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Development of Problem Based Learning Based E-Modules on Salt Hydrolysis Materials to Improve Students Science Literature

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Abstrack: This study aims to develop an e-module based on problem-based learning to improve scientific literacy for class XI Senior High School students. The method used is the 4-D Model development method with the stages of Defining Design, Development and Dissemination. The limitation of this research is only until the third stage. This development assessment is valid and practical. The elements that are validated are content, presentation, language and graphic components. Elements of practice can be seen from the questionnaire conducted by 36 students and 3 teachers. The results of this study are e-modules that meet valid and practical criteria, so that they can be used for salt hydrolysis learning in class XI Senior High School students.

Keywords: E-module; Problem Based Learning; Salt Hydrolysis

Introduction

Chemistry is a subject in high school which is considered difficult by some students. This is because the material contained in chemistry subjects is a subject that is not easily understood by all students because it is abstract and requires conceptual understanding (Ellizar, 2015).

Teaching materials have a very important role in adding and increasingthe effectiveness of learning. Useful or not a teaching material in the learning process is very dependent on the ability of educators in developing and utilizing it. The development of teaching materials may not run smoothly if previously they did not know the types and roles of teaching materials in learning (Sadjati, 2012). One of the teaching materials that can be developed is e-module as a learning resource and a means of supporting learning.

E-module is a collection of information that looks and has format similar to a book. E-module is presented in electronic media to be read through a computer, laptop or another gadget. The difference between the print module and the electronic module is in the physical presentation format (Luthfiana & Hidayah, 2022). Chemistry learning modules developed into teaching material, e-modules canbe created using the app *Flip Pdf Professional* (Seruni et al, 2020).

According to the 2013 curriculum, learning should not maintain the old paradigm, namely making the teacher as the center of learning. Teacher center learning is still widely applied in classroom because these learning is practical and does not take up much time. To improve the problems above, it can be started by increasing the competence of the teachers, either in delivering the material, in using appropriate teaching methods and techniques, or in using methods that suit the needs of students (Huda et al., 2020).

Based on the results of observations and interviews with Class XI Chemistryteachers at Senior High School 1 Rambatan, it was found that in learning students tended to passively by not responding when the teacher asks or explains the material. In addition,

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in learning, teachers rarely apply learning models *Problem Based Learning* and develop scientific literacy skills, teachers only emphasize learning outcomes (Nurtanto et al, 2020). Meanwhile, the learning model usedis the lecture method, discussion and notes the material read by the teacher (Sivarajah et al, 2019). The book used in the study is a government book published in the 2013 curriculum.

Based on the description above, the researcher intends to develop an EModule based on scientific literacy. In this case, the E module developed contains several components, namely: 1) Instructions for using the E Modulein the form of instructions that make it easier for readers to understand and work on each part contained in the E Module, 2) Competence to be achieved, 3) Chemical material is divided into some features: a) Student orientation on problems. b). organize students to learn, c) guide investigations, d) develop and present the work, e) analysis and evaluation, on assignments containing questions or questions related to the material (Peranginangin et al, 2019), 4) Assessment, 5) Answer keys, 6) Bibliography, 7) Glossary.

The material that the author developed in the E-Module of Chemistry based on Problem Based Learning is to improve scientific literacy in the matter of Salt Hydrolysis (Aulia & Hardeli, 2022). This salt hydrolysis material is a subject matter that can be observed directly and its application can also be found in everyday life so that it involves the active participation of students in the learning process. Therefore, the author intends to conduct research with the title "Problem Based Learning-Based Chemistry E-Module Development To Improve Science Literacy on Salt Hydrolysis MaterialClass XI Senior High School 1 Rambatan"

