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Validity and Practicality of Salt Hydrolysis E-Module Based on Guided Discovery Learning for SMA/MA Students

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Abstract:- The era of the industrial revolution 4.0 is an era of digitalization in various fields, especially in the field of education, so that a teaching material is needed that can increase student activity in learning. The purpose of this research is to determine the validity and practicality of salt hydrolysis e-module based on guided discovery learning. The development of e-modules uses a type plomp development model which consists of three steps: (1) preliminary research, (2) prototyping, and (3) assessment phase. The research instrument used a form validity and practicality sheet. Data were analyzed by Aiken's V formula. This e-module was validated by 3chemistry lecturers of FMIPA UNP, 2 informatics engineering lecturers of UNP, and three chemistry teachers of SMAN 14 Padang. Practicality tests were conducted on 3 chemistry teachers of SMA 14 Padang and twenty-eight twelfth grade students of SMAN 14 Padang. The value validity of construct and the validity of the media expert, the Aiken's V average was 0.90 and 0.87 with high validity categories. The value of practicality tests by teachers and students, the Aiken's V was 0.93 and 0.85 with high practicality categories. Based on the results of this research, it can be concluded that development of salt hydrolysis e-module based on guided discovery learning was valid and practical.

Keywords:- *Guided Discovery Learning, E-Modul, Plomp Development Model, Salt Hydrolysis.*

I. INTRODUCTION

The dynamics in the world of education are growing so rapidly. The most significant impact begins to be felt when facing 21st-century learning that gives a new nuance in learning. One of them is the development of the curriculum. The curriculum becomes an important part of developing the education system. Curriculum 2013 is a curriculum that expects teachers and learners to master technology in learning process and demands that students can actively engage in finding concepts. One of the 2013 curriculum learning model can improve concept understanding, motivate, and active learners to improve cognitive outcomes is the guided discovery learning model [1]. The results also showed that the application of guided discovery learning models effectively to the chemical problem-solving skills [2], the most effective teaching method of finding concepts was able to improve the concepts understanding and critical thinking skills of students [3]. To support the implementation of the guided discovery learning model, teaching material is needed. One of the teaching materials that is often used in implementing guided discovery learning models is the e-module. It is an electronic-based teaching material that contains information about the form of videos, animations, diagrams, and texts so that learners can understand more about the material studied [4].

This is in line with the 2013 curriculum guidance which expects students to be skilled in using the media, technology, information, and communication (ICT) needed in the 21st century and revolutionary era 4.0. Teaching materials that are still in printed form can be developed into e-modules (electronic-modules). Teaching materials in the form of e-modules are following accordance with the current learning conditions. The current pandemic Covid-19 has a huge impact for education sector. The government decided that the implementation of school learning is transferred to online learning. This online learning will still be effective even though educators and students are in different places [5]. Online learning is defined to transfer knowledge experience by video, audio, images, text, and some software [6]. So that we need an electronic-based teaching material such as an electronic module (e-module). The basic thing about e-module is how to present the material using a computer device.

One of the subjects in the 2013 curriculum that effectively uses e-modules in its learning is chemistry. Chemistry has materials in the form of abstracts, drawings, calculations, and practicums. One of the materials in chemistry lessons is salt hydrolysis. It is a material that must be studied by students in grade XI SMA. In this material, students are required to connected the hydrolyzed nature of salt with pH through calculation or practicum. Salt hydrolysis material has sequential prerequisite material and abstract material. This abstract concept is generally quite difficult for students because it is impossible to provide explanations or information about this concept with direct observation.

This is in line with the observations that have been made about the process of chemical learning. Salt hydrolysis material is a material that is quite difficult for students to understand. The difficulty is mostly also due to teaching materials used in learning is less interesting because the teaching materials used by teachers are still in the form of LKPD and PowerPoint. An electronic-based teaching material that is integrated with the learning model to improve the understanding of student concepts, especially in salt hydrolysis materials. Some research e-modules of chemical learning that have been developed and show valid results include the development of e-modules on chemical equilibrium [7].

Therefore, to support guided discovery learning, especially on salt hydrolysis and the use of technological advances and support online learning, it is so importent to used in school. So the researchers proposed the idea in this study with the research validity and practicality of salt hydrolysis e-module based on guided discovery learning for sma/ma students.

