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Article

Development of E-Learning Chemistry Learning for SMA / MA Project Based Learning on Colloid Materials with the Flipped Classroom Approach in Class XI Senior High Schools

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Abstract- *This study was conducted to develop e-learning content using Moodle on project-based colloid chemistry subjects. The research is a Research and Development (R&D). Using the 4-D model with stages (1) define, (2) design, (3) develop and (4) disseminate. This research stage is only limited to the developing stage. The number of validations for this study were 2 validation and students in Batusangkar, Rambatan. The instrument used in this study was a content validity questionnaire and construct validity. The data analysis technique is to process the numbers that have been obtained from the measurement results of the questionnaire data obtained from calculations using the Cohen kappa formula. The results obtained from data analysis have shown that the mean kappa moment of content validity is 0.838 and construct validity is 0.801 with very high and high validity categories. So that it can show that the content of e-learning learning for the development of e-learning chemistry learning in SMA / MA project-based learning on colloid material using the Moodle application can be said to be valid and practical so that it can increase student motivation in the learning process.*

Keywords : *E-Learning, Project Based Learning, Colloids, Flipped Classroom, Moodle*

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I. INTRODUCTION

The rapid development of IT encourages the emergence of various innovative learning models in the field of education. Innovative technology-based learning models arise because of the constraints found in traditional learning methods, where students cannot be actively involved in the teaching and learning process in the form of physical encounters [1]. In traditional learning, the learning environment refers to face to face learning (Teacher-Areded Learning) [2]. The interaction between teachers and students is not only done face to face but can also use electronic media as an intermediary so that the teaching and learning atmosphere becomes more attractive, visual and interactive [3]. Students are only reactive to their environment, but do not play an active role in their environment. One of them is by using E-learning as a learning medium [4].

The application of e-learning in learning strongly supports learning media for the rapid development of IT in Revolution 4.0 [5]. The use of e-learning in learning has 4 benefits: 1. Gaining personal learning experience, 2. Reducing costs, 3. Easy to obtain and 4. increasing the ability to be responsible [6]. Electronic learning has been implemented since the 1970s [7]. E-learning leads to the use of useful IT to help students improve their cognitive and psychomotor skills. e-learning is defined as follows: "e-learning is instruction delivered on a computer via CD-ROM, the Internet, or an intranet" [8]. E-learning is a useful technology to enable students in the learning process to learn whenever and wherever students are [9].

After knowing the meaning of e-learning, there are lots of Learning Management Systems to manage the e-learning web. One such Learning Management System (LMS) is Moodle [10]. The software used to develop systems & learning processes using computers, laptops, and other gadgets is the notion of Moodle [11]. The result of the development of moodle Can then be accessed by student using the internet network [12].

The use of e-learning with Moodle can create an active learning management system. In Moodle, images, web pages, pupil quizzes and animations can be inserted so that PU are interested in learning [13]. The use of E-Learning is not only as a learning medium, but also as a medium of information, entertainment and education [14]. With e-learning the learning process between teachers and students can shorten learning [15]. Based on research on students' chemistry learning processes in the psychomotor, affective and cognitive domains, it can be said that they have an effect on improving student learning processes through project-based learning assisted by e-learning [16]. In the cognitive domain, the treatment of learning in the experimental class can make students accustomed to being critical and creative in dealing with the problems given and already in the form of projects [17].

Project-based learning, in addition to the results of the student's learning process on the cognitive domain, other student abilities such as creativity and learning motivation can be increased [18]. The learning process can be improved with PJBL-based learning [19]. Project-based learning does not only look at the cognitive domain but also the performance of students [20]. The application of learning media with e-learning based on the Edmodo education blog is able to improve motivational responses and student learning outcomes [21]. From several studies that have been carried out that project learning with e-learning can improve student performance in learning [22]. This method is quite effective as a tool to familiarize students actively because students are encouraged to be more independent and not completely dependent on the teacher, but lead students to learn independently [23].

Based on the above problems, researchers are interested in conducting research to develop e-learning media content using the Moodle application with the title "Development of E-Learning Chemistry Learning for High School / MA Project-Based Learning on Colloidal Material with a Flipped Classroom Approach in Classroom. XI High School ".

