation, teacher practicality, student practicality and assessment of learning activities. (d) Guidelines for self-evaluation, which are used to double-check the completeness of the developed e-module components and find out errors in the preparation of e-modules. This self-evaluation guideline contains a checklist filled out by the researcher as the party conducting the e-module development. (e) validation sheet-module,is used to determine the validity of the e-modules developed. This validation instrument is filled in by lecturers / experts according to the e-module criteria according to the Ministry of National Education. (f) The e-module practicality questionnaire, *is used* to determine the responses of teachers and students regarding the practicality or usability of the e-module being developed. Practical considerations include aspects of ease of use, efficiency of learning time and the benefits of e-modules. Practicality sheets are given to teachers and students.

E. Data Analysis Technique

1. Validity Analysis Techniques

On the validation sheet, the validator will provide an assessment of the statement given. In the final section, the validator has the opportunity to give a decision on the results of the assessment that has been given. The validator's assessment of the statement given was analyzed using the Aiken's V formula

$$V = \frac{\sum(ri-lo)}{n(c-1)}$$

Description:
r = number given by the assessor
lo = the lowest validity assessment number
c = the highest validity assessment number
n = the number of experts & practitioners
i = the integer number of 1,2,3 to n
n = number of evaluators

TABLE I. CATEGORY BASED ON AIKEN'S V FORMULA

No	Aiken's V Scale	Validity
1	V ≤ 0,4	Less
2	0,4< V ≤0,8	Moderate
3	0,8 < V	Valid

[12]

2. Practicality Analysis Techniques

As in the analysis of the content and construct validation sheets, the practicality sheet assessment is obtained from filling out teacher response questionnaires and student response questionnaires which also need to be analyzed with a modified formula from (Prastowo, 2010), with the following formula:

NP= $\boldsymbol{R/SM \times 100\%}$
Description
NP: Practicality Value
R : Score given by theValidator
SM : Maximum Score

TABLE II. PRACTICALITY ASSESSMENT CATEGORY

No	Percentage (%)	Category
1	86-100	Very practical
2	76-85	Practical
3	60-75	moderate
4	55-59	Less practical
5	≤54	Not practical

III. RESULT

A. Preliminary Research

a. Needs Analysis

In this stage, interviews were conducted with three chemistry teachers from three different schools. Based on the results of the interview, it is known that the three schools have applied the 2013 curriculum in the implementation of the learning process carried out. The Discovery *Learning* model is a learning model used by teachers in schools, but the model is *guided discovery learning* more guiding students in finding concepts that have not been applied in the learning stages. The teaching materials used by teachers in schools in general are textbooks and LKPD. Based on the results of the interviews, it is known that the two teaching materials are sufficient in the learning process. However, in the midst of the current pandemic, teachers need innovative teaching materials to support distance learning. The use of more innovative and technology-based teaching materials will further support the learning process, one of which is the use of electronic modules. Of the three teachers interviewed stated that the complete supporting facilities and infrastructure for technology-based learning such as ICT laboratories were sufficient, so that they could support the use of electronic modules in the learning process.

b. Curriculum Analysis

This curriculum analysis stage aims to formulate competency achievement indicators and learning objectives from the molecular shape material. As contained in the chemistry learning syllabus class X curriculum 2013, namely KD 3.6 Applying the Valence Skin Electron Pair Theory (VSEPR) and Electron Domain Theory in determining molecular shape and 4.6 Modeling molecular shapes using materials in the surrounding environment or computer software.

c. Concept Analysis

At this stage, the identification of important concepts that are studied in the molecular shape material is identified. Then carried out details of concepts related to the material in accordance with existing source books. Meanwhile, the results of this concept analysis are presented in the concept analysis table.

d. Student Analysis

Based on the results of filling out a questionnaire conducted with students in three different schools, it can be seen that some information can be the basis for the development of guided discovery learning based e-module products, which are as follows: (1) Regarding the difficulties of students in understanding form material molecule, most of the students stated that molecular form material was quite difficult to understand, this could be due to abstract molecular form material or inadequate learning media. (2) The teaching materials they use in general learning activities are textbooks and student worksheet provided by the teacher during learning. They have never used an electronic module. (3) For the students' interest in the teaching materials used, most of them answered that they did not attract their interest in learning. (4) To support the use of electronic modules in the learning process, of course, electronic devices such as cell phones or computers are needed. Based on the questionnaire, it was found that almost 100% of students have personal smartphones that they use on a daily basis.