II. LITERATURE REVIEW

A. Definition of Electronic Module (E-module)

E-module is a form of presentation of independent learning systematically organized into certain learning units, presented in electronic format. The fundamental thing about e-modules is the way the material is presented using a computer device. The use of e-modules has several advantages in its use, namely: it can increase the motivation of students' learning because each learning activity is always clearly limited according to their ability. The e-module also comes with a video tutorial presentation, animation, and audio [4].

B. Defenition of Guided Discovery Learning Model

Discovery learning has three types: (1) pure discovery; (2) guided discovery; and (3) expositional learning; involves maximum teacher assistance and usually few discoveries or even no discoveries from students (Smitha, 2012). The GDL model is a model used to increase the activeness of learners, be more process-oriented and find their information in achieving learning goals, and educators only act as facilitators in learning activities. The application of the models effectively to the chemical problem-solving skills and improve the understanding of concepts and critical thinking of students [8]. The syntax of this guided discovery learning model, namely: (1) motivation and problem presentation, is a stage to observe through reading activities and understand the problems presented, and present hypotheses of the problems presented; (2) data collection, is the stage for digging and collecting information in various ways and sources; (3) data processing, is the stage for answering questions, solving problems, and finding the cost of the material studied; (4) verification, is the stage to prove the hypothesis that has been stated before; and (5) closure, is the stage for writing down the conclusions of the material studied and obtained [9]. Guided discovery involves students answering questions from teachers. The questions given can stimulate students to produce a proper selection of teaching materials [10]

C. Characteristics of Salt Hydrolysis Material

Salt hydrolysis is one of the materials lesson in grade XI semester 2. This material expects learners to understand the acid-base structure of salt-forming to know the salts hydrolysis and be able to connect the properties of salt hydrolysis with pH through calculation or practicum. Salt hydrolysis material has knowledge that is factual, conceptual, and procedural: salt hydrolysis explains the reaction of anion or cation salt, or both with water and hydrolysis consists of three parts namely not hydrolysis salt, partial hydrolysis, and total hydrolysis.

III. METHODOLOGY

This development research used in this study is a Plomp model developed by Tjeerd Plomp consisting of 3 stages, namely: (1) preliminary research, (2) prototyping stage, and (4) assessment phase[11]. This research was conducted until the test of validity and practicality of e-modules developed. The subject of this study consisted of three chemistry lecturers of FMIPA UNP, two informatics engineering lecturers of UNP, three chemistry teachers of SMAN 14 Padang, and twenty-eight students of grade XII SMAN 14 Padang. While the object of research is teaching materials in the form of salt hydrolysis e-module based on guided discovery learning for SMA/MA students.

A. Preliminary Research

Preliminary research has four main stages, namely; (1) Needs analysis aims to determine the fundamental problems experienced by students and teachers through literature studies. Literature studies conducted include salt hydrolysis materials, guided discovery learning models, and the use of teaching materials of e-modules in chemical learning; (2) Curriculum analysis, at this stage, is carried out an analysis of the curriculum and syllabus by lowering the Basic Competencies (KD) contained in salt hydrolysis material. Based on KD, the formulation of Competency Achievement Indicator by accordance KD 3.9 and KD 4.9 to know the competencies that must be achieved after learning; (3) Literature Study, aims to be able to find sources and references relevant to research activities, where sources and references can be in the form of journals, books, or sources from the Internet; (4) development of a conceptual framework, aims to know and identify important concepts that will be studied by students on salt hydrolysis material.

B. Prototyping Stage.

At the stage of forming a product prototype in the form of e-modules designed with Tessmer's formative evaluation consisting of 4 stages, namely: self-evaluation; expert review; one-to-one test; small group test; and field test. The stage of formation of the prototype there are four namely; (1) Prototype 1, this stage is carried out to design salt hydrolysis e-module based on GDL for SMA/MA students. The design of this e-module is adapted to the stages of the guided discovery learning model and e-module components from the Ministry of Education and Culture. The results of

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the prototype I was evaluated through self-evaluation by using a checklist system to see the completeness components in the e-module and the real errors of the prototype. The evaluation result of the prototype I through self-evaluation will be revised to produce prototype II. Prototype II is carried out one to one evaluation and expert review aimed at obtaining the level of validity of the prototype II. The evaluation result of prototype II through one to one evaluation and expert review was revised to produce prototype III. The resulting prototype III was then evaluated through a small group test of 9 students at grade XII SMAN 14 Padang who had different levels of knowledge. The revised results through a small group test resulted in a prototype IV that will be tested through field tests.