I. METHODS

There is a research approach that tries to combine 2 approaches, namely research & development. The research method used to produce a work in the form of a product and test its effectiveness is the notion of research and development methods [24]. This type of research is research & development. Approaches to produce new products or improve existing products are research and development methods [25]. The research model used is a 4-D model with the stages of define, design, develop & diffuse [26]. This research stage is only up to the development or validation stage. The practicality test cannot be carried out due to the Covid-19 pandemic. Sources of data in this study are 2 validators. 4-D stages can be seen in Figure 1

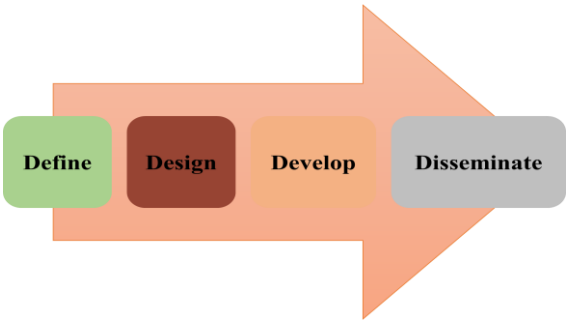

Figure 1.4-D

1. The define stage

Researchers at this stage collect information about the need for e-learning with the flipped classroom approach on colloid development using the Moodle application on the aspects of student creativity, problems in the chemistry learning process, learning learning. facilities, especially IT-based equipment

2. Design stage

At the design stage, it aims to design colloid e-learning content using the Moodle application [27]. The stages include: making an elearning guide, making the contents of teaching materials (PPT, summary, e-module, practicum video, worksheets), quizzes, introductory video, evaluation questions [28]. E-module is a teaching material that can help students measure and control their learning abilities and intensity [29] Based on [30] that students can learn from working on worksheets with a developed process skills approach.

3. Delevop stage

The researcher carried out a series of activities, namely: (a) validating chemists, (b) revising the validation of 2 validators, (c) conducting small / limited-scale results trials aimed at implementing e-learning with the flipped classroom approach to development. colloid material using the Moodle application [31].

The data analysis technique is to process the numbers obtained from the measurement results to be used as material experts and media experts. Furthermore, the data that has been obtained is analyzed to see the feasibility of the media that has been made. The data obtained are in the form of qualitative data. Measured qualitative data, criticism, and suggestions from media and material experts. In this study, research data in the form of a proportion of the validity score of the data obtained were analyzed using kappa moments [32].

$$k = \frac{\rho - \rho e}{1 - \rho e} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Information :

k = Kappa moment which shows the validity of the product.

p = Proportion embodied, calculated by the number of values given by the validator divided by the number of maximum values.

pe = Unrealized proportion, calculated using the maximum value minus the total value given by the validator divided by the maximum value.

Table 1: Category of decisions based on Kappa moments (k)

Interval	Category
0,81 – 1,00	Very high
0,61 – 0,80	High
0,41 – 0,60	Moderate
0,21 – 0,40	Low
0,01 – 0,20	Very low
≤0,00	Invalid

II. RESULT AND DISCUSSION

3.1 Define

3.1.1 Front end analysis

Front end analysis data came from interviews with chemistry teachers at SMAN 1 Rambat. Based on the results of interviews with chemistry teachers, the following results were obtained: (1) the learning model that is usually used is discovery learning (2) the teaching materials provided by the school are printed books, worksheets, and PPT (3) Students' lack of understanding in learning using teaching materials given.

3.1.2 Student analysis

The student analysis stage was carried out by interviewing class XI students and chemistry teachers. The resulting data shows that students are more interested in using IT-based media.

3.1.3 Tax analysis

Task analysis was carried out to determine the Competency Indicator of Achievement (GPA) this analyzing KD 3.14 for class XI in the 2013 revised curriculum.

3.1.4 Concept analysis

Concept analysis is conducted to determine the basic concepts needed in studying colloidal material by identifying the main concepts and compiling them in the form of a concept map.

