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Article

The Validity of E-Learning Chemistry Learning in SMA/MA Project Based Learning on Hydrocarbons Using the Flipped Classroom Approach in Class XI Senior High School

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Abstract— This research has been carried out until the validity stage by producing an e-learning based on PjBL (Project Based Learning) on Hydrocarbons by applying the flipped classroo m approach in the learning process. The type of this research is Research and Development (R&D), with a 4-D model stage is: (1) define, (2) design, (3) develop, and the last is (4) disseminate. The products produced from the study were validated by 1 Chemistry lecturer of Faculty of Mathematics and Natural Sciences UNP and 1 chemistry teacher at MAN 2 Pesisir Selatan, and continued at the revision stage based on input from the validator. The analysis of the validity test was carried out using the Cohen kappa formula. The mean Cohhen kappa results from construct and content validation were 0.811 and 0.844 with very high categories. Based on these results, the resulting e-Learning is valid and practice to use in the learning process.

Keywords— ***E-Learning, PjBL, Hydrocarbons, Flipped Classroom***

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I. INTRODUCTION

COVID-19 as a global pandemic based on the 2020 World Health Organization (WHO) press release has affected various aspects of human life, one of which is in the field of education. Ministry of Education and Culture circular said at the letter number 4 of 2020 on the kemendikbud.go.id website, the learning process is carried out online/remotely at each student's home. Based on this, innovation in the field of education is needed to support the student learning process. Teachers must be able to adjust the learning methods and models to be applied. One model that can be applied is the project-based learning model (PjBL) and blended learning by applying the flipped classroom (FC) method. The Covid-19 pandemic has spread 215 countries in this world. This is a challenge in itself for educational institutions in implementing learning. Learn

from home, work at home, and worship at home [1]. The issuance of a policy to be able to conduct online learning [2]. Therefore, teachers are not only required to be experts in learning offline process orr face to face but teacher have to expert an online learning system too.

Online learning, which is commonly known as E-learning, is following the development of digital technology in century 21, which has new method for learning problems during Covid-19 era. Emphasized that digital technology is the thing that most influences the education system in the world today. This is due to the aspects of effectiveness, efficiency, and attractiveness offered by digital technology-based learning [3].

E-learning is utilizes technological media such as the internet, interactive tv, audio videotapes, CD-ROMs to send learning materials [4]. E-learning is a system that is expected to replace conventional learning methods and materials and add new innovative methods and strategies in learning process. The application of e-learning is a new medium that can overcome passive attitudes, increase learning enthusiasm allow direct interaction, and allow students to learn independently [5]. This learning is considered to have a high-efficiency value because it can be accessed anytime and anywhere and provides new experiences to increase skills in utilizing technology [6]. Teaching and learning process using e-learning based on the Moodle application makes it easy to learning process in the classroom [7,36]. traditional classroom activities such as listening to lectures in class should be transferred into video form so that students can learn the subject matter by watching the teaching videos not only in class. Transferring conventional lectures into video form will make it easier for students to repeat the explanations in the video according to their needs [8,35].

PjBL is a learning model that designs a project and engineering processes in a lesson. The syntax is as follows: (1) presentation of the problem; (2) planning; (3) scheduling; (4) Project creation; (5) implementation of the assessment; (6) evaluation [9] Blended Learning has the following stages, (1) Seeking information, (2) Acquisition of information, (3) Synthesizing of Knowledge [10]. Flipped Classroom (FC) is a learning process that is reversed [11]. The learning phase begins with understanding the learning material outside the next class, applying and evaluating the concepts learned in the learning process of face to face[12]

The application of FC in learning in e-learning begins with the first stage of blended learning, namely Seeking of information which is carried out outside the classroom (at home), in the second stage of Acquisition of infotmation, by applying the PjBlL syntax in it, namely at the stage, (1) presentation of the problem, (2) planning, (3) preparing a schedule. The last stage of Synthesizing of knowledge is carried out in the classroom by applying the PjBL syntax, namely, (4) project creation, (5) implementation of assessment, (6) evaluation. The learning process with e-learning is very valid so this system are recomended to used in learning online system [13,35]. One of them will be applied to hydrocarbon material.

