International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

Vol. 32 No. 1 April 2022, pp. 397-404

Development of Petroleum Material e-content Based on the REACT Strategy Using the Moodle Platform

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Abstract—The challenge in the world of education in the current era of information technology is to provide learning for students that is not limited to time and place. Solutions to answer these challenges include e-content learning using e-learning. The purpose of this study is to develop and analyze the validity and practicallity categories of petroleum e-content based on the REACT strategy using the Moodle platform. This type of research is educational design research using the plomp model. The validity test is a product validity test conducted by six validators including three chemistry lecturers at the Faculty of Mathematics and Natural Sciences, Padang State University and three chemistry teachers at a high school in Padang Pariaman district. The practicality test was carried out on three chemistry teachers and students of class XI MIPA at a high school in Padang Pariaman district. Analysis of the results of validity using Aiken's V index and practical analysis using descriptive statistical formulas. The conclusion of this research is that the e-content of petroleum material based on the REACT strategy using the developed Moodle platform is valid with an average value of 0.89, and is very practical with an average practicality value of 93.33%.

Keywords—e-content, Moodle, Petroleum, Plomp, REACT Strategy

I. INTRODUCTION

The development of information and communication technology encourages educational institutions to use electronic learning (e-learning) systems. Currently and in the future e-learning technology can be a solution and alternative technology to be used in learning [1]. Electronic learning (e-learning) systems help to increase the effectiveness and flexibility of learning. Through e-learning, learning materials can be accessed anytime and anywhere. e-learning has also changed the paradigm of teacher centered learning to be student centered.

The use of e-content using e-learning is very developed in the Industrial Revolution Era (ERI) 4.0. e-content or also known as digital content is content or delivery of information via the internet. e-content is developed with media components such as text, audio, video, animation and images that will provide a multi-sensory experience to students [2]. The current era of education has been used as a very useful learning medium [3].

E-content is used in a virtual independent learning system through the Learning Management System (LMS). LMS is software created to make it easier for a teacher to organize learning activities and interact with students [4]. There are many types of LMS available on the internet, both free (free/open source) or free. Moodle is one type of LMS that is widely used and can be accessed for free [5]. In Moodle, teacher accounts and student accounts are provided for free. The advantages of Moodle can facilitate learner-centered lessons, facilitate learning anytime and anywhere and make it easier for teachers to manage courses [6].

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Moodle can be used on petroleum material because of the functions of the features on Moodle that can help students understand petroleum material, such as teachers being able to store or deliver various kinds of learning materials in the form of text, video, or audio. In addition, there are facilities that allow teachers to discuss with students and even Moodle also has the ability to evaluate the learning outcomes that have been carried out. Petroleum material has factual, conceptual and procedural characteristics. The subject matter of petroleum discusses how the process of formation of petroleum, processing of petroleum, the constituent components of petroleum and the use of each petroleum fraction which also has important meaning in everyday life.

The curriculum for chemistry subjects is the 2013 revised 2018 curriculum. During learning, teachers have not used learning strategies. So that scientific learning has not been achieved in accordance with the 2013 curriculum. From the questionnaire that was filled in, it was found that 75% of students considered petroleum material to be difficult. To make it easier to understand petroleum material, learning strategies are needed, one of which is the REACT strategy. This strategy can be used in petroleum learning because it relates petroleum material to real life [7].

The REACT strategy was designed based on five activity components. The five components of the activity are relating, experiencing, applying, cooperating and transferring [8]. At the relating stage, students connect new concepts with real situations that are already known to students. Experiencing is an activity that can make students build their own knowledge. In the Applying stage, the teacher can motivate a need to understand the concept by providing realistic and relevant exercises. Cooperating (cooperating) is learning in the context of each other, responding to, and communicating with other learners. In transferring (transferring) students use the knowledge they already have in new situations where this activity is carried out through the provision of various exercises [9].

Questionnaire analysis to determine learning using e-learning, obtained data that 100% of students already have a gadget or cellphone, 73% of students like learning using gadgets or cellphones and 63% of students like learning using e-learning. The teacher uses Whatsapp and Google Classroom. The difficulties experienced during learning through e-learning google classroom, the activeness and enthusiasm of students to learn is very less. There are students who do not follow the lesson and do not do the tasks given because the assignments given are only in the form of word files. For this reason, e-learning learning media using Moodle based on contextual strategies is expected to be able to help teachers and students in the implementation of the learning process. Because in Moodle all student activities are visible and stored. So, it will be seen which students do the assignments and those who don't. In addition, there are various types of quizzes on Moodle that can make students interested in learning.

