DESIGNING CHEMICAL ELECTRONIC MODULE USING A CONSTRUCTIVISM APPROACH FOR SMA/MA STUDENTS

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Abstract

The Covid 19 pandemic and rapid technological developments require all mobile-based educational activities, while most of the teaching materials available are still printed teaching materials. In addition, the existing printed teaching materials have not provided opportunities for students to build their own knowledge. This study aims to produce an electronic chemistry module with a constructivism approach for SMA / MA students. This research is a research development (Research & Development) with a 4-D development model, namely, define, design, develop, and disseminate. The technique of collecting data through a response questionnaire uses a validation sheet. The results showed that the quality of the content and objectives of the module was 88.33%, the construction quality was 93.33% and the technical quality was 98.96%. Overall, the quality of the modules produced is 93.11%, so it can be concluded that the electronic module with the resulting constructivism approach is very valid.

INTRODUCTION

The Covid 19 pandemic resulted in changes to learning processes and methods in educational institutions which were originally carried out face-to-face (offline) to online learning that can be carried out from home. To support the success of the learning process from home (LFH), learning components need to be prepared that make it easier for students. One of them is appropriate and interesting teaching materials that students can use independently at home. Teaching materials are an important component in the implementation of learning because through teaching materials, educators and students are easy to carry out learning (Prastowo, 2012).

One of the teaching materials that can be used independently by students is a module. According to Syarifuddin (2010), the module is a systematic and

interesting teaching material that includes material content, methods and evaluation that can be used independently, learning at the pace of each individual effectively and efficiently. The application of technology in the module produces an electronic module in softcopy form so that it is more practical because it can be accessed anytime and anywhere via a smartphone or notebook. The electronic module also includes animation, audio and video and navigation so that it is more interesting than the usual print module.

But in reality, not all schools are able to provide electronic teaching materials with all their limitations, such as at SMAN 1 West Sumatra. Based on the results of observations and interviews with chemistry teachers at SMAN 1 West Sumatra, information was obtained that the teaching materials used in the school were textbooks and printed modules. Text books that are borrowed from the library can only be used when learning is taking place in class and returned again after learning is complete.

In addition, the implementation of the learning process in class has not provided an opportunity for students to find and build their own knowledge, coupled with the assumption that chemistry lessons are difficult, containing formulas that are difficult to understand so that students only accept concepts by taking notes and memorizing them without any desire to think more. continue. This results in very few students being active in learning and making the learning atmosphere in class a routine activity that tends to be stiff, monotonous and feels boring. Based on the results of the interview, it was also revealed that there were about 60% of class XI MIPA 1 students who did not complete the PH session on acid-base material. Meanwhile, good chemistry learning is learning that can provide meaning and understanding of the scientific process to students so that students can connect chemical concepts with everyday life to construct their understanding based on the material being studied (Izzatunnisa, 2019).

To overcome the habitual way of thinking of these students, a learning approach is needed that allows students to build their own knowledge and develop it actively, not only passively accepting from others, namely the constructivism approach. In the process, this constructivist approach wants an active role of students in the learning process by means of these students engineering, initiating and constructing their own learning activities. This approach can help students build their own knowledge through problems related to subject matter so that their curiosity is high (Thobroni, 2015).

Some of the most advanced studies such as Adawiyah's research (2019) entitled the development of a five-phase constructivism-based reaction rate

module of Needham have produced valid and practical modules. In addition, Marsri (2015) has succeeded in developing a constructivism-based chemical calculation module that is valid and practical and can increase learning effectiveness.

Based on this explanation, it is important to design an electronic chemistry module with a constructivist approach. This study aims to produce a valid constructivism-based electronic chemistry module for SMA / MA students.

RESEARCH METHODS

The type of research used is research and development (R&D) with a 4-D development model, which consists of the stages of definition (define), design (design), development (develop) and disseminate (Sugiyono, 2012). In the define stage, several things were carried out, such as interviews with the chemistry teacher for class XI at SMAN 1 West Sumatra, analyzing the chemistry learning syllabus for grade XI SMA, analyzing textbooks and chemistry modules used, and reviewing literature on electronic modules. The design stage is by designing an electronic chemistry module with a constructivism approach. The develop stage is by conducting a product validation test by three experts consisting of one chemistry lecturer, one chemistry education lecturer and one physics teacher. While the disseminate stage was not carried out. The instrument used in this study was a validation questionnaire sheet that had previously been consulted with experts. The aspects that are validated on this product are quality of content, quality of construction and quality of technical. The collected validation data were then tabulated and analyzed using percentages.

