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Article

The Validity and Practicality of E-Learning Based on PjBL (Project Based Learning) Model for Thermochemistry Material with Flipped Classroom For Learning on Covid-19 Pandemic

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Abstract— Learning using e-learning with a blended learning model using the flipped classroom method is one of the learning systems suitable for use during the Covid-19 pandemic. This research has been carried out until the validity stage by producing an e-learning based on Project Based Learning (PjBL) on Thermochemistry material by applying the flipped classroom approach in the learning process. The type of research is R&D (Research and Development), with a 4-D model consisting of: (1) define, (2) design, (3) develop, and (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, and the next step practicalited by teacher and students MAN 2 Pesisir Selatan in learning. The analysis of the validity test was carried out using the kappa Cohen formula. Then obtained the kappa value of content validity is 0.884 and construct validity is 0.869 with very high categories for both, and than practicality of teacher and students is 0,774 and 0,771 with very high categories for both. Based on this, have produced a valid and parctical e-learning to can be use in the learning process.

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

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I. INTRODUCTION

The presence of Covid-19 virus (Corona virus disease) have caused problems, one of which is education field. The problems that arise are in the learning process that has changed significantly according to government recommendations by implementing online learning [4].

E-learning is divided into two words, namely "e" stands for "electronics" and

"learning" [14]. Learning with E-Learning is a flexible way of learning, because between teachers and students can access E-Learning media without being hindered by time and place to learn[15]. The learning process carried out through e-learning is very valid for use in chemistry learning [1].

Blended learning is an effective and efficient model to use during a pandemic. This model harmoniously combines online-based learning and offline learning [11]. In its implementation, the blended learning model implements the following learning stages: (1) Seeking of information, (2) Acquisition of infotmation, (3) Synthesizing of knowledge [5].

Flipped Classroom (FC) is basically a reverse learning process [2] where, the learning stage begins with understanding learning material outside the classroom (at home) and the next stage, applying and evaluating the concepts learned at the process of learning in class [3]. According to Sinaga, learning with the flipped classroom provides an increase in student self-regulated learning in Basic Chemistry courses in the experimental class [16].

The application 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 integrating the PjBL stages [6] therein, namely at the stage (1) presentation of the problem; (2) planning; (3) scheduling. The final stage is Synthesizing of knowledge, carried out in the class with the integration of the PjBL [6] stages in the form of (4) project creation; (5) implementation of the assessment; (6) evaluation [6]. PjBL is a learning model that is able to improve students' creative thinking skills [13]. Learning with the PjBL model is able to focus students on a number of problems that trigger motivation, and encourage students to face the basic concepts and principles of knowledge directly as an experience [10].

One of them will be applied to Thermochemical materials. According to Syafe'i, thermochemistry is one of the materials considered difficult for students to understand and less interesting to study because it contains complex calculations and formulas [17].

Based on this, research was carried out related to "The Validity and Practicallity of E-Learning based on PjBL model for Thermochemiatry Material with Flipped Classroom Approach for Learning on Covid-19 Pandemic".

II. METHOD

The type of research applied in this research is R & D by producing a product [7] in the form of "SMA / MA Chemistry Learning E-learning Based on Project Based Learning on Thermochemical Materials with the Flipped Classroom Approach in SMA class XI". The research was conducted based on the development stages of the 4-D model (four D models) which were limited to the third stage, namely: (1) the Define stage; (2) Design stage; and (3) Develop stage [8].

The define stage is carried out to analyze the difficulties and constraints experienced in learning, based on the the stage of front end analysis, stage of student analysis, stage of task analysis, stage of concept analysis, and stage of 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 Thermochemical Materials 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 practicality.