Previous research related to the development of e-content has been carried out by [10] with the title "Development of e-Content for Entrepreneurship Courses with Website-Based Business Model Canvas Materials at the State University of Surabaya" concluded that e-content development is included in the valid category. Research conducted by [11] with the title "Development of e-Content Based on a Scientific Approach to Build Self Learning Awareness of Class XI SMA/MA Students on Reaction Rate Materials" concluded that content, construct and media validity were included in the valid category. Other research related to e-learning moodle has been carried out by [12] with the title "Development of E-learning Arabic Subjects Based on Moodle Applications for Class X Students MA U'allimat Nahdlatul Wathan Pancor East Lombok NTB" the results show the feasibility of e-learning -learning Arabic subjects based on the Moodle Application in terms of the validity of the material, media, teacher responses and student responses including valid categories.

Based on the description above, the author is interested in conducting research with the title "Development of Petroleum Material E-Content Based on React Strategy Using the Moodle Platform".

II. METHODS

This type of research is educational design research with a plomp model consisting of three stages. The first stage is preliminary research, the second is the prototype stage, and the third is the assessment phase [13]. In the preliminary research stage, needs analysis, context analysis, literature study and conceptual framework development are carried out. The prototype development stage consists of the development of prototype I, prototype II, prototype III and prototype IV. In the assessment phase, a large-scale test (field test) is carried out.

In this study, validity and practicality tests were conducted at the small group stage. The research subjects were 3 lecturers of chemistry FMIPA Padang State University, three chemistry teachers and students of class XI MIPA in one of the Padang

Pariaman district high schools. Meanwhile, petroleum e-content based on the REACT strategy using the Moodle platform was used as the research subject. In the validity test, an instrument in the form of a questionnaire was used which was analyzed by the Aiken's V formula.

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

$$s = r - Io \quad (2)$$

Information :

V= validator agreement index

r = validtator choice category score

n = number of validators

Io = the lowest value of the validity assessment

c = the highest number of validity assessments

The practicality test used a questionnaire instrument which was analyzed using descriptive statistics.

$$P = f/n \text{ X } 100\%$$

Information :

P = product practicality

f = total value obtained from the questionnaire

N= maximum value in the questionnaire

Practicality categories can be seen in Table 1.

Table 1. Practicality categories

Score	Category
80% < x ≤ 100%	Very practical
60% < x ≤ 80%	Practical
40% < x ≤ 60%	Quite practical
20% < x ≤ 40%	Less practical
0% < x ≤ 20%	impractical

III. Result And Discussion

3.1. Preliminary Research

1) Needs analysis

The results of the questionnaire analysis obtained from the needs analysis, namely the use of existing e-learning does not support the learning process. The teacher's obstacle during the learning process through the e-learning google classroom is that students have difficulty understanding petroleum material, the activeness and enthusiasm of students to learn is very lacking.

There are students who do not follow the lesson and do not do the tasks given because the assignments given are only in the form of word files. The use of e-learning has not used the REACT learning strategy. , there is no e-content available for petroleum material based on the REACT strategy using the Moodle platform. Based on the results of the needs analysis, e-content for petroleum materials based on the REACT strategy was developed using the Moodle platform.

2) Context analysis

Context analysis is obtained by analyzing the abilities of students that must be mastered in the learning process in accordance with the 2013 revised 2018 curriculum. The basic competencies of petroleum materials, as well as learning indicators that can be derived based on these basic competencies can be seen in Table 2.

Table 2. Basic Competencies and Competency Achievement Indicators

Basic Competencies	Indicators of Competence Achievement
3.2 Explain the process of forming petroleum fractions, separation techniques and their uses.	3.2.1 Explain the process of formation of petroleum. 3.2.2 Explain the technique of separating petroleum fractions.
3.3 Identify the complete and incomplete combustion of hydrocarbons and the nature of the combustion products (CO2, CO, carbon particulates).	3.3.1 Identify complete and incomplete combustion of hydrocarbons. 3.3.2 Distinguish between complete and incomplete combustion of hydrocarbons. 3.3.3 Identifying the properties of combustion products (CO2, CO, carbon particulates).
4.2 Presenting works on the formation process and techniques for separating petroleum fractions and their uses.	4.2.1. Create works on the formation process and techniques for separating petroleum fractions and their uses. 4.2.2 Presenting works on the formation process and techniques for separating petroleum fractions and their uses.
4.3 Develop ideas on how to overcome the impact of burning carbon compounds on the environment and health.	4.3.1 Investigating the impact of burning carbon compounds on the environment and health. 4.3.2 Develop ideas on how to overcome the impact of burning carbon compounds on the environment and health.

The learning objectives that can be formulated based on the indicators above are through the REACT learning strategy by digging information from various learning sources and processing information. It is hoped that students will be able to increase their faith and devotion to God Almighty and be actively involved during the learning process, have an attitude of curiosity, thoroughness, confident and responsible in presenting, expressing opinions, answering questions and giving suggestions and criticisms, and through discussion students are able to explain the process of forming petroleum fractions, separation techniques and their uses, identify complete and imperfect hydrocarbon combustion reactions and their properties. substances resulting from combustion (CO2, CO, carbon particulates), Presenting works on the formation process and techniques for separating petroleum fractions and their uses, Developing ideas on how to overcome the impact of burning carbon compounds on the environment and health.