RESULTS AND DISCUSSION

Define Stage

This stage is carried out to get an idea of the problems that exist in school. From the results of an interview with a chemistry teacher at SMAN 1 West Sumatra, it was found that the teacher had used teaching materials in the form of textbooks and modules in learning, but the modules used had not used a constructivist approach. The use of textbooks is also limited because these textbooks have to be borrowed from the library for every chemistry lesson. Meanwhile, from the learning method, the teacher has made variations in learning methods such as lectures, discussions and conducting practicum for certain materials. From the aspect of learning media, it can be seen that various learning media are in the form of infocus media, mock-ups, science kits, atomic

models, as well as several sets of chemistry lab tools to support practicum activities in the laboratory.

Based on the results of the syllabus analysis of chemistry subjects in grade XI SMA, students have difficulty understanding acid-base material because this material applies a lot of formulas such as pH calculations so it is considered quite difficult. Furthermore, from the results of the analysis of the textbooks and modules used, that the textbooks used feature more material and formulas. The material in the textbook is not related to problem analysis in everyday events and has not stimulated students' thinking skills. The printed module used does not explain the steps for formulating the existing chemical formulas. In addition, the appearance of the textbooks and modules used is less attractive so it does not motivate students to learn. In terms of practicality, textbooks cannot be owned by each student because of the limited number that must be returned to the library. The print module also has limitations to always be carried and does not match the characteristics of students belonging to the millennial generation who prefer smartphones to solve their problems.

From the results of the analysis at the defining stage, it is necessary to develop an electronic module with a constructivist approach. This module can be used independently by students and can be studied according to the style and learning style of each student. The electronic module can also be studied anytime and anywhere by students because it is stored on their smartphones. As a millennial generation, students prefer to use smartphones in learning and searching for information. Therefore, the existence of this electronic chemistry module is expected to further motivate students in understanding chemistry learning.

Design stage

The design phase of this module begins with installing the Flip PDF Professional application first. Then run the application in accordance with the available operating command format. Then enter the module file to be developed in PDF format. After that, do some editing, such as adding sound, animated images and video tutorials that can support the learning process. When finished, to save the developed module, click the publish menu. Then select the "exe" format to save it in the form of an application so that it can be opened easily via a notebook or smartphone without having to install the application first.

The electronic module which is designed and developed refers to the steps of the constructivism approach which consists of the start phase, the exploration

phase, the reflection phase and the application and discussion phase. In the electronic module, material, instructional videos, and chemical info are presented. The following is a description of the characteristics of the designed module.

a.cover and introduction

The design of the electronic module cover with a constructivist approach looks like Figure 1.After that, in the introduction after the cover, there are introductory words and instructions for using the icons in the module, instructions for using modules (for teachers and students), table of contents, general description of the material, concept maps, competencies core (KI), gross competence (KD), and competency achievement indicators.The material description is as shown in Figure 2 and the concept map as shown in Figure 3 below

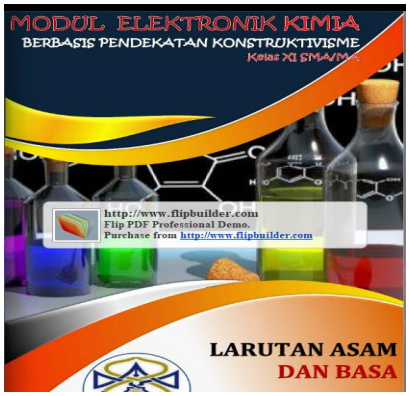

Figure 1 . Cover of the e-module

Figure 2. Description of Material

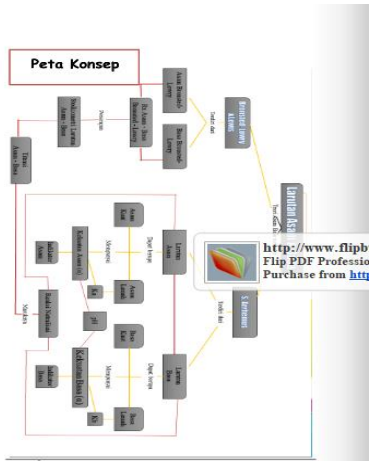

Figure 3. Concept map

b. Constructivism component

The material descriptions arranged based on the stages of the constructivism approach are presented in an electronic module, including; The start phase, which is presented with a problem related to the daily life of students, so that students are guided to find their own concepts from the learning. This problem is presented in the form of a video or animation with several questions. The start phase is shown in Figure 4. Furthermore, the exploration phase, which is the material presented in full as a guide to solving problems in the previous start phase. An example of the exploration phase is shown in Figure 5.

