

Article

Development of Guided Inquiry-Based Flipped Classroom Learning (FGIL) on Petroleum Materials with Moodle for Senior High School

Firmansyah Khairul Kamal^{1*}, Basultan Hidayat², M.Riski³

¹Magister Programme of Educational Chemistry, Postgraduate, Universitas Negeri Padang, Jl. Prof.Dr. Hamka, Air Tawar Barat, Padang Utara, Sumatera Barat, Indonesia.25171 Indonesia.

²Magister Program of Biotechnology, Postgraduate ,Hiroshima University, 1 Chome-3-2 Kagamiyama, Higashihiroshima, Hiroshima 739-8511, Jepang

³Agricultural Industrial Engineering, Vokasi Institut Pertanian Bogor, Jl. Kumbang, Babakan, Kecamatan Bogor Tengah, Kota Bogor, Jawa Barat, 16128, Indonesia

e-mail : firmansyahkhairulkamal119@gmail.com

Abstract— The advent of the Covid-19 pandemic has influenced many aspects of life, especially the world of education. One of them is the Senior High School level, which allows you to activate your learning system online. Therefore, information is needed in the form of a learning system called e-learning that can support learning activities. This study aims to develop a flipped classroom (FGIL) based on guided learning of petroleum materials using Moodle for Senior High School. This study is categorized as R & D with 4D development models. The e-learning products in this study were validated by 4 chemistry teachers, and validity and practicality test analysis were performed by 3 teachers and 10 students in SMAN 6 Padang using the VAiken formula. It was analyzed. Aiken's V-scores, obtained from the validity of the construct and the validity of the content, are 0.88 and 0.89, which is a high category. The results of practical relationships between students and teachers are in the high categories of 84.38 and 87.29, respectively. Based on the results of the data analysis, we can conclude that the content of e-learning is valid and practical to use in the learning process.

Keywords— **4D Model; Flipped Class Room; Moodle; GIL ; Petroleum Material**

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I. INTRODUCTION

The emergence of the Covid-19 pandemic has hit the world in various fields of life, especially in the world of education. One is the Senior High School level where the learning system can be switched to an online or distance learning system. Online learning (digitalization of learning) is essential because it is part of the characteristics of the Industrial Revolution 4.0 era and needs to be addressed and accepted by teachers [1].When implementing online learning, students are dissatisfied with the learning outcomes achieved,

such as the quality of learning and when and how they receive the learning provided. One of the most important factors in online learning. It is not easy for teachers to learn online, so we need a learning model that can adapt to the current situation and motivate students [2]. A learning model that uses technology and online learning is blended learning. Blended learning is a combination of classroom lessons and online learning [3].The blended learning model can be applied to improve the student learning experience. This allows students to use

technology to quickly enter the world of education and participate in the learning process, be it in class or distance learning [4]. In blended learning, there are learning methods that need to be considered. A good way is a synchronous and asynchronous learning system. This learning system is in the flipped classroom, which is one of the blended learning areas [5,6]. a Synchronous learning condition is a learning condition in which teachers and students study simultaneously, although they are in different locations of (synchronized online) [7]. Therefore, so that the learning process can take place actively, a learning platform media is used in the form of a Learning Management System that can support the learning process.

LMS is a web-based software application technology that is used to plan, implement, and evaluate a particular learning process. These learning management systems typically provide instructors/teachers with the ability to create and distribute content, monitor student participation, and assess student performance [8]. The LMS used are moodle and Google Meeting as application support [9,10].

Learning Platform Media can run well and require learning strategies. One that supports active learning with the 2013 curriculum is Guided Inquiry Learning (GIL). Guided inquiry learning (GIL) emphasizes students' thinking processes to answer suspicious questions, encourages students to study in groups, and looks for their resources to deepen and improve conceptual understanding. It is effective for learning [11]. The selection of the learning model must be based on the characteristics of the material. Petroleum materials are materials that contain dimensions of facts, concepts, and procedures. In addition, this material covers the macroscopic, ultramicroscopic, and symbolic levels that are difficult to reach [12,13]. After observing one high school in Padang, the conclusions are as follows: a) Students find it difficult because they are not used to using online learning systems. b) Students' interest in learning can be boring because too much material is stored. Based on previous research with student learning success in Flipped Classroom Learning,

students are more motivated to learn and have high validity and practicality scores [14,15,16]. Based on these problems, researchers are interested in researching the Development of Flipped Classroom Learning (FGIL) Based on Guided Inquiry on Petroleum Materials with Moodle for Senior High School.