3) Literature study

The results obtained based on a literature study are the development of e-content for petroleum materials based on the REACT strategy using the Moodle platform by following the Moodle usage manual which is used as a reference referred to from [14].

According to Amiroh, (2017) Moodle in terms of many things has advantages that neither Edmodo nor Schoology have, especially in terms of administrative tools. According to [15] the advantages of building e-learning developed with open source Moodle, among others, are simple, efficient, lightweight and compatible with many browsers. According to [16] the use of moodle-based e-learning in the learning process can increase student activity, because there is an increase in student learning activities from 49.4% to 87.2%. According to [17] learning by using e-learning moodle can improve understanding of concepts. This can be seen from the results of the assessment of the total number of students who took part in the lecture as many as 34 people got a high score with a percentage of 85% and as many as 6 people in the moderate category of 15% One of the conceptual chemicals is petroleum. The content or content of the material in the developed e-learning is referred to from college books and high school chemistry books. Petroleum material is factual, conceptual, and procedural material based on the 2013 revised 2018 curriculum. The REACT strategy is referenced from Crawford (2001) and Trianto (2014). The e-learning development model used is the Plomp development model which consists of three stages, namely preliminary research, prototyping phase and assessment phase which is referred to Plomp (2007).

4) Conceptual framework development

The results of the development of the conceptual framework are made in the form of a chart containing the problems found to the solutions provided. The problems obtained based on needs analysis and context analysis as well as literature study are that scientific learning has not been achieved according to the 1013 curriculum, the use of existing e-learning has not supported the learning process, has not used learning strategies, students have difficulty understanding petroleum material. This problem was solved by developing petroleum e-content based on the REACT strategy using the Moodle platform.

The features in Moodle are utilized and combined with the REACT strategy to help students learn well. These features include video facilities, images, text, quizzes, attendance, discussion rooms, assessments. The product was developed using the plomp model and analyzed for validity, practicality and effectiveness tests.

3.2. Development and Prototyping Phase

1) Prototype I

Prototype 1 is a prototype resulting from the design and realization of preliminary research. Prototype 1 was produced in the form of e-content of petroleum material based on the REACT strategy. In the e-content there is a general information section, an introduction to learning, a part of the learning process carried out in two meetings, at the end of the lesson a test is carried out and then there is a cover containing a bibliography. This general information section is presented to students on topics that will be studied in this e-content and instructional instructions using e-content in text form. The learning introduction consists of core and basic competencies, indicators of competency achievement and learning objectives, as well as a concept map. The learning process consists of two meetings. Each meeting consists of five stages of learning, namely, relating, experiencing, applying, cooperating, transferring. Each meeting is also equipped with a video related to the material being discussed at the meeting.

2) Prototype II

The second stage is a self-evaluation of the design on prototype I which aims to see the completeness of the developed e-content components. From the results of self-evaluation in the form of a checklist, it was found that this prototype requires revision, namely adding videos in e-content. After being completed, prototype II was produced.

3) Prototype III

The resulting prototype II was then evaluated in the form of an expert review by six validators and an individual evaluation (one to one evaluation) to obtain a valid development product.

a) *Expert review*

The expert review was carried out with a validity test consisting of content validity and construct validity. The validity test data collection instrument used was in the form of a validity questionnaire. The overall average of the validation results can be seen in Figure 1. The e-content of petroleum material based on the REACT strategy using the Moodle platform has a content validity of 0.89, and a construct validity of 0.89. If it is adjusted to Aiken's V table, it can be said that the e-content of petroleum materials based on the REACT strategy using the Moodle platform was developed to be valid.

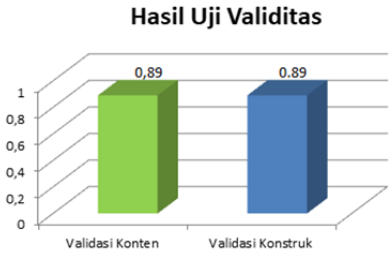

Fig 1. Overall Validity Test Results

The results of content validation from 6 validators for each petroleum meeting are presented in Figure 2. Meeting 1 obtained a content validity value of 0.88 and declared valid. At meeting 2 the validity value was 0.90 and was declared valid. The validity of the developed content shows that the GPA and learning objectives presented in the e-content have been in accordance with KD 3.2, 3.3, 4.2, and 4.3 on petroleum material, the content of the e-content created is in accordance with the characteristics of petroleum material, so that the e-content the material content of petroleum can be declared valid.

