

*Article***Development Content Learning System in Acid Base Solution Using Flipped Classroom at Senior High School****Elvina Gusman¹, Fadila Gusman^{*2}, Wirasyid Hafizul Lathief³**¹Art and Humanities Faculty, English Education, Central Queensland University Australia²Department of Chemical Education, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, Sumatera Barat, Indonesia³Department of Mathematic education, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, Sumatera Barat, Indonesia
email: fdilagusman@gmail.com

Abstract —This research was conducted on developing an e-learning content using the Flipped Classroom application in chemistry subjects which is Acid base solution. The method of this research applied Research and Development (R and D) that use the 4-D model with the stages of define, design, develop and disseminate. In designing this research, the author applied Thiagarajan (4D) model. In this model, 4D means define, design, develop, and disseminate. Populations in this research are students from Senior High School in West Sumatera, Indonesia. There are 10 students of SMA N 1 Rambatan, in 11 class level as respondents for developing this product. The data sources of this study were 3 chemistry and student and teacher in Rambatan. This study applied content validity questioner as an instrument. were a content validity questionnaire, construct validity and a practicality questionnaire. This research focus on the develop stage. To analyses the data, the 4D technique is used to process the numbers of questionnaire that have been obtained from the measurement results of the questionnaire data obtained from calculations using the Aiken's V formula and a Likert scale.. The data analysis results show that the mean of Aiken's V formula and a Likert scale of content validity is 0.832 and construct validity is 0.847 with high and very high validity categories.

Keywords— *E-Learning, Acid Base Solution, Project Based Learning, Flipped Classroom*

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**I. INTRODUCTION**

The spread of 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 the aspects is education. Based on the Ministry of Education and Culture circular letter number 4 of 2020 on the kemendikbud.go.id website, the learning process is carried out online or remotely at student's home. Learning in the end inevitably takes place at home, but not with the arrival of the teacher to teach at students' homes but with online media [1]. Activities in schools are

focused on being closed by the system, with a learning-based learning system from home to avoid the spread of this virus. Starting from giving daily assignment, attendance, examination carried out online [2]. Based on this explanation, innovation in the field of education is needed to improve the process of student learning. The innovation that can be done is by improving the teaching materials used, one of which is the development of materials in e-teaching learning such as electronic or e-learning modules. E-learning which includes audio, video, animation and navigation are the

forms of implementation of student learning resources independently so that it can improve student competence and understanding which is displayed in electronic format [3][4]. E-learning can encourage students' ability in increasing self-confidence to take an active role, as well as be brave and confident in expressing opinions in the process of learning [6][8].

E-learning is learning that utilizes technological media such as the internet, interactive TV, audio videotapes, CDs to send learning materials anywhere and anytime [1]. The e-learning application is a current medium which may solve the passive attitudes, increase learning enthusiasm, allow direct interaction, and allow students to learn independently [11]. 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 [13]. Teaching and learning process using e-learning based on the Flipped Classroom application makes it is easy for students and teachers who teach in the process of learning particularly in the classroom [3].

E-learning can be an alternative way to support the development of IT in the 4.0. era or revolution of industry. The use of e-learning in the learning process has four benefits, namely obtaining personal learning experience, reducing costs, easily obtained and increasing responsible capabilities. In addition, to prepare students in using IT is when learning also prepares educators to face the era of Industrial Revolution 4.0. [11].

E-learning is also based on the Project Based Learning (PjBL) model, which is a learning model that emphasizes complex learning in which students play the main role replacing the teacher in problems solving and completing a given project[5][7]. Project Based Learning can increase students' motivation to learn, enhance pupils works, enhance pupil skills, practice and

develop skills in communication particularly in team working, provide opportunities for pupils to organize projects The use of this learning model includes the completion of a project by students whose final result is a product.[9] [10][11]

In learning media, there are also images that can be included so they can reduce student boredom while studying. The learning process in teaching e-learning based on Flipped Classroom applications makes it easy for students and teachers who do teaching and learning activity in the classroom (3).[14] The amount of features contained in Flipped Classroom approach in e-learning can be optimized to increase learning interest and student learning outcomes during classroom learning (2). Data obtained from teacher interviews and charging questions by students (1) Most students are still difficult to understand the acid base solution material, (2) Printing Books, *PPT* and *LKS* (student's worksheet) with a practicum guide is a teaching material used at school, (3) The lack of students' understanding in learning by using teaching materials used by the teacher.[16] Along with the development of technology and information, learning media is increasingly developed, both software and hardware learning media so that the role of teachers as a source of learning will be there are still land screw into facilitators.