Method

Types of research carried out in developing -chemistry-based e-modules *problem based learning*to improve scientific literacy on the material of salt hydrolysis class XI Senior High School is research *research and development* (R&D). The 4-D development model consists of 4 stages (Rahayu & Sukardi, 2020) namely: (1) *define,* there are five stages carried out, namely: (a) Front end analysis; (b) Student analysis; (c) Task analysis; (d) Concept analysis; (e) Analysis of learning objectives (Verawati et al, 2022). (2) *design*, was carried out to design -based chemistry e-module *Problem Based Learning* to improve scientific literacy on salt hydrolysis material for class XI Senior High School. The design of this e-module consists of a cover, instructions for using the module, a concept map, Basic Competence and Competency Achievement Indicators, as well as learning objectives, materials, competency test, glossary, and bibliography (Chairil et al, 2020). (3) *develop*, two things were assessed on the e-module, namely the evaluation of the validity of the e-module and the practicality of the e-module (Rahmatika et al, 2020). The validity test can determine the level of validity ofthe e-module (Rahmatsyah & Dwiningsih, 2021), and the practical test is to determine the level of ease of use of the e- module, time efficiency and the benefits of the designed e-module. The practicality test involves the teacher and the high school student concerned. and (4) *disseminate,* However, this research is limited only to the *develop* namely by testing the level of validity and practicality of the e-module, while the deployment stage was not carried out due to time and cost limitations.

Subject This study consisted of 3 chemistry lecturers, FMIPA UNP, 3 chemistry teachers Senior High School 1 Rambatan, and 36 students of class X Senior High School 1 Rambatan. Meanwhile, the object of research is an e-module based on chemistry*problem based learning*to increase*scientific literacy*on salt hydrolysis class XI Senior High School. Furthermore, the data that has been obtained is analyzed using the V Aiken as Formula 1.

$$V = \frac{\sum s}{n[c-1]} \qquad (1)$$
$$s = r - lo$$

Information:
lo = The lowest score in the category (scoring) (in this case = 1)
c = Number of categories chosen by the rater (in this case = 5)
r = Score given by rater
n = Many raters

The validity criteria are based on the Aiken's V scale as follows (Oktafia & Zainul, 2022)

Table 1. Aiken's V Scale Validity Assessment Criteria

Aiken's V Scale	Validity
$V \leq 0.4$	Less
$0.4 < V \leq 0.8$	Medium
$0.8 < V$	Valid

The data generated from the practicality test were analyzed using the following equation 2 (Jannah et al, 2019).

$$P = \frac{Q}{R}\ x\ 100\% \qquad (2)$$

Information:
P = Practicality value
Q = Score obtained
R = Highest score

The level of practicality of the developed e-module can be seen in Table 2 (Adriani et al, 2021; Wahyuni et al, 2022).

Table 2. Practicality Assessment Criteria

Value Practicality (%)	Criteria
80 < x ≤ 100	Very Practical
60 < x ≤ 80	Practical
40 < x ≤ 60	Quite Practical
20 < x ≤ 40	Less Practical
0 < x ≤ 20	Impractical

Result and Discussion

Define Stage (definition)

This definition stage is carried out to find out the general picture in the school, such as an overview of how the learning process and the obstacles faced in thein class. At this defining stage, it begins with an interview with a chemistry teacher Class XI Senior High School 1 Rambatan, analyzing the syllabus of class XI chemistry subjects Semester II especially salt hydrolysis material, analyzing chemical and material textbooks teaching materials used by chemistry teachers in class XI of Senior High School 1 Rambatan as a resource student learning and reviewing the literature on the e-module that the researcher will develop.

(1) Based on the results of interviews, in learning chemistry using textbooks as the main teaching material. However, the obstacles encountered when learning chemistry are: Many students have difficulty in understanding the material and solving problemsmaterial related problems.

(2) Based on the analysis of the subject syllabus chemistry class XI semester II it is known that salt hydrolysis material has 2 competencies basic and 6 indicators of competency achievement that have been presented, From the description also shows that the concept of salt hydrolysis matter emphasizes the importance understanding and analysis of material and is closely related to phenomena that are around, so a science literacy-based workbook is needed.

(3) Based on the results analysis of chemistry teaching materials in class XI Senior High School 1 Rambatan, researcher found some of the weaknesses of these teaching materials namely: (a) The teaching materials used in learning in the form of textbooks as the main source; (b)Both learning resourcesit only presents a summary of the material and practice questions that make participants passive learners in learning. (c). The questions contained in the package book are still is global and focuses more on scientific content than on processes and context. (d). The material in the textbook only contains theories and formulas. Without Emphasis on process *problem based learning*.