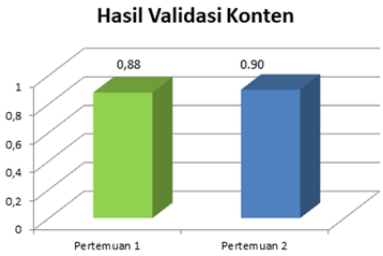

Fig 2. Overall Validity Test Results

The results of construct validation from 6 validators for each meeting of e-content of petroleum materials using the Moodle platform can be seen in Figure 4. Construct validity states the consistency of the product between one component and another (Watson & Crick, n.d.). From the diagram in Figure 3. it can be stated that the construct of petroleum e-content from each component is valid.

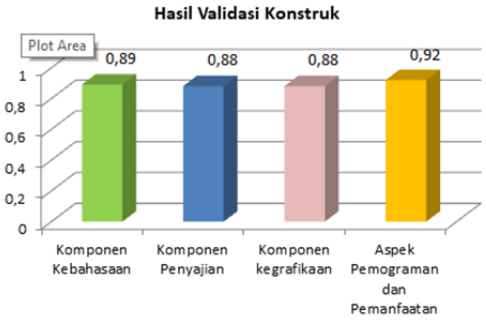

Fig 3. Construct Validation Results

a) *One to one evaluation*

One to one evaluation is done by selecting 3 students based on their ability level, namely, high, medium and low. Students are asked to fill out a questionnaire. Based on the results of the analysis carried out, it was obtained that the petroleum e-content based on the REACT strategy using the Moodle platform that was made was attractive so that students were motivated to learn petroleum material. The typeface, color, and writing size used are clearly legible. The language used in the e-content is clear and easy to understand, so it helps in finding concepts. The videos, pictures, available are interesting, making it easier to understand the material. The stages of the REACT strategy contained in each meeting can help students understand the concept. Based on the suggestions obtained from expert assessments and one-on-one evaluations, revisions were made to improve and produce valid products. This stage produces prototype III.

3) Prototype III

The fourth stage is testing the revised product through small group trials. In this stage, the practicality and effectiveness of the e-content that has been developed is tested. The assessment of the practicality of e-content consists of aspects of benefit, ease of use, and time efficiency. The assessment of the practicality questionnaire was carried out by three chemistry teachers, and 6 students with different abilities. The results of filling out this questionnaire were analyzed based on descriptive statistical formulas. The results of the teacher practicality questionnaire analysis at the small group stage can be seen in Figure 4. The practicality for the ease of use aspect is 97.78%, the learning time efficiency aspect is 96.67%, and for the benefit aspect it is 98.33%. The average overall score for the practicality of e-content of petroleum materials is 97.59% with a very practical category.

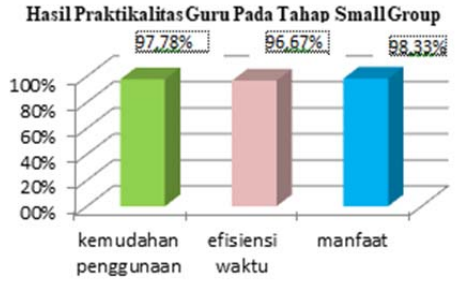

Fig 4. Practical Results at the Small Group Stage

The results of the practicality questionnaire analysis of students at the small group stage can be seen in Figure 5. Practicality was obtained for the ease of use aspect of 92.22%, the learning time efficiency aspect of 85%, and for the benefit aspect of 90%. The average overall score for the practicality of e-content of petroleum material is 89.07% with a very practical category.

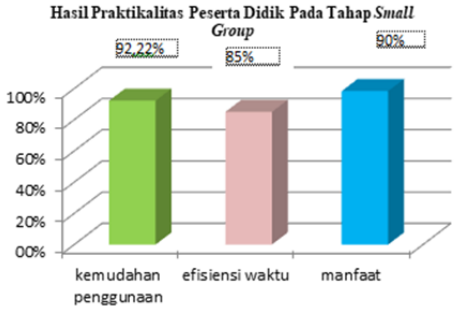

Fig 5. Practical Results of Students at the Small Group Stage

IV. Conclusion

Based on the data, it was found that the e-content of petroleum material based on the REACT strategy using the Moodle platform developed through the Plomp model was valid with an average value of 0.89 and very practical with an average practicality value of 93.33%.

V. Acknowledgment

Thanks to Mrs. Eka Yusmaita, S.Pd., M.Pd, Mrs. Yerimadesi, S.Pd., M.Si, Mrs. Dr. Desy Kurniawati, S.Pd., M.Si., Mrs. Dra. Elfitri Devitayetti, Mrs. Siti Rahmah, S.Pd., and Mrs. Winda Annisa Suryanti, S.Pd. as contruct and content validators of the petroleum material e-content based on the react strategy using the moodle platform.

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