Examples of learning that utilize technology and information is e-learning. The designation of e-learning is more suitable to be used to transform learning activities in schools today into digital forms associated with the use of information technology in the form of computer networks . In addition, the existence of teaching materials on the media can also help students increase creativity and learning outcomes [12]. This utilization of IT makes teacher priorities to form attitudes and characters than cognitive intelligence. The learning process with e-learning using Flipped Classroom can increase

student learning outcomes (2). The application media of e-learning can increase pupil studying motivation [14]. Flipped Classroom-based in E-Learning is categorized as a mean of learning that is valid and practical with a high level of validity and practicality. Based on these problems, researchers are interested in conducting research to develop e-learning media content using the Flipped Classroom application with the title Development Content Learning System in Acid Base Solution Using Flipped Classroom at Senior High School.

II. METHODS

This research carried out is a developmental research. This research has the goal of developing new products or improving existing products. The aim of this research and development is to develop new products. The design of this research used a development research method with a product such as e-learning with a flipped classroom approach on the development of acid base solution using the Moodle application. The Research and Development method is a research method used to produce certain products and test the effectiveness of these products. The research design used the Thiagarajan (4D) model. The 4D development model consists of 4 development stages, namely define, design, develop, and disseminate [17]. The 4D development stages are depicted in the following figure.

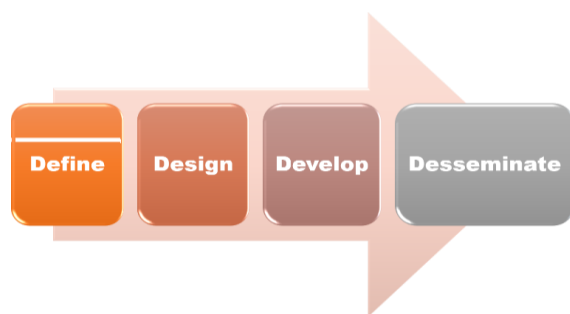


Figure1. Stages of the 4D Model

A practicality test cannot be done due to Covid-19 pandemic. The source of this research data is 3 Chemistry teacher, and students in SMA 1 Rambatan. The define stage (define) is carried out by determining and defining the requirements in learning.

The data analysis technique is to process the numbers that have been obtained from the measurement results of the questionnaire data to be used as an assessment of material experts and media experts. Furthermore, the data that has been obtained are analyzed to determine the feasibility of the media that has been made. The data obtained are in qualitative ways. It is in question form (assessment, criticism, and suggestions) from the experts. In this study, the research data were in the form of a percentage of the validity score. The percentage of validity is obtained from calculations using the following Aiken's V formula.

Description

- I_o = the lowest score of validity assessment
- c = the highest score of validity assessment
- r = the score given by the validator
- n = number of validators

The validity category according to *Aiken's V* is presented in Table 1.

Table 1. Validity category based on *Aiken's V*

<i>Aiken's V</i> scale	Validity
$V \leq 0,4$	Less valid
$0,4 \geq V \leq 0,8$	Current valid
$0,8 <$	Valid

The range of numbers V that may be obtained is between 0 to 1. 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 validity value of an item/item is also getting lower. Descriptively quantitatively is used to analyze the questionnaire sheets. Likers scale score is used to calculate the subject response data.

Description:

P: percentage of respondents' number of answers from the questionnaire
 f: the total score obtained
 N: total ideal score for all items.

The practicality category according to *Likert's scale* is presented in Table 2.

Table 2. Practicality category based on *Likert's scale*

<i>Aiken's V</i> scale	Practicality
$80\% < x \leq 100\%$	Very Practical
$60\% < x \leq 80\%$	Practical
$40\% < x \leq 60\%$	Practical enough
$20\% < x \leq 40\%$	Less practical
$0\% < x \leq 20\%$	Impractical

III. RESULT AND DISCUSSION

Based on the research that has been done, the results of each stage of the Thiagarajan (4D) development model have been carried out as follows. Validity testing is intended to be able to assess a product that has been designed. The validity of this e-learning is determined using an assessment questionnaire sheet that has been validated by three validators. This is based on the statement that to test the validation, three experts can use judgment. [13]

3.1. Defining Stage

3.1.1. Front end analysis

The front end analysis data came from interviews with chemistry teachers. Based on the results of interviews with chemistry teachers at SMAN 1 Rambatan, 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, PPT and learning videos, (3) lack of students understanding in learning use the teaching materials provided.