II. METODE

The type of research used in this research is development research or research and development (R&D). According to Sogiono [17,18], "Development research is a study used to create a particular product and test the effectiveness of a product". The development model used in this study is a 4-D model developed in 1974 by Thiagarajan, Semmel and Semmel

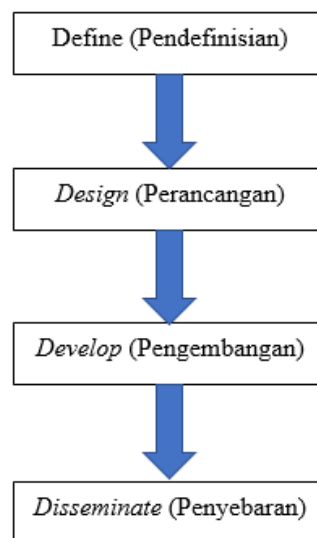


Figure 1. Stages of the 4-D development model

The Define stage is the stage to establish and define the learning requirements between the subject matter, the time of study, the location of the study. The Design Stage is the process of designing e-learning that will be developed. The Develop stage aims to produce product development through two stages, namely expert appraisal, and developmental testing. The Disseminate stage is the final stage of E-learning development that is used in disseminating products developed to accepted by users

[19,20,21]. Instruments used in the form of interview sheets, validation questionnaires, and practicality. Data analysis on validation using Aiken's V. Aiken's V formula as follows:

$$V = \frac{\sum s}{n(c-1)}$$

$$S = r - 1$$

Table 1. Validity based on Alken's V scale

Alken's V Scale	Validity Category
$V \leq 0,4$	Less
$0,4 \leq V \leq 0,8$	Medium
$0,8 < V$	Valid

III. RESULT AND DISCUSSION

The research was conducted using research and development (R&D) methods using a 4D development model consisting of definition, design, development and dissemination [22]. The resulting is in the form of "Development of Guided Inquiry-Based Flipped Classroom Learning (FGIL) on Petroleum Materials with Moodle for Senior High School" which is already valid. Validity is carried out by 4 chemistry teachers in then proceed with the product revision stage. The results of the study as a whole are:

A. Define Stage

- 1) **Front End Analysis:** The data in the analysis comes from filling out questionnaires by students and interviews with several teachers. In addition, researchers also make direct observations.
- 2) **Student Analysis:** In this analysis, the student who is subjected is the student of class XI of high school. In the student analysis, the researcher also conducted interviews with chemistry subject teachers and distributed questionnaires to students. Based on observations using questionnaires obtain that the students can already operate cellphones or laptops and also most of them have laptops and can already operate them. In addition, the facilities and infrastructure in the school are complete, such as the internet network used to access e-learning

3) **Task Analysis:** In this phase is carried out by identifying basic competencies and then reduced into indicators of competency achievement in accordance with the learning objectives carried out. The basic competencies of colloids is: 3.2 Explain the process of forming petroleum fractions, separation techniques, and their uses 4.2 Presenting works on the formation process and techniques for separating petroleum fractions and their uses.

4) **Concept Analysis:** Based on the concept analysis, it can be determined the properties of the concepts studied in petroleum materials. Concept analysis obtained concept analysis table. The main concepts of petroleum are the fraction of petroleum, the quality of gasoline, the impact of fuel, and how to overcome it.

5) **Analysis of Learning Objectives:** Petroleum learning objectives are formulated based on indicators of competency achievement that must be achieved by students.

B. Design Stage

The E-learning can be accessed via the link: <https://elearning.zainulteam.id>. When students have accessed the link, then they can create an account and log in as shown in Figure 2.

Figure 2. Login to Zainul Team E-learning (<https://elearning.zainulteam.id/>)

1) **E-learning Introductory Page:** At this stage, a petroleum e-learning design will be developed.



Figure 3. E-Learning Display (<https://elearning.zainulteam.id/>)

In this petroleum e-learning, there are three levels of learning that students must go through. The three steps are the introduction of petroleum materials, petroleum learning resources, and petroleum learning activities. This third part is so close that students need to understand it to achieve their learning goals.

The first stage is the introduction of the earth material, which is also called the orientation stage. At this stage students can fill out the attendance list, access the syllabus and read the introduction to petroleum materials. In addition, students will

also have access to the online learning meeting links provided at this stage.



Figure 4. Introduction to Petroleum Materials (<https://elearning.zainulteam.id/>)

2) **Learning Resources Page:** The second part is Petroleum learning resources. This section contains learning videos about Petroleum materials, powerpoints, books, or materials and worksheets. At this stage, students can listen to explanatory videos and read the subject matter provided to strengthen the concept. In addition, students must work with the provided worksheets. The worksheets given are based on guided exploratory learning. Help students find their own concepts by answering important questions on the worksheets.



Figure 5. Learning Resources for Petroleum Materials (<https://elearning.zainulteam.id/>)

3) Learning Activities Page: The third part is the oil learning activity. In this section, students are instructed to use discussion forums or chat rooms to discuss the petroleum material they are studying. Students are then given a place to upload their completed worksheets. At the final stage, students can make a final assessment of petroleum materials and measure their understanding of petroleum materials. This evaluation can be done twice.