The instruments used in this study were validation and questionnaire of practicality test, and the results of the analysis were processed using Cohen's kappa formula:

$$kappa\ Cohens's\ (k) = \frac{\rho_o - \rho_e}{1 - \rho_o}$$

k = value of kappa moment

ρ_o = realized proportion

ρ_e = unrealized proportions

Table 1. Categories of Decisions based on Kappa Moments (k)

Interval	Kategori
< 0,00	Valid
0,00 – 0,20	Invalid
0,21 – 0,40	Low
0,41 – 0,60	Medium
0,61 – 0,80	High
0,81 – 1,00	Very High

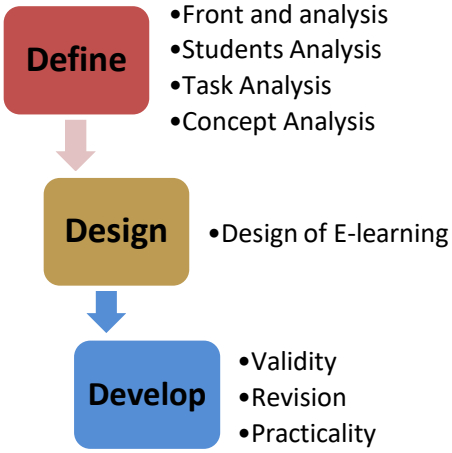

Fig 1. 4D stage Method

III. RESULTS 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 [8]. The product that has been produced is in the form of "E-learning Chemistry Learning SMA / MA Based on Project Based Learning on Thermochemical Materials with the Flipped Classroom Approach in SMA class XI" which has been valid. The validity was carried out by 1 chemistry lecturer of Faculty of Mathematics and Natural Sciences UNP and 1 chemistry teacher at MAN 2 Pesisir Selatan then continued with the revision stage of the product. The overall research results were obtained in the form of:

Define Stage

The define stage are obtained 5 datas form of:

3.1.1. Front End Analysis

The analysis results were obtained based of debriefing with several teachers (teachers), and students through interview questionnaires. Followed by direct observation by researchers.

3.1.2. Students Analysis

Through the analysis has been carried out on students, it was found that online learning with the method of providing material links 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. Taks Analysis

Task analysis is carried out by analyzing KD (Basic Competence), then reducing it to GPA (Competency Achievement Index), and objectives learning are required to be achieved by students in learning. The basic competencies for Thermochemistry consist of: 3.4. Describe the concept of enthalpy change for a reaction at fixed pressure in the Thermochemical equation; 3.5. Describe the enthalpy types of reactions, Hess's law and the concept of bond energies; 4.4. Conclude the results of the analysis of thermochemical experimental data at constant pressure; 4.5. Comparing the enthalpy changes of several reactions based on experimental data. The KD is downgraded to several GPAs, and porpose of learning.

3.1.4. Concept Analysis

This stage results in; (1) Analysis of the material obtained based on the dimensions of knowledge is 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. Learning objectives Formulation

The learning objectives in Thermochemistry material are formulated based

on the minimum indicators and competencies that must be achieved by students.

Design Stage

The design stage is carried out with the aim of being the initial planning regarding the media and learning equipment that will be developed related to the results of interviews that have been conducted at the scheming stage (define) [12].

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

Fig 2. E-learning display

Fig 3. Learning guide with e-learning

Develop Stage

3.3.1. Validity Test

The implementation of the validity test is in the form of validity content and validity construct [9].

In assessing the validity of content, there are 6 principles that must be considered in the form of proximity of space, proximity of time, modality, redundancy, coherence, and individual differences [18]. In assessing the validity of content, there are 6 principles that must be considered in the form of proximity of space, proximity of time, modality, redundancy, coherence, and individual differences [19].

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 [7]. Based on this assessment, data processing was carried out using the Cohen kappa formula. Then the results obtained from the validity of the content can be seen in "Fig 4"

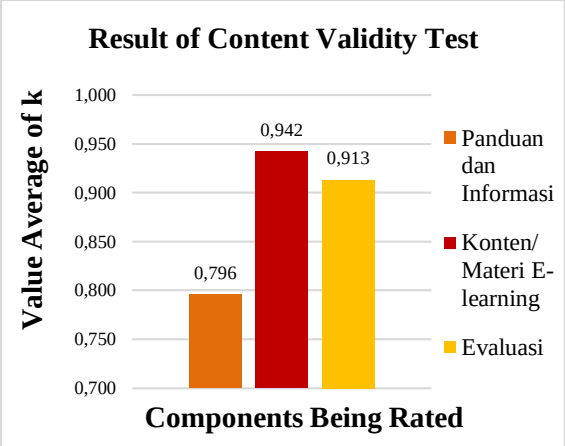

Fig 4. Graph of Content Validity Test Results

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 resulting kappa value shows that the e-learning developed is in appropriate with claim of the 2013 revised 2018 curriculum and has been adapted to the learning system during Covid-19 and according to the demands of the digitalization era 4.0.