2) Student Analysis

The student analysis is carried out to determine and understand the characteristics of students in the learning process. Regarding to the results of the student analysis, it is known that the project based learning model can be applied into e modules to help students find concept. In addition, students tend to like teaching materials that contain animation, images, video and audio and with an attractive appearance.

3) Task Analysis

Task analysis was carried out to determine competency achievement indicators (GPA) by analyzing basic competency (KD) 3.10 class XI in the revised curriculum.

4) Concept Analysis

Concept analysis is carried out the determine the main concept needed in the acid base solution material by identifying the main concept being taught and arranging them in the form of a concept map.

5) Learning Objective Analysis

Regarding to the result 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

The activities carried out in this step, namely making designs on the preparation of e-learning acid base solution that will be developed. The e-learning arrangement was made using the Microsoft Power Point, YouTube, pic art.



Figure 2. Home Display on E-Learning

In addition, at the design stage there are also several other views such as learning meeting page views, student worksheet assessment views and student worksheets that have been prepared to do exercises as learning evaluation. The view is attached to Figure 2, Figure 3.

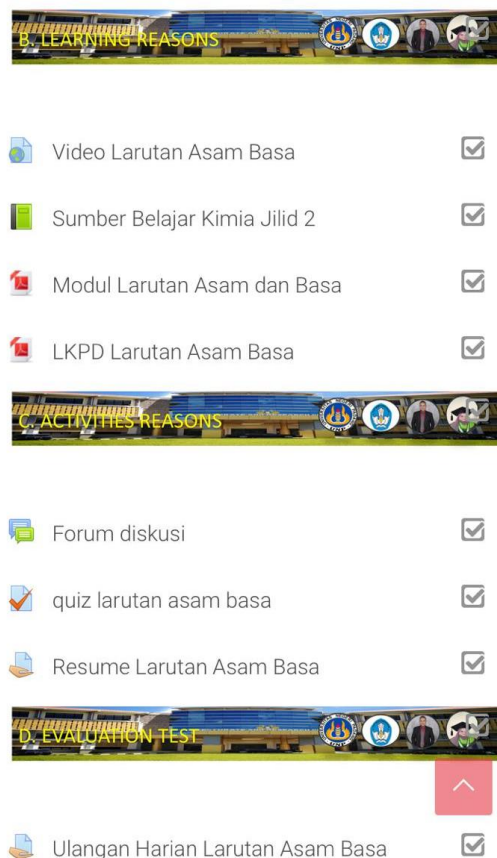


Figure 3. E Learning Content

3.3. Development Stage

3.3.1. Validation Test

The validity test is intended to be able to assess a product. There are two types of validation tests, namely the content validity test and the construct validity. The validation was carried out by 3 chemistry teachers. The content validity consists of a guide and information component, content / material on e-learning and evaluation. Construct validity also consists of three components, namely information guidance, program performance and systematics, aesthetics and design principles.

The e-learning content designed was assessed by a chemistry teacher. The assessment is based on the statement that testing the validation can use the opinion of experts (judgment experts) which number three people.

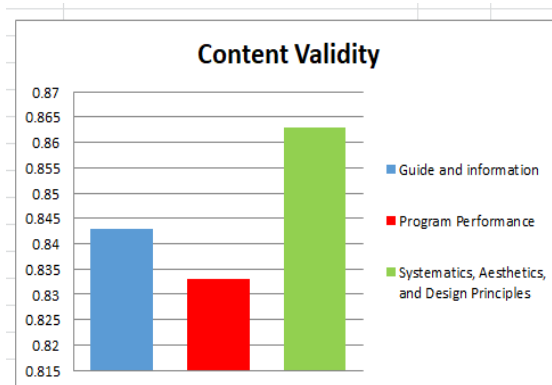


Figure 4. Graph of the Content

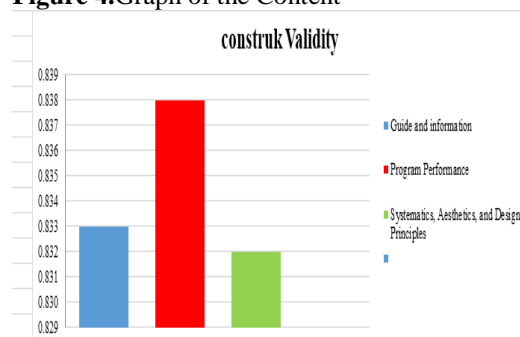


Figure 5. Graph of Construction

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 respectively, namely 0.847 and 0.832. The validation data results that the e-learning content for material development of acid base solution using the Moodle application is declared valid and in accordance with the components of the validity assessment. [19]

The guide and information components on content validation have an average k value of 0.843, including the very high category. This proves that the guides and information on e-learning have met the requirements for clarity and ease of understanding e-learning. The content/material component of e-learning has an average k value of 0.833, including the very high category. This value proves that the content on e-learning developed is in accordance with the demands of KD according to the 2013 revision of the 2018 curriculum. The aspect of

content feasibility includes the suitability of the material contained in content with KI, KD and the learning objectives provided depend on students' abilities [12].