B. Prototyping Phase

a. Prototype 1

In this stage, the process of designing the components of the molecular electronic module components to be developed is carried out. The components are the cover of the e-module in molecular shape, foreword, table of contents, list of pictures, instructions for using e-modules, competencies, subject matter, concept maps, activity sheets, worksheets, evaluation questions and references. The following is a description of the components of the module.

b. Prototype II

Prototype II resulted from the process of self-evaluation (self-evaluation) of making the prototype I did before. Based on the results of the evaluation itself, it is known that in e-module design there is still a wrong way of writing compounds. As there is an error in writing chemical compound notation, where the typing of H2O and CO2 needs to be revised to H_2O and CO_2 to fit the actual chemical compound notation format.

c. Prototype III

In the development of prototype 3, a formative evaluation was carried out in the form of a one-to-one evaluation to determine the practicality level and expert judgment to obtain the validity level of the developed LKPD. In the one to one evaluation test, a one-on-one trial was conducted through interviews with 3 students of class X MIPA 1 SMA N 14 Padang. Based on the results of the interviews conducted, it was known that the three students interviewed stated that the e-module developed was

interesting and they understood the instructions for using the e-module well. In terms of material presentation, the three students stated that the presentation of the material in the e-module was good enough and used language that was easy to understand. The sequence of learning activities with the guided discovery model in e-module was also clear so that it could help students find concepts. However, these students still found typing errors such as typing BeCl2 should be $BeCl_2$.

In expert judgment. The validation was carried out by five material experts, namely 3 chemistry lecturers of FMIPA UNP and two chemistry teachers at SMAN 14 Padang and one media expert. In the validation process, there are several revisions proposed by the validator before giving a value to the validation sheet, such as adding the title of the material to the table of contents on each activity sheet so that students are easier and more guided to find the material they want to learn, and so on. After making improvements to the molecular form e-module based on the suggestions given by the validators, then the validator will provide an assessment of the e-module draft developed using an instrument in the form of a molecular form e-module validation sheet. Based on the results of the analysis of the validation sheet, the average Aiken's V value in general for the validation of content / material is 0.84 in the valid category. Meanwhile, the assessment of the validity by media experts obtained an average score of Aiken's V as a whole of 0.86 in the valid category.

d. Prototype IV

In the development of prototype IV, a formative evaluation was carried out, namely testing in small groups to see the practicality of prototype III. This trial was carried out on students of class XI IPA SMAN 14 Padang. After the learning is complete, at the end of the meeting students are asked to fill out a practicality questionnaire related to the use of e-module molecular shape based on guided discovery in the learning process. Based on the average results of the practicality of the e-module molecule formed by small groups, the practicality value is 87.6% with the very practical category.

C. Assessment Phase

In this study, the assessment stage carried out was only up to the practicality assessment of large groups or field tests and the assessment of the practicality of e-modules by teachers involved in chemistry learning. The practicality test by the teacher was carried out on 3 chemistry teachers at SMAN 14 Padang. As for the practicality test of this large group, it was carried out on 20 students of class XI SMAN 14 Padang. Based on the results of the processing of the questionnaires filled out by the teacher and students, the overall average value of the practicality test percentage from 3 chemistry teachers was 89.46% with the very practical category. and from class XI IPA 1 SMAN 14 Padang as much as 87.6% with the practicality category is very practical.

IV. DISCUSSION

A. Validity of E-Module Molecular Shapes Based on Guided Discovery Learning

To be able to test the validity of a product being developed is to consider the opinions of experts who are at least three people (Sugiyono, 2012). In the assessment by these experts, there are two components that are assessed at this validity testing stage, including content validation by material experts and then technical validation by media experts. Furthermore, the data obtained is based on the five validators, then an analysis is carried out using the assessment category with the Aiken's V formula. The components that are assessed by the validator on the validity of the content include four components of the assessment, namely the components of content, presentation, language, and graphics. The assessment in terms of the components of the e-module content obtained an aikens v value of 0.842 with the valid category. The value obtained means that the guided discovery-based molecular shape e-module is in accordance with the demands of Basic Competence (KD), namely those found in KD 3.6 and 4.6. The linguistic component of the guided discovery-based e-module molecular form obtained aiken's v value of 0.89 with a valid category, which means that the shape and size of the e-module designed can be read clearly, the clarity of the information provided is correct and clear, and the use of language is clear and appropriate. with the rules of writing in Indonesian that are good and correct and the symbols or symbols used are consistent.