(4) E-Module based *Problem Based Learning* is an e-module designed based on the structure of e- module by adding components *Problem Based Learning* (Mahmudah et al, 2022; Efendi et al, 2022) which one is this enable students to more effectively understand the content of the lesson, and more challenge students' abilities and provide satisfaction to discover new knowledge for students, as well as increasing student learning motivation and activities (Situmorang et al, 2020).

Design Stage (design)

This stage is carried out to prepare and design e-modules based on *Problem Based Learning* on salt hydrolysis. The steps thatcarried out at the design stage are (Serevina et al, 2018):

Organizing students to learn

Encourage students to collect relevant information,and carry out experiments, until they get*insight*for solution to problem.can be seen in Figure 1.

Figure 1. Organizing students to learn

Organizing students to study

Encourage students to collect relavant information and carry out experiment to get incentives for problem solving.

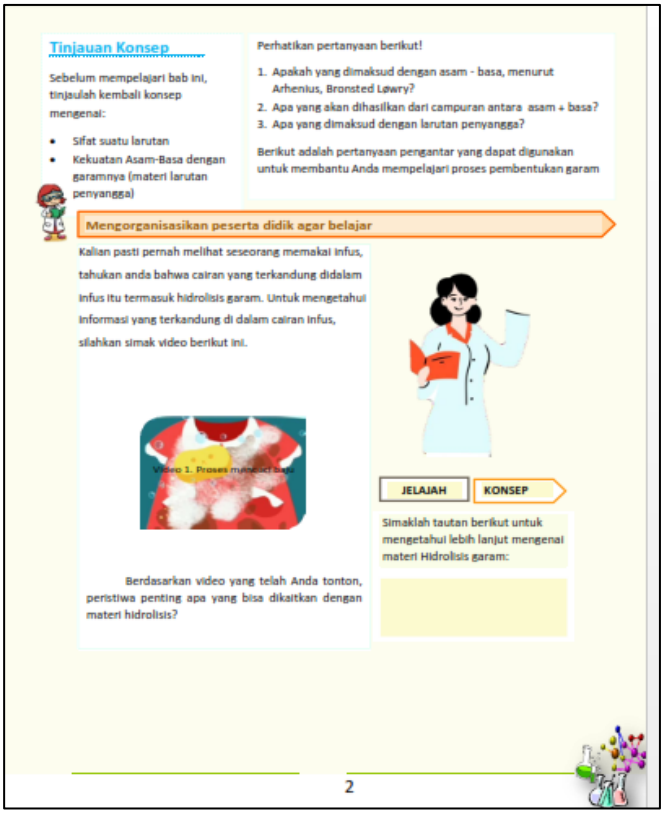

Figure 2. Organizing students to study

Guiding Individual and Group Investigation

Encourage students to collect relevant information,and carry out experiments, until they get*insight*for solution to problem can be seen in Figure 3.

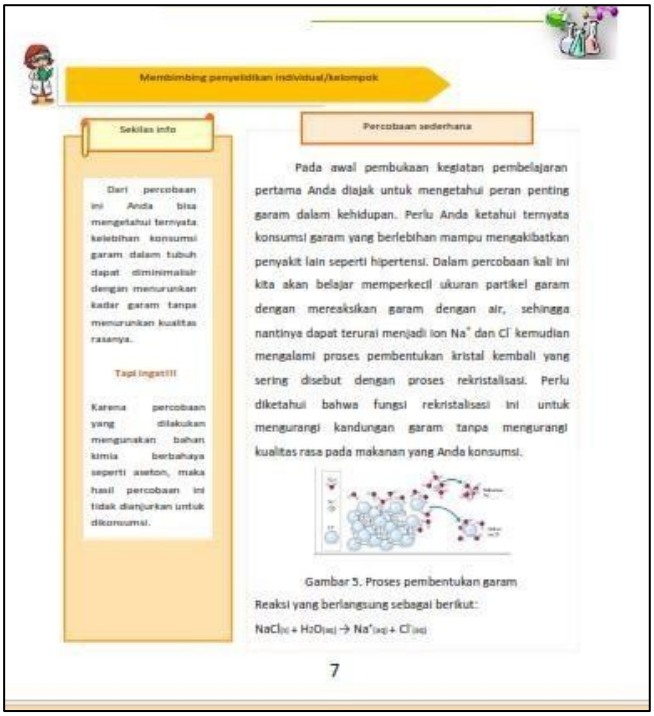

Figure 3. Guiding Individual and Group Investigations

Develop and present the work

Directing students to carry out evaluations in each process carried out in the investigation can be seen in Figure 4.