Figure 4. Start Phase

Figure 5..Exploration Phase

The reflection phase, which is to present examples of questions so that students analyze and discuss what they have done, as shown in Figure 6 below.

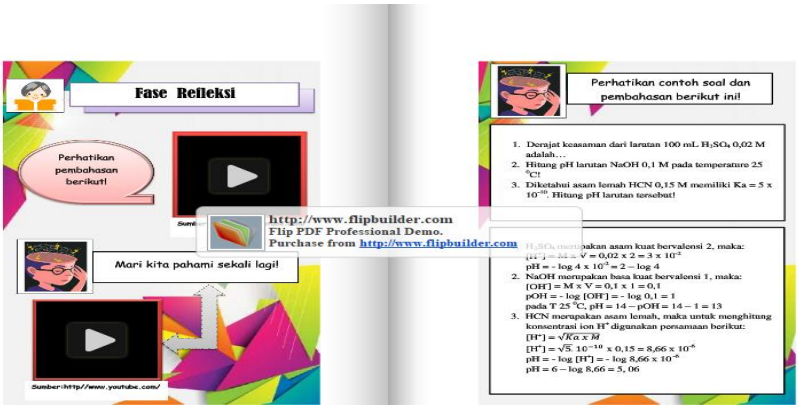

Figure 6. Reflection phase

The application and discussion phases, which are presented with several practice questions in order to hone the brains and abilities of students in mastering the learning as shown in Figure 7 below.

Figure 7. Application and discussion phase

c. Summary and evaluation section.

This evaluation section consists of 20 objective questions and 5 essay questions related to all the sub-material contained in this electronic module. The goal is to see the extent to which students can understand the material that has been learned. The summary and evaluation section can be seen in Figure 8 below. Furthermore, there is an answer key from the evaluation that has been done by students.

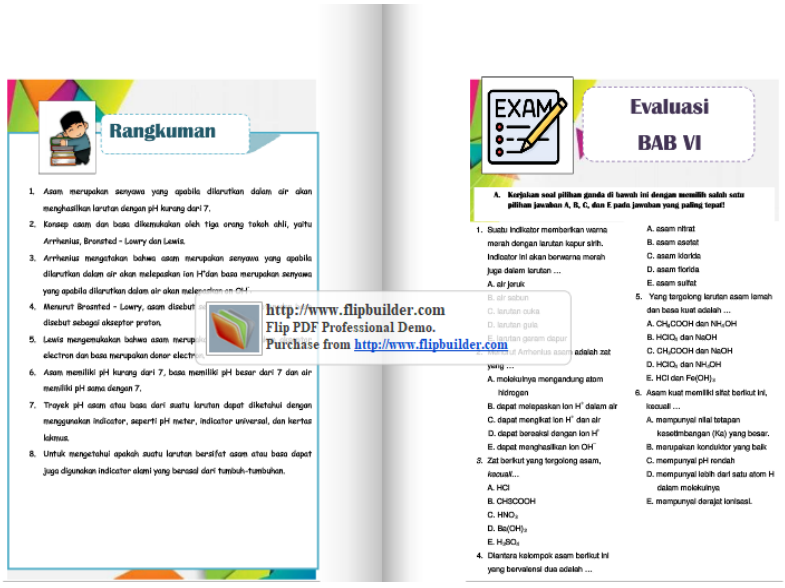

Figure 8. Summary and evaluation

d. Chemical Information

This section contains information about chemistry so that it can add insight to students. Examples of chemical info can be seen in Figure 9 below.

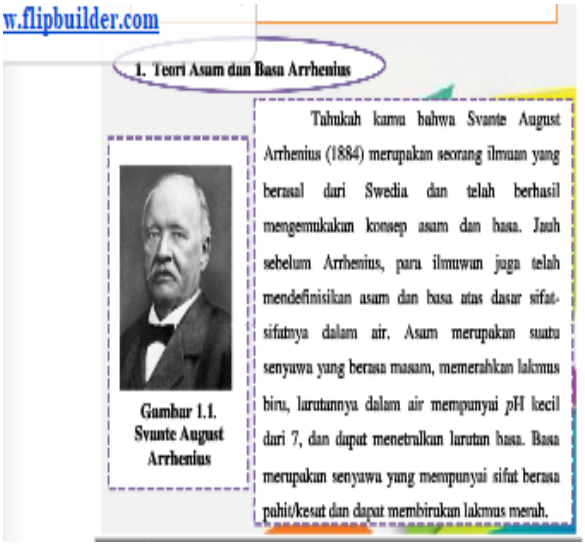

Figure 9. Chemical Information

2. Development Stage (Develop)

The e-module product that has been designed is then validated by 3 validators and the results can be seen in table 1 below.

