Article

Development Content Learning System (CLS) Material Corrosion Based on Project Base Learning (PjBL) with Shortened Flipped Classrooms in SMA / MA

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Abstract— This study goals is to produce an e-learning to help students understand chemistry lesson eventough they can't study in class or study in a normal condition. This research is focused development of content learning system e-learning on corossion topic based on project- based learning model using flipped classroom. This study is a research and development (R&D) method to produce a particular product, and test the effectiveness of the product. The data collection techniques used is questionnaire of product evaluation. The e-learning product validation conducted by postgraduates students of educational chemistry from Universitas Negeri Padang. The validation analysis was carried out using V aiken index. The validation of 3 aspects of content validity shows is Guide and information, this components show the average result of V about 0.833, it means this component is valid. The average result of V for material content is 0.838 and for evaluation is 0.84.For the construct validity for guide and information, which the V average result is 0.796. For the program performance the v result is 0.83 and in the design principles shows 0.777 of v result. This result conclude that the e-learning product is valid, and can be use for learning process in Senior High School.

Keywords— *Content Learning System; Flipped Classroom; Project Based Learning; Moodle; corrossion*

I. INTRODUCTION

Since the Covid-19 pandemic broke out, we have been given an overview of future learning activities that will be assisted by technology [1]. With the drastic change in learning activities, it was also supported by the development of information technology in theera of the industrial revolution 4.0. Learning is carried out using virtual activated technology [2]. Learning is carried out without limits in the era of digitalization [3]. where in the interaction learning activities carried out by lecturers and students are carried out virtually without doing face-to-face classes. By carrying out a good teaching and learning process, it is expected that there will be an increase in social skills and social

awareness between teachers / lecturers and students / students [4].

In these learning activities, each lecturer must be able to ensure that digitalization learning is carried out not only in transmitting knowledge, but also how to ensure that learning material is conveyed properly [5]. Of course, this is also an opportunity for all lecturers to be able to help and bring students to become competent for the 2nd century [6].

The use of e-learning in learning activities provides various facilities for digital learning. Based on research by Bariah, Rahdian, and Tresna (2019), the use of e-learning requires a learning strategy that is different from traditional learning [7]. Learning strategies in e-learning require no longer be carried out in one direction only but must be able to build communication between lecturers and students, build cooperation in groups, solve problems faced by students in everyday life, build creativity and student critical thinking, all of which can building basic competencies in the twenty-first century [8]. One of the learning strategies that can accommodate twenty-first century skills in e-learning learning activities is to use e-learning flipped classrooms [9].

The learning strategy, e-learning flipped classroom provides many opportunities for students to learn actively and innovatively [10]. The use of learning strategies, e-learning flipped classroom, students are encouraged to leave the classroom to study anytime and anywhere [11]. The results of other studies show that e-learning flipped classrooms are able to grow their own learning speed without direct instruction from lecturers and they are able to fully participate in learning so that students' performance shows positive changes [12].

Moodle is a software package produced for internet-based learning activities and websites that use the principles of the social constructionist pedagogy [13]. Moodle stands for Modular Object Oriented Dynamic Learning Environment which means a dynamic learning place using an object-oriented model or is a dynamic web- based educational environment package developed with an object- oriented concept [14].

Moodle serves as an effective tool in providing learning facilities because it is equipped with important learning support features such as assignments, quizzes, chat, collaboration, as well as main features that can upload various formats of learning material and are easier to understand because the information presented is not[15]. only in the form of writing but also images [16].

Project-Based Learning Model (PjBL) is a model learning that has been developed in developed countries such as United States of America [17]. If translated into Indonesian, PjBL means as project-based learning. PjBL is a learning model that begins of fundamental questions that require teachers to develop a guided question so that in this case it is possible each student is finally able to answer the guiding questions [18]. Project-based learning basically starts from a problem solving that needs to be done in order to be able to create contextual and useful work [19]. PjBL can create students' learning motivation and interest in the learning process[20].

II.   METHODE

The research metod used in this research is R&D with the 4-D (four-D) development model which consists of 4 stages, namely the define stage, the design stage, the develop stage and the dissemination stage. The 4-D stages can be seen in Figure 1 below.
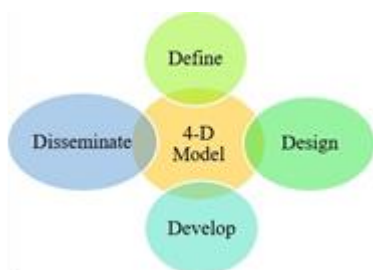
Figure 1.4D Stages of the development model

The study is conducted for corossion lesson in SMA N 1 Batang Natal. The subjects are the students of SMA N 1 Batang Natal. The define stage is the stage that aims to determine the initial conditions of learning being developed. The design stage is the preparation for the instructional media. The developments stage aims to test instructional media and to validate the product. And then, the dissemination stage is not include due to some term and condition. The validation is carried out by 3 experts form Postgraduate students of chemistry department in Universitas Negeri Padang. The practicality test was conducted in SMA N 1 Batang Natal.. The questionnaire for the assessment of the validity and practicality tests used was arranged based on a Likert scale as in Table 1.

