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Article

Development of E-Learning Content by Lab Rotary Inquiry Learning on Support Solution Materials for Senior High School

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Abstract— Chemistry as an everyday science, students first need to understand everyday chemistry. Inquiry learning is a learning model in which students acquire the necessary knowledge through direct thinking, questioning, inquiry or research, experimentation or independent research. This study aims to help high school students understand chemistry learning during the Covid-19 pandemic. The study was conducted using a research and development (R & D) model using a 4D development model. Verification of e-learning products was performed by two chemistry teachers using Kappa Cohen's analytical formula. Content validity and composition validity are in a very high range, with k values of 0.87 and 0.84. The program performance k-value is in the very high category of 0.82, and the last aspect is the e-learning design and the very high k-value category of 0.84. Based on the results of the data analysis, we can conclude that e-learning is effective and can be used in the learning process.

Keywords— **Lab Rotary, Inquiry Learning, Buffer Solution**

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I. INTRODUCTION

The increase in intelligence and quality of life of the educational community is developing rapidly. This will encourage educators to adopt pedagogical approaches appropriate to these conditions. One form of development in education is the use of e-learning as one of the ways to support the learning process during the Covid-19 pandemic [1].

E-learning is a form of learning model that can use information and communication technology to enhance student understanding [3],[5]. Effective learning can be interpreted as

learning that uses technology and communication as much as possible as a tool in the learning process [4],[32]. One application of information and communication technologies in learning is the use of e-learning [2].

Some of the features of e-learning are: 1) Availability of content related to educational goals [7] 2) Use constructive methods such as presenting examples and exercises to enhance learning, 3) Learning materials using media elements such as words and images provided to students [6],[8], 4) Teacher-led education (synchronous e-learning) or self-study (asynchronous e-learning) is provided, 5) Improve individual understanding and develop skills or group learning related to learning goals [10]. E-learning is an innovation that can be used in the learning process not only to provide learning materials, but also to improve the ability of students to learn in different roles [9][11].

The inquiry-based learning model is a series of educational and learning activities that use the inquiry and inquiry skills of all students to enable them to form their own knowledge [13]. The inquiry-based learning model is a process of asking questions, investigating, creating new knowledge and things, and fully engaging students in learning [12],[15].

There are many models that educators can use to conduct online and face-to-face learning activities using e-learning [14]. One of them is the Rotary Laboratory [16]. The use of digital technology requires digital transformation in theA educational world, which is increasingly being sought after by students [17]. One of them is the Rotary Laboratory. The vast lives of the real world can manipulate time. A variety of training methods are used for balance and development [18],[35]. One of them uses blended learning methods that combine technology and information-based learning with face-to-face or face-to-face training. This is a combination of face-to-face, distance learning, and e-learning [20]. The blended learning model used is a rotating laboratory model [19].

The blended learning feature gives students flexibility in learning [21],[33]. Online information technology allows students to easily interact with teachers and receive resources and materials both inside and outside the classroom. The learning does not do this entirely online, but instead complements and addresses the non-classroom learning material [23],[29]. Blended learning can provide students with more experience and benefits, including: B. Improve student access to learning materials, improve learning quality and reduce learning costs [30].

Effective blended learning begins with organizing efforts, improving tools and accessibility to learning contexts, increasing user satisfaction and streamlining learning [27],[34]. It teaches students the requirements of Society 4.0 and Industry 4.0. One is to create a collaborative virtual learning environment.[36]. In other words, there is learning management to keep up with the changes of students in the digital world [25],[31].

The choice of learning model must be in accordance with the nature of the material. Because buffers are chemicals that are closely associated with everyday life, understanding buffers requires not only learning the theory, but also associating buffer materials with real-world examples [26].

II. METHOD

The type of research used in this study is research and development (R&D). In the form ofAe-learning development based on a rotational research learning lab on buffer material for SMA/MA. The development model used in this study is a 4D model. 4D modeling is one of the R & D methods used to develop learning resources. This study is limited to the development phase, or validation. The subjects of this study were two chemistry teachers from SMAN 2 Kerinci.

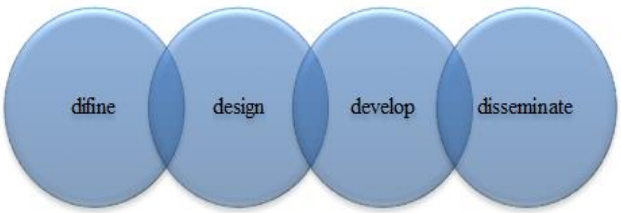

Figure 1. 4D Model Development Stage

The definition phase is carried out to identify and identify the need for the development of educational media [28]. It consist of five steps: “intial analysis, student analysis, task analysis, concept analysis and identification of the learning purpose” [22].