The guided discovery-based e-module presentation component obtained an aiken v value of 0.86 with the valid category, the resulting value showed that the e-module design was in line with the learning indicators that had been compiled. In the preparation of teaching materials, students must have clear, specific goals and can be achieved by students [14]. Regarding the graphic component of the guided discovery based e-module molecular shape, it was obtained that Aiken's v value of 0.80 in the medium validity category. The value obtained shows that the font used is clear, the layout or appearance in the e-module design is quite attractive, the images and illustrations in the e-module are clear and the e-module design is quite interesting. Including pictures in a teaching material can increase the attractiveness of teaching materials and student boredom in learning can also be reduced [13]. The results of the validation assessment of the guided discovery learning-based molecular shape e-module as a whole can be seen in the figure below.

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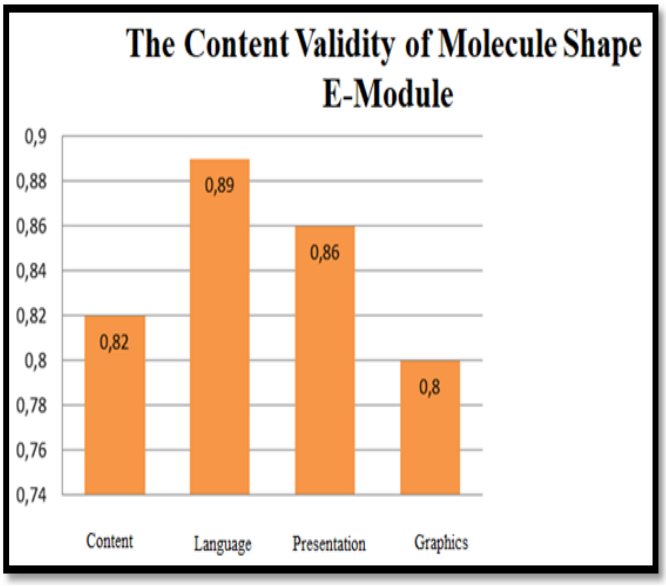

Fig. 1. Content validity of molecul shape e-module

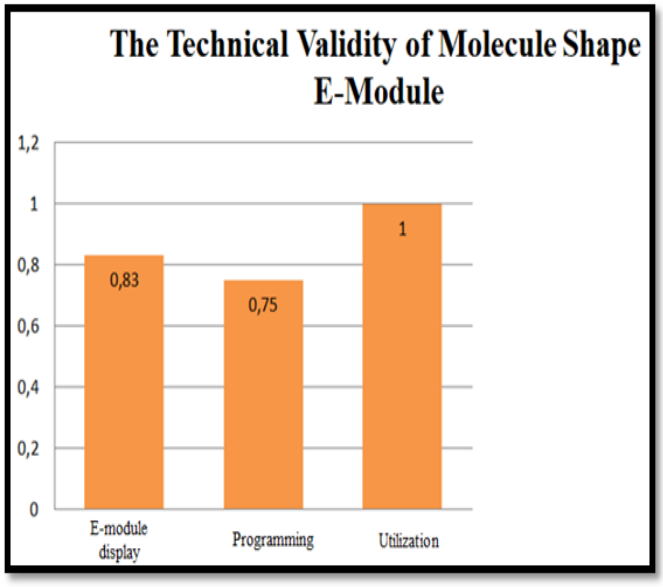

Fig. 2. Technical validity of molecule shape e-module

Meanwhile, the technical validity includes three aspects including aspects of e-module display, e-module programming and aspects of e-module utilization. The assessment in terms of the appearance of e-module has a value with the Aiken v formula of 0.83 in the valid category. The evaluation category for the aspect of a valid e-module display means that the e-module molecular shape based on guided discovery learning that has been developed already has a good display including the selection of the font and font size used in the e-module is correct and can be read properly by users. -module. Furthermore, the assessment in terms of programming aspects obtained a value of 0.75 with the medium validity category, meaning that the e-module has a fairly good programming aspect. Where the efficiency of the displayed media is efficient enough, the composition balance between image text and video is good. Apart from that, the ease of use of the e-module, both in terms of clear instructions for use, and the use of symbols that can be understood. Instructions for use of e-modules are important components that must be complete, clear and concise so that users can be easy to use [15]. The final assessment of this technical validation is an assessment in terms of the use of e-modules. Based on the results of data processing using the aiken's v formula, the value for the e-module utilization aspect is 1.0 with the valid category, which means that the content contained in the e-module is able to increase students' insight and knowledge in understanding the material in molecular shape. The results of the technical validation as a whole can be seen in the image below.