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 student's abilities. This is following the provisions of the facillities that e-learning must have, which must be able to build new insights and techniques related to learning objectives and also following the principples of making e-learning, namely subject matter that is deliveres systematically and according to applicable standards genera [20, 21].

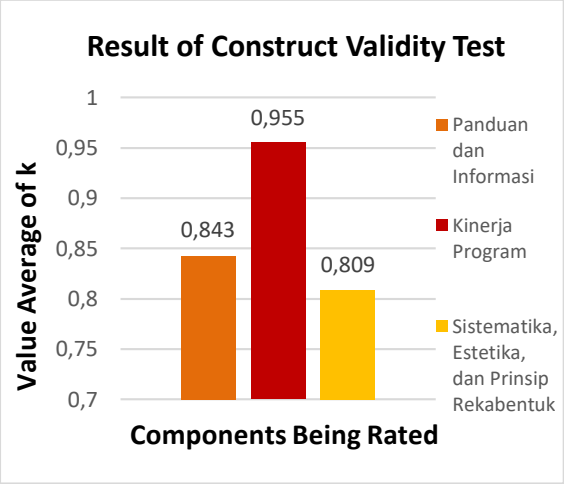

Fig 5. Graph of Construct Validity Test Results

Based on the graph above, the average kappa moment for each component is 0.843 for the guidance and information components with a very high category, 0.955 for the program performance component with a very high category, 0.809 for the systematics, aesthetic and design principles components with a high category. Based on these three components, the average value of the momment kappa for the construct validity is 0.869 with a very high category. The resulting kappa value shows that the e-learning developed is in appropriate with claim of the 2013 revised 2018 curriculum and has been adapted to the learning system during Covid-19 and according to the demands of the digitalization era 4.0.

3.3.2. Revision

The revision was made based on suggestions from 2 validators. The suggested revisions, namely:

1) Replacing learning procedures with blended learning procedures

Before Revision

After Revision

2) Change in the layout of understanding the material from the Learning activities stage to the Acquisition of Information
3) Adding descriptions and improving learning syntax in the learning characteristics section..

3.3.3. Practicality

The practicality of an 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 made must also have high learning flexibelity to handle the needs of students[22]. The learning process with e-learning can increase student learning, motivation, and have a high level of validity and practicality [23]. Information can be seen in Fig.6.

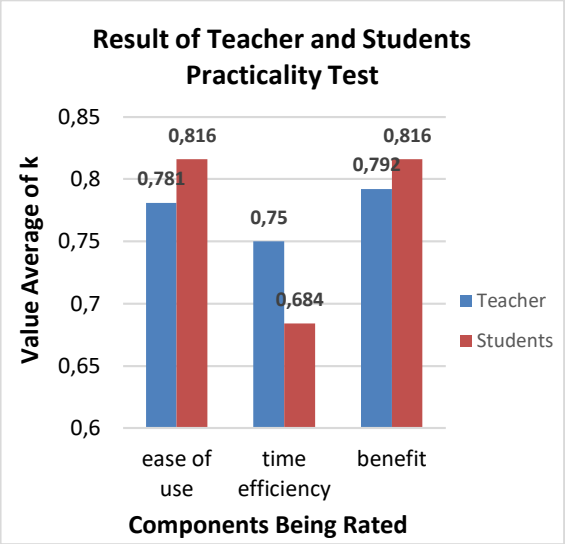

Fig 6. Graph of Practicality test of Teacher and students

Based on the graphic above, the results of the practicality test from teachers and students are illustrated in each component of the assessment. The average value of the practicality of the teacher is 0.774 with the high practicality category, and that of the students is 0.772 with the high category. This shows that the e-learning learning developed is practical for use in learning.

IV. CONCLUSION

The result of content construct validity is 0.884 and 0,869 with a very high category. Than the average value of the practicality of the teacher and students is 0.774 and 0.772 with the high category. This shows that the developed of e-learning based on Project Based Learning (PjBL) on Thermochemical material by applying the flipped classroom approach is valid and practical, so that it can be used in the learning process.

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