C. Assessment Stage

The assessment stage aims to evaluate and reveal the practicality of salt hydrolysis e-module based on guided discovery learning used in the learning process. At this stage, field tests are carried out to obtain the level of practicality of the prototype IV that has been produced.

The instruments used in this study are checklists, validity questionnaires, and practicality questionnaires. The checklist is used at the self-evaluation stage to evaluate the components that must be in the e-module. Validity questionnaires are used at the expert review stage to assess the validity of the salt hydrolysis e-module based on guided discovery learning. Validity questionnaires are validated by chemistry lecturers of FMIPA UNP, informatics engineering lecturers of UNP, and chemistry teachers of SMA. Practicality questionnaires are used at the field test stage to determine the practicality of using e-module salt hydrolysis based on guided discovery learning developed. This practicality questionnaire is conducted to chemistry teachers of SMA and students of grade XII SMA. The data obtained is then analyzed using Aiken's V formula [12].

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

Description:
s : r - lo
r : number given by validator
lo : the lowest validity assessment number
c : the highest number of validity assesment
n : number of validators

Table 1. Decision Categories Based on Aiken's V

Criteria V	Category
≤ 0,4	Low
0,4 ≥ V ≤ 0,8	Medium
≥0,8	High

IV. RESULTS AND DISCUSSION

A. Preliminary Research Stage

1. Needs analysis.

From the results of the needs analysis obtained that students have difficulty in understanding the concept of salt hydrolysis materials. The understanding of the concept of students in salt hydrolysis material is only 35% while the other students still do not understand the concept. Students have difficulty associating the material with the previous material (prerequisite material) and difficulty in calculating pH. On the other hand, teachers have difficulty in implementing several learning models due to the lack of teaching materials available where the teaching materials used are still in the form of LKPD and PowerPoint. Therefore, there needs to be a teaching material in the form of e-modules to help teachers in implementing learning models.

2. Curriculum analysis.

From the results of curriculum 2013 analysis on KD 3.9 and 4.9, IPK and learning objectives for salt hydrolysis material. Basic Competencies and Indicators of Achievement of Competencies of salt hydrolysis material can be seen in table 2.

Table 2. Basic Competencies and Competency Achievement Indicators

Basic Competencies	Indicators of Competency Achievement
3.9 Analyzing the equilibrium of ions in a saline solution and linking its pH	3.9.1 Analyzing salts that are not hydrolysis, have partial hydrolysis and that undergo total hydrolysis. 3.9.2 Analyze salt hydrolysis reactions and determine their properties. 3.9.3 Analyzing the pH of hydrolyzed saline solution through calculation.
4.9 Reported experiments on the acid- base properties of various saline solutions.	4.9.1 Present an experimental report on the acid-base properties of various saline solutions.

3. Literature studies.

The results obtained based on literature studies that have been done are e-module based on guided discovery learning has several components. E-module components in general are: (1) cover; (2) table of contents; (3) glossary; (4) introduction, which includes basic competencies and indicators of competency achievement, brief description of the material, rationalization and relevance, prerequisites (if any), instructions for use of modules; (5) learning, which includes learning activities, objectives, material descriptions, summaries, tasks; (6) exercise; (7) self-assessment; (defense activities and so on following the amount of planned learning); (8) evaluation; (9) key answers and scoring guidelines; (10) bibliography; and (11) attachments.

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4. Development of conceptual frameworks.

The results obtained based on the development of conceptual frameworks that have been done are obtained the main concepts studied in salt hydrolysis material. The main concepts in salt hydrolysis material are acid-base properties (strong and weak) of a salt, indicators of determining the acid-base properties of salt, and calculating the pH of salt both through experiments and calculations. From the analysis of concepts can be seen the relationship between concepts in the form of concept maps arranged hierarchically.