3.1.5 Formulation of learning objectives

Based on the results of basic competency analysis and competency achievement indicators, learning objectives can be formulated to be achieved during the learning process.

3.2 Design

At the design stage, the activities carried out were creating a colloid e-learning compilation design that would be developed in the Zainulteam.id LMS Software. This software is a project-based e-learning. The e-learning arrangement was made using the Microsoft Power Point 2016 application, PicsArt Photo Editor and VN. The following shows the elearning design

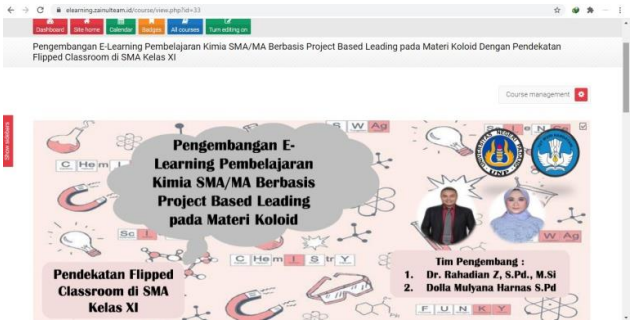

Figure 2. Cover of E-Learning

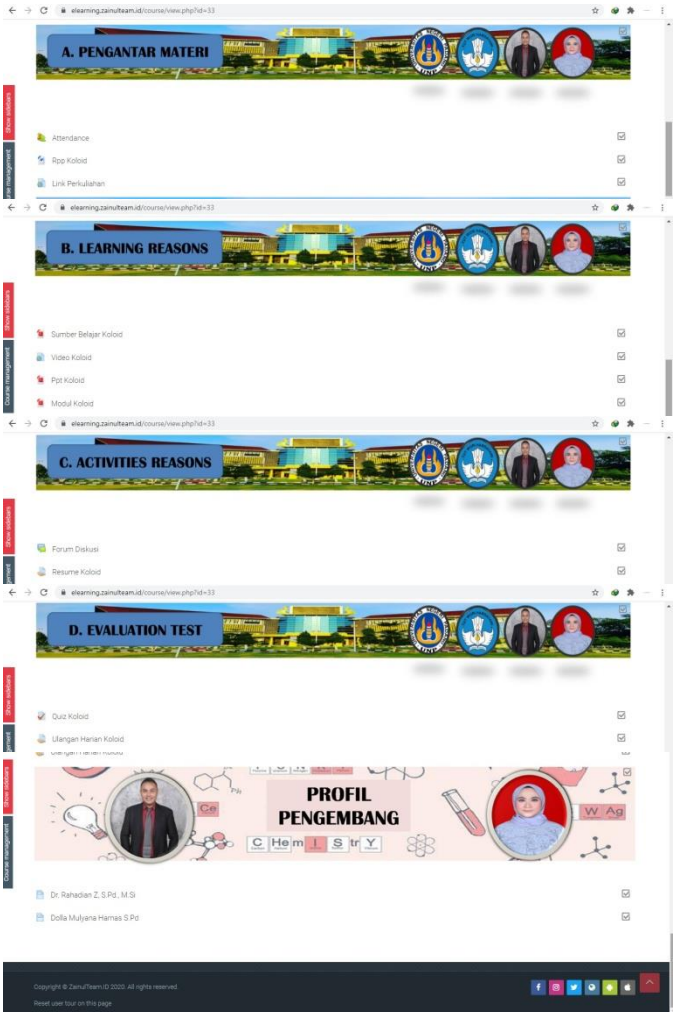

Figure 3. E-Learning Content

3.3 Develop

3.3.1 Validation test

The validity test aims to be able to assess a product in a study. There are two types of validation tests, namely the content validity test and the construct validity. The validation was carried out by 2 chemistry teachers. Content validity consists of a guideline and information component, e-learning content / material and evaluation. The validity of the content or the validity of the focus content provides evidence on the elements existing in the measuring instrument and is processed by rational analysis. The validity of the content was assessed by experts [33]. Construct validity also consists of three components, namely information guidelines, program

performance and systematics, aesthetic principles and design. The e-learning content designed is assessed by a chemistry teacher. The assessment is based on the statement that validation testing can use the opinion of two experts. The results obtained can be seen in Fig