The 2013 curriculum demands that the learning process be carried out with a scientific approach and is student centered. One of the learning models in accordance with the demands of the 2013 Indonesia curriculum is the project based learning. Project based learning learning model have six cycles or procesed, the first one is stimulation, second is problem identification, data collection, data processing, verification and the last is generalization. These procesed

emphasize student-oriented critical thinking processes.

According to the New Media Consortium (NMC) report, which annually releases the latest technology in the world of education, flipped classroom learning is classified as the latest innovation medium and is highly recommended for higher education throughout the world, aiming to build students' individual learning skills, teaching and critical thinking [14,37]. In research stated that the flipped classroom method has been applied all over the world both in schools for various fields of study [15]. By combining the learning approach, the technology base used, and the appropriate learning model, it will be very supportive of the 2013 curriculum learning process, which requires students to be more active and more able to learn independently to be used in learning process. Learning with e-learning can increase student learning outcomes, increase student learning motivation, and have a high level of validity and practicality [16, 17, 18].

The results after observations, we conclude that: 1) students were not accustomed to using teaching with daring system, 2) the hardest part of experienced by students in the Hydrocarbons were in understanding the concept and still learning by memorizing.

Based on the explanation above, the writer is interested in developing project based learning based on Flipped Classroom on Hydrocarbons. From the research we carried out related to "The validity of e-learning in SMA/MA Chemistry Learning Based on Project Based Learning on Hydrocarbons with the Flipped Classroom Approach in SMA class XI".

II. METHODE

This reasearch uses a development research type. The development model this research based on 4-D (four-D) development model which consists of 4 process, the first is define, design, develop and the last is disseminate [25]. The research subjects consisted of postgraduate students of Chemistry Education at Padang State University. The defining stage is composed of a series analysis process of front-end, student, task, concept and the last is learning objectives analysis. This stage aims to determine and define the conditions that must be met in learning based on Basic Competence (KD) in the revised 2013 Curriculum. The design stage aims to design teaching materials in the form of project based learning based e-learning based on the material and learning objectives that have been defined at the define procesed. At this stage, e-learning is designed based on the syntax in the project based learning model and in accordance with the module components based on a combination of the Ministry of National Education [19]. The type of this research applied in this research is R & D by producing a product [9] in the form of "E-learning Chemistry Learning for SMA / MA Project Based Learning on Hydrocarbons with the Flipped Classroom Approach in SMA class XI". The research was carried out based on the stages of the development model, 4-D (four D models) consisting of 4 Process or stage: (1) Define; (2) Design; (3) Develope; and (4) Dissiminate.

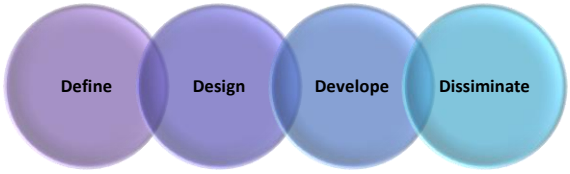

Figure 1. Stages of the 4-D development model

The define stage is carried out to analyze the difficulties and constraints experienced in learning, based on alaysis of the front end process, student analysis process, task analysis process, concept analysis, and the last is formulation of learning objectives. The design

stage is the stage which aims to design "E-learning Chemistry Learning for SMA / MA Project Based Learning on Hydrocarbons with the Flipped Classroom Approach in SMA class XI"

The develop stage aims to produce and test the validity and practicality of a product that has been designed. At this stage, three processes are carried out, namely, product validity testing, product revision of validation results, and product practicality testing.

Furthermore, the assessment phase (assessment phase) was carried out with a field test to determine the practicality of the module. Data validation and practicalitywhich are considered validators and students in practicality will be analyzed using the Kappa Cohen formula below

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

k = value of the kappa moment

ρ_o = proportion realized

ρ_e = unrealized proportion

The questionnaire for the assessment of the validity and practicality tests used was arranged based on a Kappa Cohen as in Table 1.

Table 1. Category Kappa Cohen

Interval	Category
<0.00	Invalid
0.00 - 0.20	Very low
0.21 - 0.40	Low
0.41 - 0.60	Moderate
0.61 - 0.80	High
0.81 - 1.00	Very high

III. RESULT AND DISCUSSION

The research was conducted using the R&D (Research and Development) method using a 4-D development model consisting of define, design, develop and disseminate [20]. The product that has been produced is "E-learning for Chemistry Learning for SMA / MA based on Project Based Learning on Hydrocarbons with the Flipped Classroom Approach in Class XI Senior High School" which has been valid. Validity was carried out by 1 chemistry lecturer of Faculty of Mathematics and Natural Sciences UNP and 1 teacher of MAN 2 Pesisir Selatan then continued with revisions to the product, as well as practicality tests by high school chemistry teachers and students of class XI IPA MAN 2 Pesisir Selatan. The overall research results were obtained in the form of.