B. Prototype Formation Stage

1. Prototype I.

At this stage, the e-module design is carried out so that it is produced in the form of e-modules based on GDL with learning stages including motivation and problem presentation, data collection, data processing, verification, and closure. The learning stages are integrated into the learning activities in the salt hydrolysis e-module. This e-module consists of several components that have been described in literature studies.

2. Prototype II.

From the results of the formative evaluation of self-evaluation in the form of a checklist of e-module components obtained results that prototype I does not require revision. This is because the components of the e-module are complete.

3. Prototype III.

a. One to One Evaluation.

This evaluation was conducted on three students with different abilities (high, medium, and low). From this evaluation obtained an idea that the prototype II that has been produced in terms of cover appearance and color selection is considered good and able to attract students to read it. The choice of usage and typeface on the e-module is quite clear, not too small and not too large and the language used is easy to understand. The presentation of the material contained in the module is good and easy to understand. There are instructions for using e-modules that contain some details that make it easy for the reader to understand and work on the questions in the e-module. The images, videos, and tables presented in the e-module are considered capable of helping learners better understand the lessons in the e-module. In general, the guided discovery learning-based salt hydrolysis e-module as the resulting prototype II can guide learners in finding concepts in accordance with IPK and learning objectives.

b. Expert Review.

At this stage, the validity test was conducted by three chemistry lecturers of UNP, three informatics engineering lecturers of UNP, and three chemistry teachers of SMA. validity test consists of the test of the validity of the construct and the validity of the media expert. Aiken's V value on all aspects obtained from the validation of construction and media experts respectively of 0.90 and 0.87 with high validity category. In the validity of the construct, the data obtained shows that the developed salt hydrolysis e-module is valid both in terms of content feasibility, language, presentation, and graphics. The results of construct validity analysis can be seen in Figure 1.

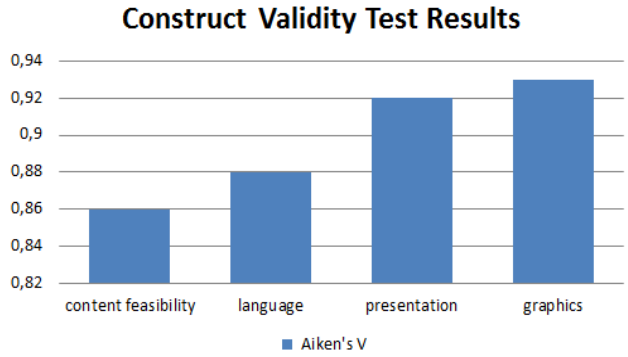

Figure 1. Construct Validity Test Results

Based on the data above shows that these four aspects are already said to be valid because they have a value of Aiken's V ≥ 0,8 with high category. In terms of the content component of the salt hydrolysis e-module based on guided discovery learning has an average Aiken's V of 0.86 This indicates that the e-module developed is in accordance with the curriculum demands on salt hydrolysis material. Key aspects of content include the suitability of the material contained in the e-module with KI, KD, IPK, and learning objectives to be achieved and the material provided in accordance with the ability of students.

In terms of the language component of the salt hydrolysis e-module based on guided discovery learning has an average value of Aiken's V of 0.88. This means that the language used in the e-module developed is in accordance with the Indonesian Spelling (EBI) which is good and correct, communicative, and easy to understand. E-modules use simple sentences so that the information conveyed is clear and user friendly. The use of communicative and simple language makes e-modules easy to understand, thus improving the understanding of students' concepts and learning interests.

In terms of the presentation component of the salt hydrolysis e-module based on guided discovery learning has an average value of Aiken's V of 0.92. This means that the salt hydrolysis e-modules that have been developed are made in accordance with the IPK and learning objectives that have been formulated. The presentation of e-modules is organized the stages of the based on guided discovery learning model. At that stage there are pictures, tables, and questions related to the material discussed. This aims to make students more active and motivated to improve their understanding of the material.