The average k value of the evaluation section is 0.863 which is categorized as very high. In general, evaluation is a systematic process, which determines the value of something based on certain criteria through evaluation [9]. 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. [20]

With this average value, it illustrates that the evaluation of e-learning may measure the abilities of pupil. Next is construct validation. [21][22]The assessment was carried out by three chemistry teachers. The first component construct validation is a guide and information. The mean value of k is 0.847, including the very 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 0.847, including in the very high category.[23][24] This section covers program installation, user-friendliness and consistency in e-learning. The last component, namely systematics, aesthetics and design principles, received an average k value of 0.863, including the very high validity category. [25][26]

E-learning that is made interesting can motivate students to read learning material [4]. This is also supported by previous research.[27][28] 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.[29]

3.3.2. *Revision*

The revision stage is intended to be able to increase the part of e-learning content for the development of atomic theory using the Moodle application developed which is considered inappropriate before being tested. After the

revision is made, then it is given to the validator to be discussed again. The revision is complete if the e-learning content for the development of atomic theory using the Moodle application has been declared valid by the validator.

From the data analysis that has been carried out regarding PjBL based e-learning with the flipped classroom approach on the material of acid base solution development using the Moodle application, practical results are obtained of 0.83 with a very high category.[19] This shows that e-learning with the flipped classroom approach on the development of acid base solution uses the practical Moodle application for use in chemistry learning. It is hoped that this valid and practical PjBL-based e-learning media can increase the creativity of students supported by previous research.[22][30]

3.3.3. *Practicality*

Test The practicality test was carried out on 10 students at public high schools in Rambatan City. The practicality data of students who get an average score of 0.816 are included in the very high category. The practicality assessment by students as a whole is an indication of the use of e-learning that is delivered, language that is easy to understand, the storyline that is presented is easy to understand, can be used repeatedly, learning time is more efficient and effective, can increase memory, increase learning desire and make it easier students to study independently on acid base solution.[31] Pictures and experiments may assist pupil understanding the concept through the questions in the evaluation questions. E-learning that is made must also have high learning flexibility (can be used repeatedly) to handle student need [1]. The learning process with e-learning can improve student learning outcomes, increase student learning motivation, and have a high level of validity and practicality [8]. The student results of the student practicality analysis may be seen in Figure 6.[32]

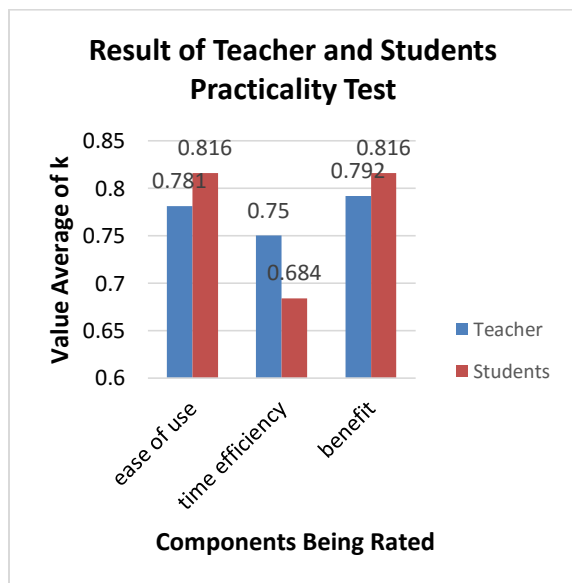


Figure 6. Graph of Teacher Practicality test and Student

IV. CONCLUSION

Regarding to the data analysis, e-learning content for the development of acid base solution using the Moodle application produced in this development research has content and construct validity levels of 0.89 and 0.87 respectively with very high categories and a level of practicality. Amounting to 0.83 in the very high category. Thus, it can be summarized that the content of e-learning for the development of acid base solution using the Moodle application on the material for the development of acid base solution is valid and practical.

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