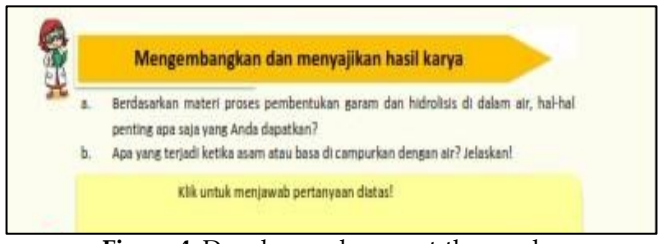

Figure 4. Develop and present the work

Analyze and Evaluate the Problem-Solving Process

After the assignment there is an assessment column for the teacher Write down the score for each student can be seen in Figure 5.

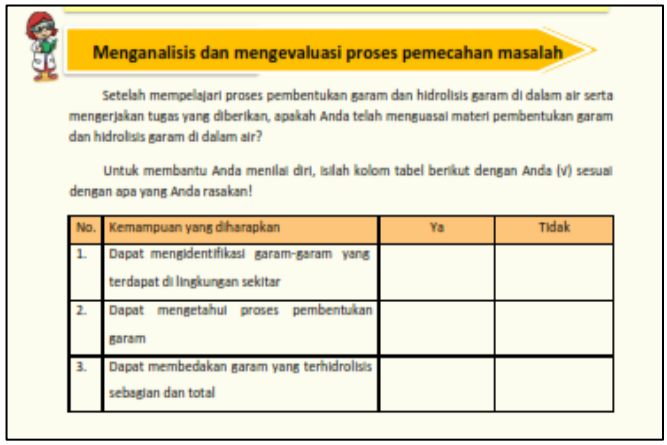

Figure 5. Analyze and evaluate the Problem-Solving Process

Development Stage

1. Validity test

The e-module validation test consists of the content components, the quality of the presentation method, the use of language, the use of illustrations, the quality and supporting materials, the physical quality of the e-module, and the characteristics of the e-module. Based on the results of the e-module validation data analysis, the average V Aikens is 0.92 with a very high validity category which indicates that the chemical-based e-module *Problem Based Learning* to increase *scientific literacy* the salt hydrolysis material developed is valid and in accordance with the assessment components contained in the Ministry of National Education (Sari, 2018). -based chemistry e-module validation test results *problem-based learning* consisting of these components can be seen in Table 3.

Table 3. he results of the analysis of the validity of the e-module by the validator

Rated aspect	V Aikens	Category Validity
Content Component	0.93	Very high
Quality of Presentation Method	0.89	Very high
Language Usage	0.89	Very high
Use of Illustration	0.93	Very high
Supporting quality and materials	0.94	Very high
Physical Quality of e-module	0.91	Very high
Characteristics of e-module	0.92	Very high
Average	0.92	Very high

In the aspect of the content component, V Aikens is obtained 0.93 with a very valid category high, meaning that the material in the e-module is in accordance with basic competencies, indicators of competency achievement, learning objectives to be achieved and the material beingtaught, and the questions presented are able to direct and guide students in finding and understanding concepts (Rosanna 2022).

On the quality of the presentation method, V Aikens 0.89is obtained with a very high validity category, meaning that the e-modules have been systematically arranged according to the presentation systematics starting from the cover to the bibliography. In the aspect of language use, V Aikens is 0.89 with a very high validity category, meaning that the language in the e-module is based on *Problem Based Learning* it is in accordancewith the language used in the communicative Indonesian language rules and the language used is taken from high school chemistry books, making it easier for students to receive lessons (Asrial et al, 2019). In the aspect of using illustrations, V Aikens is 0.93 with a very high category, in the aspect of quality and supporting materials, V is obtained. Aikens 0.94 with a very high category, meaning that thexperimental pictures and videos made are in accordance with the experiments contained in the hydrolysis material. Salt and animations created using colored backgrounds to beautify the appearance and focus on presentation on the physical quality aspect of the e-module obtained by V Aikens 0.91 with a very high validity category. In the aspect of e-module characteristics, V Aikens is obtained 0.92 with very high validity category.