Table 1.Likert Scale

Likert scale	Assessment
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

The data obtained from the validity and practicality test results were analyzed by means of the Aiken's V (V) index item validity and formulated as follows:

$$V = \frac{\Sigma s}{n(c-l)}$$

$$S = r - lo$$

Information :

Lo = the lowest number of validity assessments (for example 1)

c = the highest number of validity assessments (eg 5)

r = number given by the assessor

Table 2. Decisions Based on Index *Aiken's V* (V)

Interval	Category
≤ 0.4	Less
$0.4 < V \leq 0.8$	Moderate
$0.8 < V$	Valid

The higher the number V (close to 1 or equal to 1), the higher the validity value of an item / item will be, and the lower the number V (close to 0 or equal to 0) then the value the validity of an item / item is also getting lower

III.   RESULT AND DISCUSSION
3.1   Define Stage
Definition stage is a stage that aims to determine the initial conditions of learning being developed. Data that obtained from this stage are:

3.1.1.   Front-end Analysis
Front end analysis was conducted to know what problems are being done by students and teachers in the learning process especially in corrosion topic. Based on the result of the quistionnaire that anwer by students and teachers, students are difficult to understand the corrosion topics because their leck of attractiveness in chemistry lesson and difficult to memorizing the lesson and the concept. The students are less knowledge about e- learning too.

3.1.2. Student Analysis

Based on the result of student analysis, most of the student like to study using visually attractive media, like power point slide, animation video, etc. So, the researcher decide to used project based learning in this study.

3.1.3. Task Analysis

Task analysis was carried out to determine Competency Achievement Indicators (GPA) by analyzing Basic Competency (KD) 3.11 class XI in the 2013 revised curriculum.

3.1.4. Concept Analysis

This analysis used to determine the concept that must be done for corossion lesson..

3.1.5. Learning Objectives Analysis

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

3.2 Design Stage

At this stage, the e-learning product was being designed. The e-learning was build in moodle. The researcher used Zainulteam.id LMS software to produce the e-learning. The e-learning is consisted 5 section and build for 1 topic meeting. There are welcoming page that consist of guide and information about e-learning for teacher and students. Then, the introduction page that consist ofstudy plan draft, the aim of the lesson, attendance and meeting link. The next page is learning resource that consist any source of the topic like textbook and video [21]. The learning activities page is for working space for the students in form of worsheeet. And the last is developer profile that serving the data of the e-learning developer. The elearning design display can be seen in thefollowing Figure.
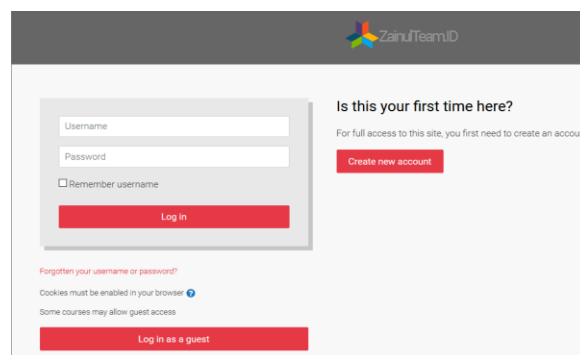

Figure 1. Login To E-learrnig ZainulTeam.id

Figure 2. Home on E-Learning

In this e-learning there are 6 section that fill with different content. The first section is Introduction section. The introduction section is a section that containt the goal of the learning process and there is an attendance for the students too. In this section there are information and guidance for teacher and students about how touse the e-learning. This section is served a lesson plan that contain indicator and goal of the lesson. The second

section is, learning resource. In this section, there are lesson source that reserve in document in mic. Word, pdf document, and some source are from website and blog. This source are given in different form to make students more easily understand the lesson.

The tird section are learning activities. In this section, students are conduct to do some activitied related to corrosion topic. This activities based on learning model project-based learning [22]. The next section is discussion forum. In the discussion forum section, students are push to active in discussing with each other and with the teacher, so that every students will understand what are the topic about. And then, there are task section. In this section there are some worksheet for the students [23]. So, the students can do exercise and work on some question thah has given in that worksheet.