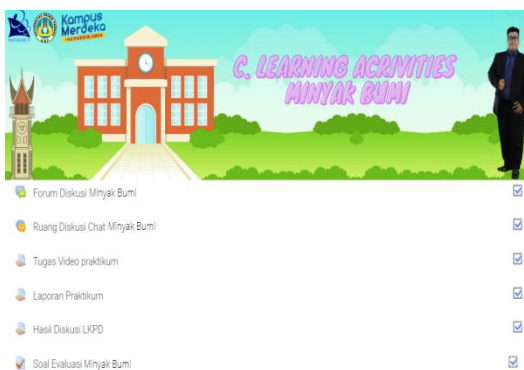


Figure 6. Display of Learning Activities (<https://elearning.zainulteam.id/>)

C. Develop Stage

1) Validity Test

Validation tests are performed in the form of contract validity and content validity [23,24,25]. This verification test was conducted by four chemistry teachers based on expert opinion (judgment report), with more than one verifier [26,27]. This evaluation data is processed according to Aiken's V formula. Figure 7 shows the results of the content validation.

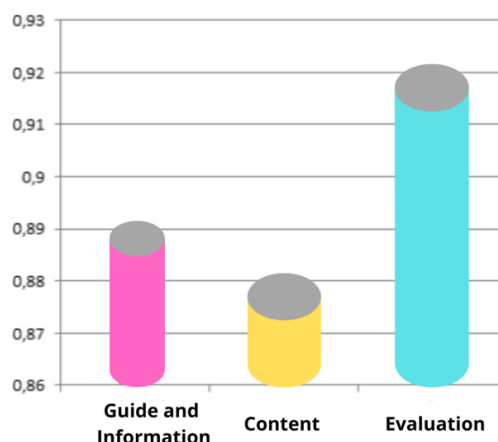


Figure 7. Graph of Content Validity Test Result

Based on Graph 7, it can be seen that the validity value for guides and information is 0.89 has a v high category, the validity value of elearning content/materials is 0.88 in a very high category and also the validity value of evaluation, which is 0.92 in a very high. From this it can be concluded that the validity of the e-learning content of a Petroleum system with a value of 0.89 belongs to a very high category.

The resulting Aiken's V value shows that the e-learning developed is valid and accordance with the 2013 curriculum in the blended learning system in the digital era 4.0. Aspects of content feasibility can be seen from the suitability of the material or content with KD, KI and learning objectives in accordance with the abilities of the students [29,30]. The creation of e-learning must be arranged systematically and in accordance with applicable standards so that students can understand the material more easily [31]

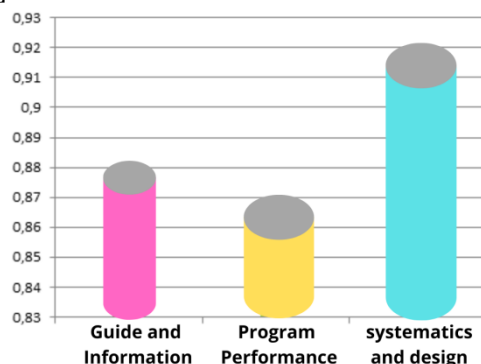


Figure 8. Graph of Construct Validity Test Result

Based on the graph, the value for the guidance and information component is 0.88 with a very high category, 0.87 for the performance of programs with high categories and 0.92 for Systematics, aesthetics and design principles in high categories. From the three results of this analysis, the construct validity value was 0.88 with a very high category. The resulting value shows that the e-learning developed is valid and in accordance with the 2013 curriculum in the blended learning system in the digital era 4.0

2) Practicality

The utility of using e-learning developed with the can be seen from the use of the product in a limited field trial. The test was conducted by 3 chemistry teachers and 10 students. The created e-learning should have high learning flexibility (reusable) for students.

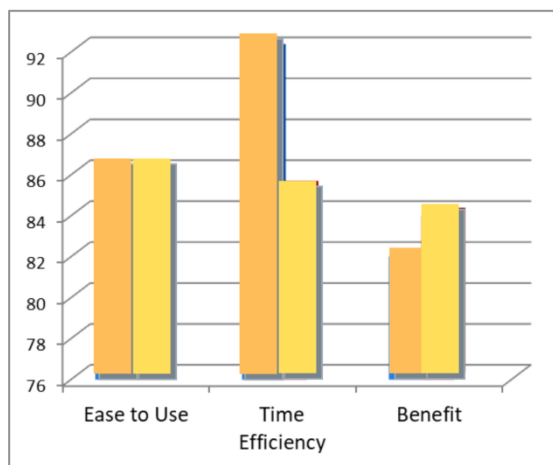


Figure 9. Student Practicality

The figure shows a result of 87.29 in the very practical category for the teacher internship test, while the student's practical score is 84.38 in the practical category. This shows that we use e-learning with petroleum materials that are designed to be used in learning.

Practical results prove that the Development of Guided Inquiry-Based Flipped Classroom Learning (FGIL) Petroleum Materials with Moodle for Senior High School is practically used in the learning process.

IV. CONCLUSION

The development of guided inquiry-based Flipped Classroom Learning (FGIL) on petroleum material using Moodle for Senior High School has a content validity score of 0.89 and a composition validity score of 0.88 in the high category. The result of the teacher's practice test was 87.29, and the students' practice level was 84.38. To support the development of guided inquiry-based flipped classroom learning (FGIL) so that it is effective and can be applied practically in the learning process.

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