2. Practical Tes

Based on the results of the teacher response questionnaire with 3 chemistry teachers at Senior High School 1 Rambatan, an average practicality of 0.95 was obtained in the very practical category and the validated students were distributed to students in class X IPA with 36 students, the results of the e-module based on *Problem Based Learning* on the salt hydrolysis material with an average value of 0.91 with very practical criteria. E-module based *Problem Based Learning* on salt hydrolysis material, when viewed in terms of time, it is very effective and efficient where e-modules are -based *Problem Based Learning* the salt hydrolysis material is presented in a fairly short time so that it can help the limited time in the learning process, and is efficient to use. In terms of ease of use, e-modules based on *Problem Based Learning* on this salt hydrolysis material is very practical to use. Due to e-module based on *Problem Based Learning* on this salt hydrolysis material can be accessed on a laptop that can be studied anywhere and anytime.

Based on the description of the based e-module *Problem Based Learning* on the good salt hydrolysis material that the author did, it can be concluded that the based e-module *Problem Based Learning* on salthydrolysis material is feasible and practical to use as an alternative medium of learning for high school students.

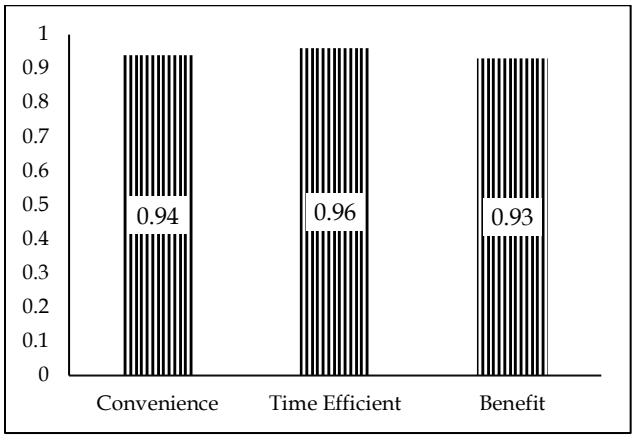

Figure 6. Practicality Value of Each Component of Teacher Practicality

The results of the data processing of the teacher's practicality questionnaire assessment of the based e-module *Problem Based Learning* The salt hydrolysis material for each component can be seen in Figure 6.

The results of the data processing of the student practicality questionnaire assessment of the -based e-module *Problem Based Learning.* The salt hydrolysis material for each component can be seen in Figure 7.

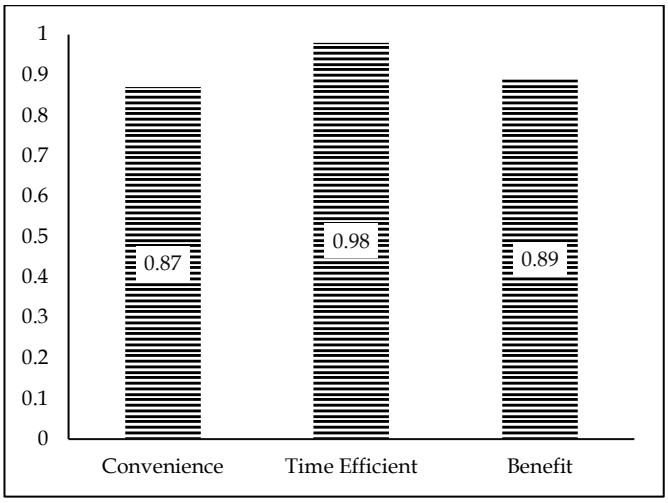

Figure 7. Practicality value of each student's practicality component

Conclusion

Based on the data obtained, it can be concluded that the -based chemistry e-module *Problem Based Learning* to increase *scientific literacy* the Senior High School class XI salt hydrolysis material developed has very high validity and practicality. E-Modules can assist teachers in delivering material and assist students in finding and understanding lesson concepts, because they contain images, videos, and submicroscopic animations as well as guiding questions in each lesson. *slides* which are displayed.

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