The design phase is followed to create a prototype of the learning device [24]. Related steps are curriculum development, lesson planning, learning implementation design, LKPD, learning videos, strength design, and e-learning content, starting with rating questions.The development phase continues by modifying the material based on she student's response to validator input and e-learning in the buffer materials[37].

The content and composition validity questionnaires submitted to two media experts and one chemist served as a means of research. The effectiveness of e-learning is assessed by analyzing the questionnaires filled out by validator and student responses. The result of the data analysis used was the analysis of technical data.

The analysis of technical data aims to determine the relevance and validity of the content developed by e-learning. The level of validity was analyzed using Cohen's Kappa formula [38].

$$momen\ kappa\ (k) = \frac{\rho_o - \rho_e}{1 - \rho_o}$$

Description:
k = moment value kappa
ρ_o= realization rate
ρ_e= proportion not realized

Table 1. Decision Category Based on Kappa Moment (k)

Interval	Kategori
< 0,0	Invalid
0,0–0,2	Very low
0,21–0,4	Low
0,41–0,6	Medium
0,61–0,8	High
0,81–1,0	Very high

III. RESULT AND DISCUSSION

It is a research & development research. The resulting e-learning product is already valid from the validation check. The results obtained are "E-learning based on rotational inquiry learning lab on buffer solution material for SMA/MA". The overall phase of the study is described below.

3.1 Define Stage

Development requirements are defined at the beginning of the 4D model. Five activities are performed during the definition phase:

3.1.1 Front-end Analysis

To establish the fundamental issues with the learning process and provide context for the need improvement, the first analysis is conducted [39]. Interviews, observations, and student questionnaires were used to conduct the first data analysis.

3.1.2 Student Analysis

The purpose of student analysis is to pinpoint the traits of the students who will be the focus of the creation of learning materials [40]. Provided that the learning that was done was not yet accessible in the form of e-learning, it was decided to create teaching materials in the form of e-learning based on the findings of the questionnaire given to students at SMAN 2 Kerinci.

When it comes to learning during the Covid-19 epidemic, project-based development is acceptable and one of the best options, particularly for buffer solution content.

3.1.3 Task Analysis

Task analysis tries to pinpoint the abilities the researcher investigated for further analysis into potential extra talents [43]. In this step, fundamental skills are identified, and they are subsequently reduced to indicators of competence attainment in line with the undertaken learning goals. A buffer solution's fundamental abilities are: 3.12 Outlining the operation, computing pH, and function of a buffer solution in living things 4.12 Making a pH-specific buffer solution.

3.1.4 Concept Analysis

In order to establish the number and kind of educational materials, this conceptual analysis analyzes competency criteria. In particular, training materials are analyzed to identify the resources needed to assure the development of training materials [41]. The purpose of this idea analysis is to identify and create a concept for the 2 buffer solution material. Concept of a buffer: the basis for buffer operation, the procedure for making a buffer, its characteristics, its pH and pOH, and its function.

3.1.5 Specifying Instructional Objectives

In order to understand the findings of concept analysis and task analysis and to ascertain how the study object behaves, learning goals must be developed [42]. Students may attain their learning objectives thanks to the rotating lab-based e-learning with inquiry learning model, which was built utilizing indications of student performance for the learning objectives on the buffer solution material.

3.2 Design Stage

The activity carried out at this stage is to design a buffer solution e-learning that is being developed. The preparation of this e-learning is done using the Canva application, Microsoft Power Point and Youtube.

Figure 2. Home Display on E-learning

This is to provide material for the buffer. Information about the learning activities carried out at the beginning of the activity, such as student involvement, lesson plans, introduction to the buffer materials and the buffer program developed by the researchers as methodological guidelines for the learning process.

Figure 3. Material Introductory

Learning resources are the steps taken by students in understanding the learning material provided by the teacher. The teacher facilitates students' learning resources in the learning process, such as supporting Power Point videos, resource books and student activity sheets that have been developed. Learning resources aim as a guide for students in finding concepts in the buffer solution material.

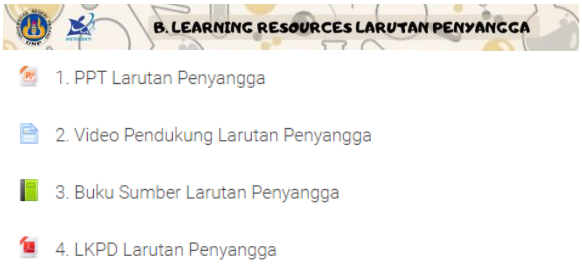

Figure 4. Learning Resources

Learning activities are activities of students in carrying out learning that aims to see the students understanding in understanding the buffer solution. Learning activities on the buffer solution material include peer discussion, rooms, and results, resume assignments, and also questions of evaluation.