In terms of the graphics components of the salt hydrolysis e-module based on guided discovery learning has an average value of Aiken's V of 0.93. This shows that development of salt hydrolysis e-modul based on guided

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discovery learning has a clear layout, layout, image, display design and font size as a whole has been interesting. E-modules are made as interesting as possible so as to motivate learners to read materials in learning. This e-module is also equipped with images that support and increase the attractiveness of students in the learning process for this material.

In the validity of media experts, the data obtained shows that the developed salt hydrolysis e-module is valid both in terms of appearance, programming, and utilization. From the three aspects above, the display, programming, and utilization obtained Aiken's V values respectively of 0.87, 0.87, and 0.87. Based on this data shows that these three aspects are already said to be valid because they have a value of Aiken's V ≥ 0,80 with high category. The results of the Media Expert validity analysis can be seen in Figure 2.

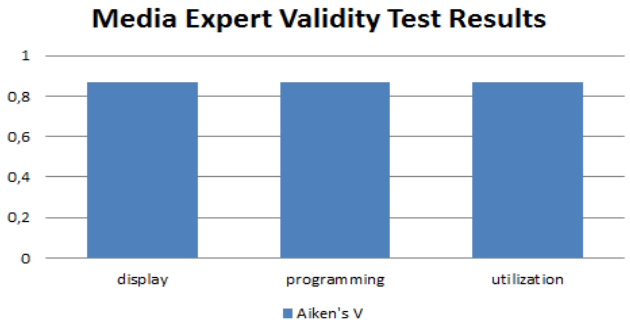

Figure 2. Media Expert Validity Test Result

From the three aspects above, the display, programming, and utilization obtained Aiken's V values respectively of 0.87, 0.87 and 0.87. So it can be said that the selection of font size in the e-module is appropriate and clear, the use of symbols/ icons in the e-module can be understood, and some examples and illustrations in the form of images and videos can help in understanding the material. The validity result obtained from the validator, then carried out revisions to the salt hydrolysis e-module developed based on the advice of the validator so as to produce a prototype IV.

5. Prototype IV.

At this stage, a small group test was carried out on nine participants. From the test obtained the value of e-module practicality of 0.84 so it has been said practicality. Data from all aspects of the small group test can be seen in Figure 3.

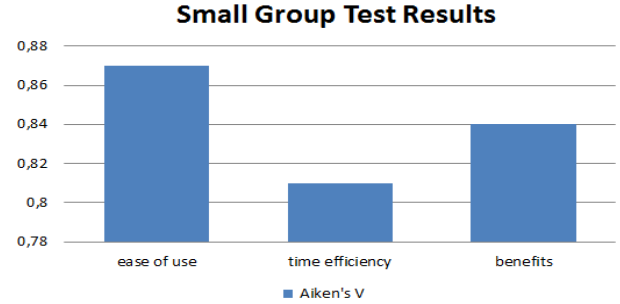

Figure 3. Small Group Test Results

In terms of ease of use, time efficiency, and benefits, the e-module has Aiken's V values of 0.87, 0.81, and 0.84. This means that e-modules using language that is easy for learners to understand, make learning time more efficient, can help students in finding concepts through questions in the module so that students can learn independently.

The resulting Prototype III has an average Aiken's V value of 0.84 so it can be said to be practical because Aiken's V ≥0,80 with high category. However, in this case, it is still necessary to revise the prototype III so that the prototype IV is obtained.

6. Assessment Stage.

At this stage, a field test is carried out. At this stage, the value of e-module practicality is obtained by teachers and students. The practicality test is divided into three aspects, namely ease of use, time efficiency, and benefits. The results of practicality e-modul by teachers and students can be seen in Figure 4.