B. Practicality of E-module Molecular Shape Based Guided discovery learning

The practicality of the guided discovery-based molecular shape e-module was assessed by three chemistry teachers at SMAN 14 Padang and 20 students at SMAN 14 Padang. An assessment of the practical aspects of the guided discovery-based molecular shape e-module include ease of use, benefits, and efficiency of learning time. The ease of using e-modules has an average percentage of 86.8% based on assessments by students and an average percentage of 91.40% based on assessments by teachers. Based on the results of the analysis, it can be seen that the molecular shape e-module is easy to use so that students and teachers understand the activities carried out in the learning process. The material is arranged clearly and simply and the overall content of the e-module developed can be understood by teachers and students. A teaching material must make it easier for the wearer to respond and access the teaching material according to their wishes [16].

For the efficiency aspect of learning time, using e-module has an average percentage of 85% with a practical category based on assessments by students and an average percentage of 89.5% with a very practical category based on an assessment by the teacher. This shows that learning using e-module based on guided discovery learning increases time efficiency, because students directly carry out learning using e-modules and the teacher does not need to write down on the blackboard, especially note down the questions. The main purpose of using teaching materials in the learning process is to be able to increase the effectiveness and efficiency of learning activities both in terms of time, facilities, funds and energy in order to achieve optimal goals [17].

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Then for the usefulness aspect of the e-module it has an average percentage of 86.14% with a very high practicality category based on assessments by students and 87.5% with a very practical category based on an assessment by the teacher. This means that the guided discovery-based molecular shape e-module can support the role of the teacher as a facilitator because the steps in the e-module are clear, systematic, and easy for students to understand. So that the teacher does not need to explain the material too much because students must play a more active role in the learning process. The results of the practicality test as a whole by students and teachers can be seen in the picture below.

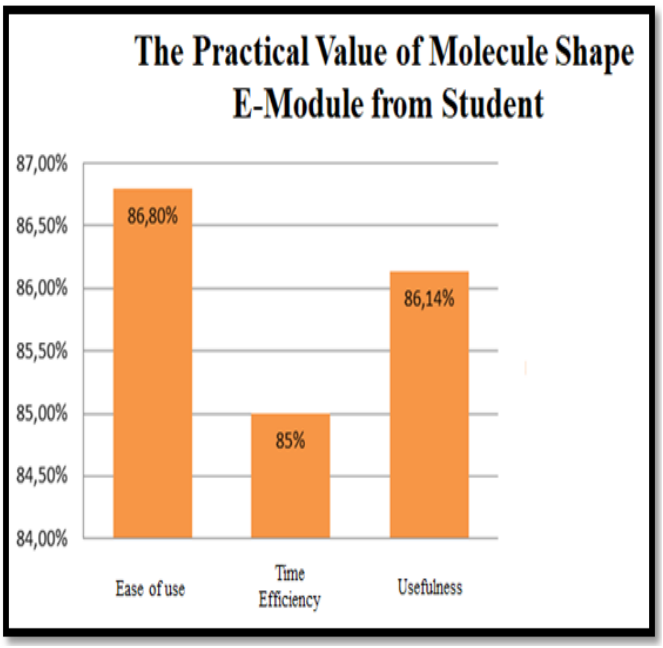

Fig. 3. Practicality molecul shape e-module from student

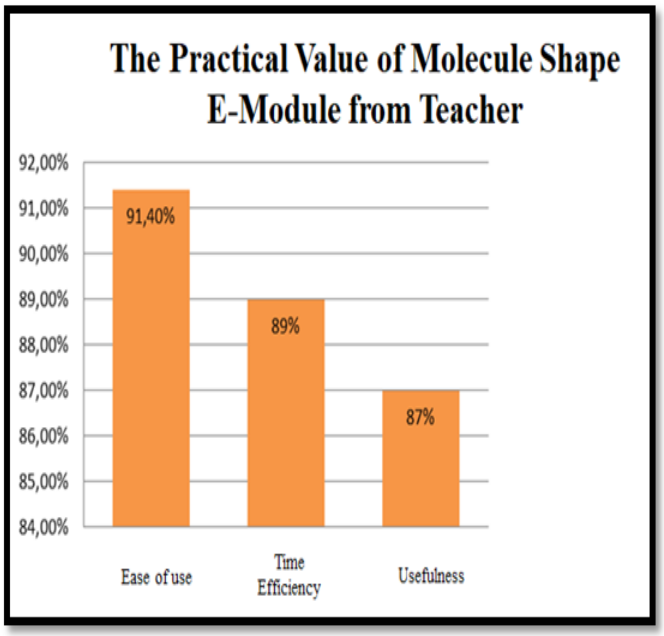

Fig. 4. Practicality molecul shape e-module from teacher

V. CONCLUTION

The guided discovery-based molecular shape e-module for senior high school that was developed has very high validity and very high practicality by teachers and students.

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