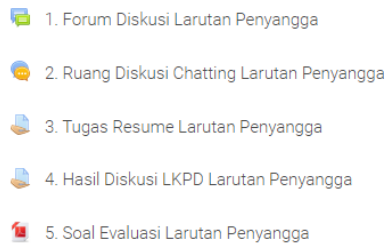

Figure 5. Learning Activities

3.3 Develop Stage

3.3.1 Validity Test

Construct and content validity tests were administered [22, 23]. Two chemistry instructors from SMAN 2 Kerinci conducted the validity test based on their professional judgment and the input of a minimum of two other individuals [44]. Two experts carried out the validation. Three different parts make up content validation: assessment, content materials for e-learning, and guidance and information components. Guidelines and information, program performance, and systematic aesthetics and design principles make up the other three parts of construct validation. The Kappa Cohen algorithm was used to analyze the data based on this evaluation. In Figures 6 and 7, the outcomes of the content and construct validation are shown.

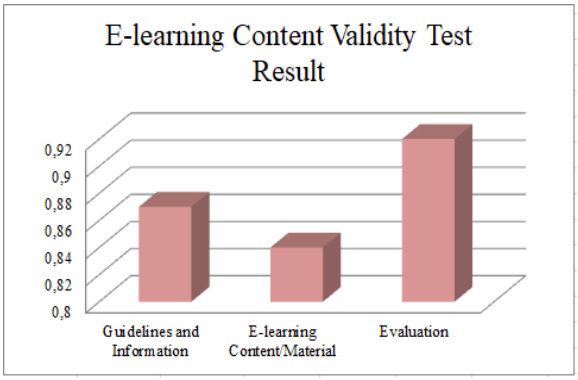

Figure 6. Content Validation Test Result Graph

Based on the graph, it can be seen that the validity of the content based on the rotational inquiry learning lab on the buffer solution material within score of 0.87 is categorized into "very high". Kappa value analysis proved the developed e-learning is valid.

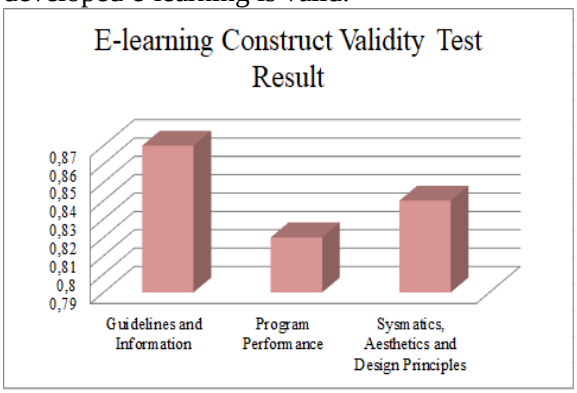

Figure 7. Construct Validation Test Result Graph

Based on the graph, it can be seen that the validity of the content based on rotational inquiry learning lab on buffer solution material within score of 0.84 is categorized into "very high". Kappa value analysis shows that the developed e-learning is valid.

3.3.2 Practicality

This term was tested on 10 SMAN 2 Kerinci students. Students' assessments of the usefulness of e-learning, which was developed to address a number of aspects including language that is easy to understand, the flow of the information presented is easy to understand, effective learning time, can be used repeatedly, improves memory, fosters curiosity, and makes it simpler for students to learn, are indications of its use. reading up on the subject of buffer solutions. For the demands of students in the learning process, e-learning must be created with a high degree of learning flexibility. Figure 8 shows the outcomes of the practicality test.

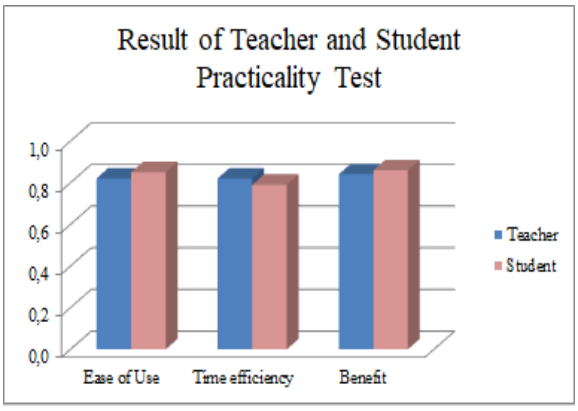

Figure 7. Practicality Result Graph

Referring to the diagram, the teacher's practicality test are 0.868 in the very practical category, while the students' practicality value is 0.852 in the practical category. This shows that learning uses e-learning on buffer solution material that has been developed practically for use in learning.

IV. CONCLUSION

Referring to the data analysis, it can be seen that e-learning development based on rotational inquiry learning lab on the buffer solution material has content validation and construct validation levels of 0.87 and 0.84, respectively, in the very high category, according to the data analysis performed. The teacher scored 0.868 on the practicality test, while the student scored 0.852, both in a very high level. Thus, it is concluded that the rotating inquiry learning lab-based e-learning on a buffer solution for SMA/MA is both legitimate and useful.

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