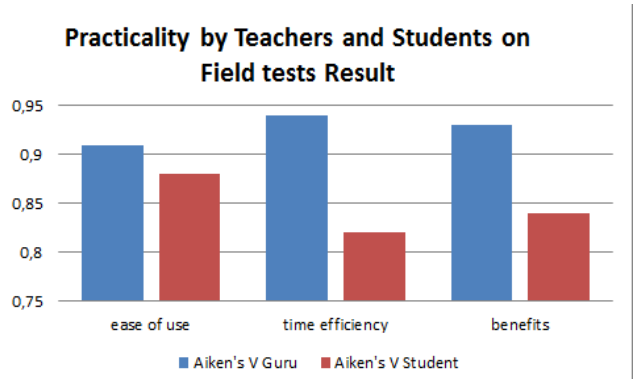

Figure 4. Practicality by Teachers and Students on Field tests Result

From the aspect of ease of use e-module has a value of Aiken's V of 0.91 from teacher assessment and 0.88 from the assessment of students. This means that e-modules use language that is easy for students to understand and easy to carry e-module size. In terms of learning time efficiency, e-module assessment by teachers and students has consecutive Aiken's V values of 0.94 and 0.82. This means that e-modules can make learning time more efficient and students can learn according to their speed and ability. In terms of benefits, the assessment of e-modules by teachers and learners has consecutive Aiken's V values of 0.93 and 0.84. This means that images, tables, and readings in e-modules can help students in finding concepts through questions in e-module, so that students can learn independently.

After the field test of the prototype IV, no revision was made because the resulting prototype was practical both in terms of ease of use, efficiency and benefits called the final prototype. The final prototype produced is a salt hydrolysis e-modul based on GDL learning for SMA/MA students that has been valid and practical.

V. CONCLUSION

Based on the research that has been done, it can be concluded that the e-module salt hydrolysis based guided discovery learning for SMA students produced by the plomp model is practical and valid because it has the value of Aiken's ≥0,80 with high category. Furthermore, researchers are expected to be able to test the effectiveness of salt hydrolysis e-modul based on guided discovery learning for SMA/MA students.

REFERENCES

[1]. Smitha. (2012). *Inquiry Training Model and Guided Discovery Learning.* Kozhikode: Vilavath Publication.
[2]. Alabi, T., & Nureni, L. (2015). Effects of Guided Discovery and Problem Solving on Achievement of Secondary School Students'in Volumetric Analysis In Niger State. *Journal of Science, Technology and Education*, 3(4), 75-87.
[3]. Udo, M. E. (2010). Effect of Guided-Discovery, Student-Centered Demonstration and The Expository Instructional Strategies on Student' Perfomance in Chemistry. *African Research Review. An International Multi-Disciplinary Journal. Ethiopia*, 4(17), 389-398.
[4]. Hafsah, J., Rohendi, D., & Purnawan. (2016). E-modul Sebagai Media dalam Penigkatan Kualitas Belajar. *Jurnal Teknik Mesin*, 3(1), 106-112.
[5]. Verawardina, Asnur, Lubis, & Hendriyani, (2020). Online Learning Facing the Covid-19. *Outbreak*, 12(3), 385–392.
[6]. Basilaia, G., & Kvavadze, D. (2020). Transition to Online Education in Schools during a SARS-CoV-2 Coronavirus (COVID-19) Pandemic in Georgia. *Pedagogical Research*, 5(4), 20-26.
[7]. Asmiyunda, Guspatni, & Azra. (2018). Pengembangan E-modul Keseimbangan Kimia Berbasis Pendekatan Saintifik untuk Kelas XI SMA/ MA. *Jurnal Eksakta Pendidikan (JEP)*, *2*, 155–161.
[8]. Yerimadesi. (2017). *Modul Guided Discovery Learning untuk Pembelajaran Kimia (GDL-PK) SMA.* Padang: Repository UNP.
[9]. Yerimadesi., Bayharti., Azizah., Lufri., Andromeda., & Guspatni. (2019). Effectiveness of Acid-Base Modules Based on Guided Discovery Learning for Increasing Critical Thinking Skills ad Learning Outcomes of Senior High School Student. *Journal of Physics: Conference Series.* 1(1), 1-7.
[10]. Bamiro, Adekunle Oladipupo. (2015). Effects of Guided Discover and Think Pair-Share on Secondary School Students Achivement in Chemistry. *Sage Open.* 1-7.
[11]. Plomp, T. (2007). *Educational Design Research: An Introduction. dalam Tjeerd Plomp and Nienke Nieeveen (Ed). An Intoduction to Educational Design Research.* Netherlands Institute for Curriculum Development: SLO.
[12]. Hermawan, Heri. (2016). *Analisis Kuantitatif Instrumen Penelitian.* Yogyakarta: Parma .