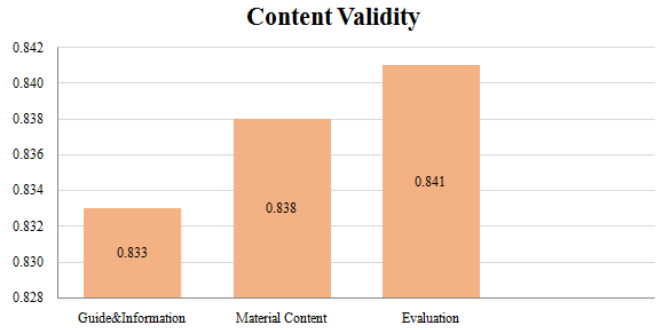

Figure 4. Graph of Content Validation Results

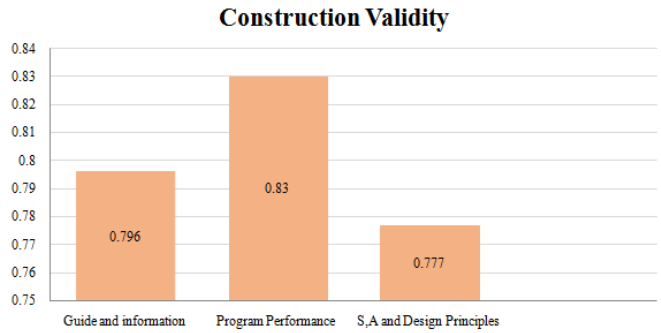

Figure 5. Graph of Construct Validation Results

Overall, the content validity and construction of e-learning learning content for development materials using the Moodle application developed for each component have high and very high categories, namely 0.838 and 0.801.

The components of the guideline and content validation information have an average k value of 0.833, including in the very high category. This proves that the guides and information about e-learning meet the requirements for clarity and ease of understanding of e-learning [34]. The content / e-learning material component has an average k value of 0.838 which is included in the very high category. This value proves that the content in the developed e-learning is in accordance with the demands of KD in accordance with the 2018 revision of the 2013 curriculum. The aspect of content eligibility includes the suitability of the material contained in the content with KI, KD and the learning objectives given depend on the students' abilities [35]. The average k value of the evaluation section is 0.841 which is categorized as very high. With this average value, it shows that e-learning evaluation can measure students' abilities.

In construct validation. The assessment was carried out by two chemistry teachers. The first component construct validation is a guide and information. The average k value of 0.796 is in the high category. This value proves that e-learning has conveyed information that is clear and easy to understand. The k average score of the program performance components is 0.830, including in the very high category. This section covers program installation, ease of use and consistency in e-learning. The last component, namely systematics, aesthetics and design principles, obtained an average k value of 0.777 including the high validity category. E-learning is made interesting so that it can motivate students to read and study learning material [36]. The results obtained from the validator's assessment were then made several revisions to the e-learning content which was developed based on the suggestions of the validator.

3.3.2 Revision

The revision stage is intended to increase the portion of e-learning content for the development of colloid material using the Moodle application, which has been deemed inappropriate before being tested. After the revision is made, it is then submitted to the validator to be discussed again. The revision is complete if the e-learning content for colloid development using the Moodle application has been declared valid / can be used by the validator.

From the data analysis that has been carried out regarding PjBL-based e-learning with the flipped classroom approach on colloid development material using the Moodle application with a very high category. This shows that e-learning with the flipped classroom approach in colloid development uses the practical application of Moodle for use in chemistry learning.

III. CONCLUSION

Based on the data analysis that has been done, the elearning material for colloid development using the Moodle application produced in this study has content and construct validity levels of 0.838 and 0.801, respectively with very high and high categories. So it can be concluded that e-learning content for the development of e-learning chemistry learning in SMA / MA project based learning on colloid material using the Moodle application can be said to be valid and practical so that it can increase student motivation in the learning process. Thus the products produced in the research can already be used or used by SMA / MA schools.

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