The last section is developer profile. In this section, profile of the developer of e-learning is served. This section will make the students and the teacher easily to contact the developer if there are any problems [24][25]. The display of each section are shows below.
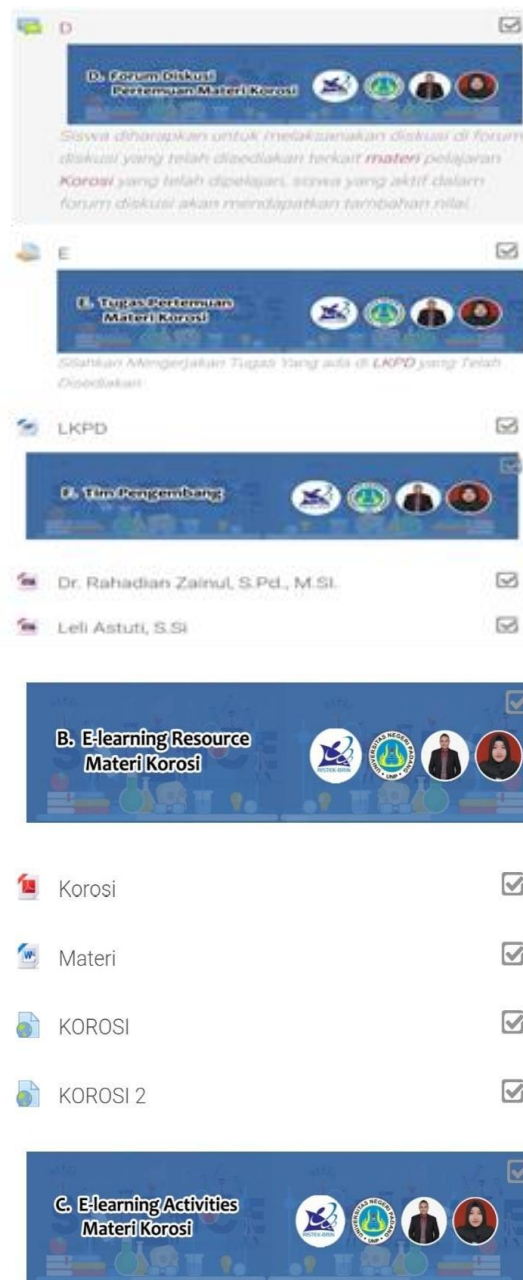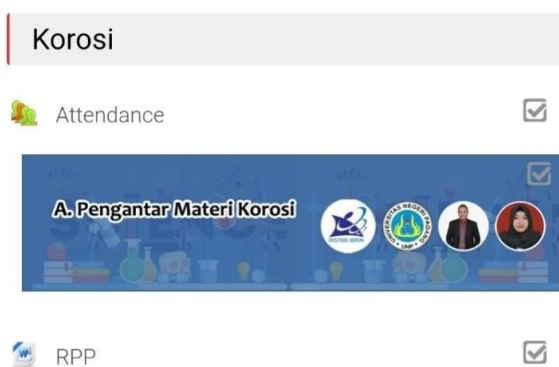

Figure 3. E-learning content

3.3 Development Stage (Develop)
3.3.1 Validatity Test

The validity test is done for content and construct validity. The validity test wa conducted by the experts. In the content validity, there are 3 major components that will be validate [26][27]. The first component is Guide and information, this components show the average result of V about 0.833, it means this component is valid. The average result of V for material content is 0.838 and for evaluation is 0.84. From the validity test, the result show that the content of the e-learning are valid. The graph of the construction validity are shos below.

Figure 5. Graph of Content Validation Result

In the construct validity, there are 3 major components that will be validate [28]. The first component is guide and information, which the V average result is 0.796. For the program performance the v result is 0.83 and in the design principles shows 0.777 of v result. From the result, it shows that contruction of the e-learning are valid. The graph of the construction validity are shows below
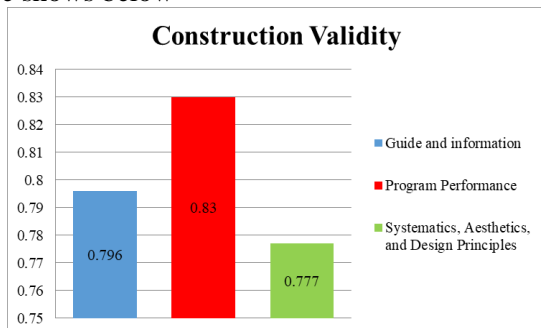
Figure 6. Graph of Construct Validation Result

Elearning that has been validated by the validator is then made some improvements based on suggestions from the validator to support elearning perfection [29][30].

IV.   CONCLUSION

E-Learning material corrosion based on project base learning (pjbl) with shortened flipped classrooms in SMA / MA has been produced. V value of content validity is categorized valid. V value of construct validity is categorized valid too. The result conclude that the products have high validity and can be used for Senior High School Students.

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