3.1 Define Stage (Definition)

At the define stage, 5 data are obtained in the form of:

3.1.1. Front End Analysis

The results of analysis were obtained from interviews with several teachers and some students through an interview questionnaire. Followed by direct observation by researchers.

3.1.2. Student Analysis

Through the analysis that has been carried out on students, it was found that online learning through the provision of material and assignments has a saturated effect on students in learning, then causes students to not understand the material well, as well as a lack of enthusiasm for students in learning.

3.1.3. Task Analysis

Task analysis is carried out by analyzing KD (Basic Competence), then reducing it to GPA (Competency Achievement Index), and learning objectives are required to be achieved by students in the learning process. The basic competencies for Hydrocarbons consist of: 3.1. Analyzing the structure and properties of hydrocarbon compounds and the specificity of carbon atoms and their compound groups; 4.1. Visually create various hydrocarbon molecular structures that have the same molecular formula; 4.4. These KDs are downgraded to several GPAs

3.1.4. Concept Analysis

This stage results in; (1) Analysis of the material obtained based on the dimensions of knowledge in the form of facts, concepts, principles and procedures; (2) Concept analysis, which is divided into concept labels, concept definitions, concept attributes, concept hierarchies, types of concepts, examples, and non-examples until they are compiled into a concept map.

3.1.5. Formulation of Learning Objectives

Learning objectives on Hydrocarbons are formulated based on indicators and minimum competencies that must be achieved by students.

3.2 Design Stage (Design)

As for the design stage, an e-learning learning and learning is produced as follows:

and the design stage, an e-learning learning and learning guide book with e-learning is produced as follows,

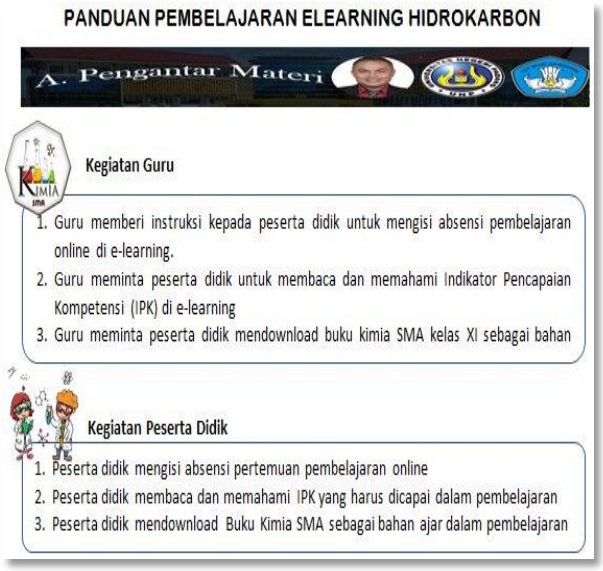

Figure 3. Learning guide with e-learning

3.3. Define Stage

3.3.1. Validity test

The implementation of the validity test is in the form of content validity and construct validity [21,31,32]. This test was carried out by 1 chemistry lecturer of Faculty of Mathematics and Natural Sciences UNP and 1 chemistry teacher at MAN 2 Pesisir Selatan based on expert opinion (expert judgment) with a minimum number of 2 people [9]. Based on this assessment, data processing was carried out using the Cohen kappa formula. "Information can be seen in Figure 1".

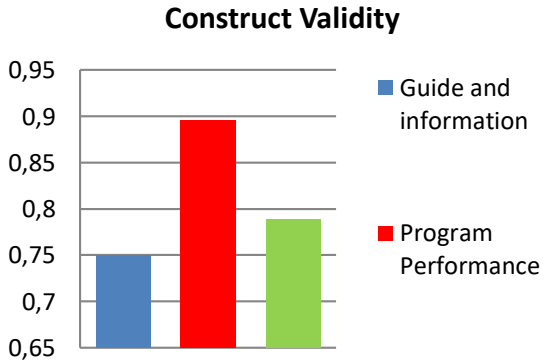

Figure 4. Graph of Validity Test Results

Based on the graph above, it is obtained that the average kappa moment in each component is 0.75 with a high category, in the guide and information components 0.896 with a very high category, in the elearning material component of 0.788 with a very high category. Then the results of the Kappa moment are 0.811 with a very high category. The resulting kappa value means that the STEM-PjBL integrated hydrocarbon LKPD has adjusted to the demands of the 2013 revised 2018 curriculum. So that the LKPD is declared valid because it has adjusted to the demands of the curriculum.