Table 1.Data on the results of the analysis of the chemical electronic module

No.	Aspect	Validator			amount	Max Score	%	Category
		1	2	3				
1	Quality of content and purpose	36	35	35	106	120	88,3	very valid
2	Constructional quality	19	19	18	56	60	93,3	very valid
3	Technical quality	32	31	32	95	96	98,9	very valid
amount		87	85	85	257	276	93,1	very valid

Based on table 1 it can be seen that the average validation for the quality of content and objectives is 83.33%, the average validation for instructional quality

is 93.33% and the average validation for technical quality is 98.96% so that overall the validation results are 93. , 11% with very valid category

Based on the define stage that has been carried out by conducting interviews with chemistry teachers in class XI of SMAN 1 West Sumatra, analyzing the chemistry learning syllabus for class XI SMA, analyzing chemistry textbooks used, and reviewing literature on electronic modules, it is necessary to create an electronic chemistry module with a constructivism approach. This module can help solve problems experienced by students such as limited teaching materials available in school in terms of insufficient quantities, unattractive appearance, abstract material because it is not assisted by animation or video displays and lack of practicality to carry and access. This module can also make it easier for teachers to teach especially on acid and alkaline solutions. Students can learn independently anytime and anywhere according to their respective ability levels and speeds. This is because the module is in softcopy form that can be stored on a student's smartphone which is relatively small and easy to carry anywhere. An attractive appearance and clear explanation of the material are reasons for students not to need to access learning materials via the internet. So that the problems that exist at school can be overcome with the existence of a chemical electronic module based on the constructivism approach that was developed.

The design stage is to design an electronic module with a constructivism approach with the steps of a constructivist learning approach, namely: the start phase, the exploration phase, the reflection phase and the application and discussion phase. The constructivism approach will lead students to build their own knowledge and develop it actively because students are involved in learning.

Furthermore, the development stage is carried out a validation test with the results as shown in table 1. For the quality of the content and objectives have been fulfilled properly with a result of 83.3%. This indicates that the learning objectives using a chemical electronic module based on the constructivism approach have been achieved well. This is known by the compatibility between Core Competencies (KI) and Basic Competencies (KD) as well as Competency Achievement Indicators (GPA) contained in the chemistry learning syllabus for class XI SMA / MA. The three components have been included in the chemical electronics module based on the developed constructivism approach. Besides that, the purpose of a lesson will also be achieved if there is relevant learning material in the module. The chemistry

learning material in this electronic module has been presented completely and is relevant to the learning objectives to be achieved. As stated by Rusman (2012) that the subject matter must be relevant to the learning objectives to be achieved, and the subject matter must match the level of difficulty with the student's ability to receive and process the data.

When viewed from the aspect of the suitability of the electronic module format and its characteristics, the results show that the chemical electronics module based on the constructivism approach is in accordance with the existing electronic module components. The characteristics of this electronic chemical module are proven by the layout of the module cover that is harmonious and attractive. This chemical electronic module based on the constructivism approach has written clear and consistent headings. Learning instructions are clearly stated, the presentation of the material is in accordance with the aspects or phases of the constructivism approach, and there are practice questions and evaluations to measure the abilities of students. This aspect of the suitability of the electronic module format and its characteristics can be seen in the constructional quality of the chemical electronic module based on the constructivism approach, which is 93.3% with a very valid category.

When viewed from the language suitability aspect of the developed electronic module, it is known that the language used is simple and communicative so that it is easily understood by students. The presentation of the electronic chemistry module based on the constructivism approach already uses good EYD and the terms used are also in accordance with the concepts contained in chemistry learning. The physical form of the developed electronic chemical module has attracted the attention of students with its small size and easy to carry anywhere. In the electronic chemistry module based on a constructivism approach, clear illustrations and videos that support learning with interesting color combinations are presented. The validation results from the aspects of the suitability of language and physical form in the chemical electronic module can be seen in the technical quality of the chemical electronic module with a value of 98.96% with a very valid category. This is in accordance with Uno's (2008) statement that the use of appropriate and varied media can overcome the passive nature of students. The results of this study are in accordance with the results of research conducted by Rizalini (2018) entitled development of student activities sheets based on guided inquiry.

CONCLUSION

Based on the research that has been done, it can be concluded that the chemical electronic module based on the constructivism approach for class XI SMA/MA is very valid with a percentage of 93.11%.

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