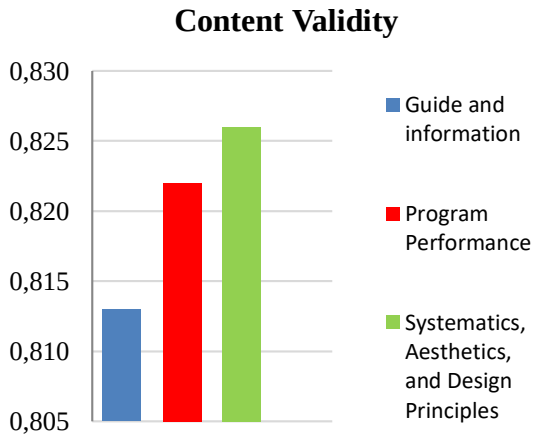

Figure 5.Graph of Content Validity Test Results

Based on the graph above, the average kappa moment for each component is 0.796 in the high category of guidance and information components. 0.942 for the content component / e-learning material with a very high category, 0.913 for the evaluation component with a very high category. Based on these three components, the average value of the momment kappa for content validity is 0.884 with a very high category. The aspect of content feasibility includes the suitability of the material contained in a content with KI, KD and the learning objectives provided depend on students' abilities [22,33,34]. This is following the provisions of the facilities that e-learning must-have, which must be able to build new insights and techniques related to learning objectives and also following the principles of making e-learning, namely subject matter that is delivered systematically and according to applicable standards general [22, 23,24,25].

3.3.2. Prakticality

The practicality of the e-learning being developed can be seen in the use of the product based on the results of limited trials in the field. The practicality test was carried out on 1 chemistry teacher at MAN 2 Pesisir Selatan and 10 students. E-learning that is made must also have high learning flexibility (can be used repeatedly) to handle the needs of students [26,27,28]. The learning process with e-learning can increase student learning outcomes, increase student learning motivation, and have a high level of validity and practicality [16,29,30] Information can be seen in Figure 5

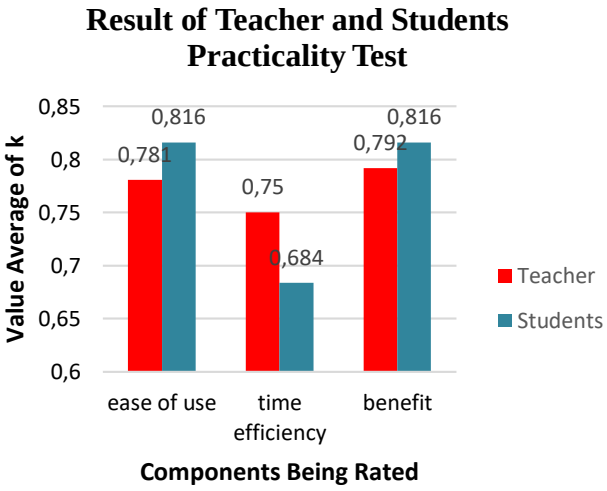

Figure 6. Graph of Teacher Practicality test and student

Based on the graphic above, the practicality test results from the teacher and students are illustrated for each component of the assessment. The average value of the teacher's practicality was 0.774 with the high practicality category, and the student's score was 0.772 with the high category. This shows that the

developed e-learning learning is practical for use in learning.

IV. CONCLUSION

E-learning based on Project Based Learning on Hydrocarbons using the Flipped Classroom Approach in Class XI SMA/MA produced in this development research has content and construct validity levels of 0.811 and content validity 0.84, respectively, with very high scores. The practicality test results from the teacher and students was 0.774 with the high practicality category, and the student's score was 0.772 with the high category. So, e-learning learning content based on Project Based Learning on Hydrocarbons using the Flipped Classroom Approach in Class XI SMA/MA produced is valid and practical for use in the learning process.

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