Development of E-Modules Based on Project Based Learning (PjBL) to Increase Student's Interest in Learning and Learning Outcomes on Reaction Rate Material

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Abstract : This research aims to: (1) determine the validity of e-modules based on project based learning, (2) determine the practicality of e-modules based on project based learning, (3) determine the effectiveness of e-modules based on project based learning, and (4) determine whether there is a significant correlation between interest and learning outcomes. This research was conducted at SMA Negeri 10 Medan with the sample studied was class XI IPA 2. The data analysis technique is carried out by: e-module feasibility test according to BSNP, learning interest test, and correlation test between learning interest and learning outcomes. The results obtained in this research are: (1) E-modules based on project based learning are considered "valid" after being validated by 1 chemistry lecturer with an average material assessment of 89% and an average media assessment of 92% which can be categorized as "very feasible"; (2) e-modules based on project based learning can be considered "practical" after receiving chemistry teacher responses with an average percentage of 94% which can be categorized as "very feasible" and student responses with a grade of "very feasible". average grade of 98%; (3) e-module based on project based learning is considered "effective" with a posttest score of 93, an increase from 58, resulting in an N-Gain score of 0.83 (83%), which means it is in the high criteria; (4) There is a positive and significant relationship between interest in learning and student learning outcomes where "rhitung" is 0.6471 and "rTable" is 0.361.

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Introduction

Education is one of the important things for student that must be pursued and lived to improve their knowledge and self-quality. Education is carried out through the process of acquiring and instilling skills from teacher to students with the aim of developing various potentials within students, so that students can think critically in solving problems The education system in Indonesia requires all its people to study for 12 years in several levels of education. One of the levels of education in Indonesia is the senior high school (SMA) level. High school (SMA) is a school that studies various subjects such as mathematics, Indonesian languange, history and chemistry (Supartono, 2009).

Chemistry subjects in high school learn everything about substances which include composition, structure, properties, changes, dynamics and energetics of substances at the

molecular level which involves skills and reasoning. Learning chemistry, there are several components such as: assignments, daily tests, midterm exams, final exams and achieving learning outcomes that are in accordance with the student's KKM (Supartono, 2009).

Student's cognitive learning outcomes are achievements that students achieve academically through exams and assignments set through KKM, the activeness of asking and answering questions that support the acquisition of cognitive learning outcomes. In academic circles, the idea often arises that the success of education is not determined by student grades listed on the report cards or diplomas, but for the measure of success in the cognitive field, it can be seen through the increase in student's cognitive learning outcomes (Somayana, 2020).

In order to improve the cognitive learning outcomes of students with high KKM, a growing interest in learning is needed. Interest means a tendency and high enthusiasm or a great desire for something. Interest affects the quality of students' achievement of cognitive learning outcomes in learning (Simbolon, 2013).

To train student's interest in learning, it can be done in the learning process in class. Classroom learning should train students to have an interest in learning, in order to achieve good cognitive learning outcomes. To get cognitive learning results that are in line with learning interests, learning should be done with appropriate learning models and media (Rijal, 2013). After knowing the problems that often occur in the classroom, there are things that must be paid attention to, such as things related to the learning model used in school. An interesting learning model used is using the Project Based Learning model. Project Based Learning is a learning model that uses projects or activities as its learning media (Afriana, 2016).

This model can attract student's attention, where students are given a basic question about the project that to be carried out, with the aim of developing student's learning interest in working on the project and improving student's cognitive learning outcomes in the learning. The Project Based Learning model requires students to learn to produce work. Project Based Learning also requires students to study in groups, to make it easier to produce a work (Nirmayani et al., 2021).

Based on previous research conducted by Ariani & Dea Ristria (2002), the Project Based Learning, based e-module teaching material media products that have been produced are theoretically and practically feasible to use as one of the learning media on reaction rate material and have potential to increase the ability to interest in learning, train the ability to develop projects, and find solutions, either personally or in groups (Yusuf Sukman, 2017).

Furthermore, it is supported by research conducted by Lukman (2015), the Project Based Learning (PjBL) learning model accompanied by Mind Mapping media is effective on learning achievement in the Colloidal Systems material for class The calculation results are at a significant level, 85% of students experienced an increase in their learning outcomes (Lukman et al., 2015).

Apart from choosing an interesting learning model, interesting teaching materials such as e-modules are also needed to meet student needs such as: increasing interest in learning, facilitating students in learning anywhere and anytime, in order to improve student learning outcomes. E-modules are digital learning media that are structured systematically so that students can learn independently and solve existing problems. The advantages of e-modules compared to other print media are that they are interactive, cost effective, and can be accessed anytime and anywhere. The e-module is also equipped with facilities such as learning videos, animations, Figures and audio (Pramana et al., 2020).

Previous research conducted by Indah Sari Sihombing and Marham Sitorus (2022) found that the e-module learning based on Project Based Learning on electrolyte and non-electrolyte solution material developed was in accordance with BSNP standards. This is shown by obtaining a high average score for content suitability, language suitability, project based learning based e-module presentation (Sihombing & Marham Sitorus, 2022).

One of the learning method that can be used to overcome the problems mentioned above is the ADDIE method. The ADDIE model can be used as a reference in developing effective learning tools with several stages. The stages implemented in the ADDIE learning model are expected to increase student interest in learning and learning outcomes

Methods

This research is included in development research which refers to the development of Research and Development (R&D) with the ADDIE research model which consists of 5 research stages including Analysis, Design, Development, Implementation and Evaluation. This research produces a product in the form of an e-module based on project based learning to increase student interest and learning outcomes in reaction rate material.This research was conducted at SMA Negeri 10 Medan which is located at Tilak Sei Rengas I, Medan City, North Sumatera. The research time was conducted in January 2024 – March 2024.

The subjects in this research are validators. There was 1 validator in this research, as a material expert validator and overall media expert validator. Meanwhile, the object of the research is the e-module that will be developed. The subjects in this research are validators. There was 1 validator in this research, as a material expert validator and overall media expert validator. Meanwhile, the object of research is the e-module that will be developed. E-modules that become development products will be validated by material expert validators and media expert validators. In addition, the practicality of the e-module will also be seen by asking for responses from 1 chemistry teacher and 30 students, and the effectiveness of the e-module will also be seen from the results of the students' pretest and posttest. This is done to see the feasibility of the e-module that has been developed.

The instruments used in this research were questionnaires, interview sheets, test questions, and validation sheets. Data processing in this research was carried out using descriptive analysis, including feasibility analysis and data analysis of learning outcomes and learning interests.

The data collection method in this research is to use a validation questionnaire to determine the validity of the e-module from material experts and media experts, as well as to determine the practicality of the e-module by asking the responses of 1 chemistry teacher. and responses from 30 students. Test questions are used to see improvements in student learning outcomes. And using a student interest questionnaire, which is given in two stages, including: before learning with e-modules based on project based learning and also given after learning with project based learning to see the increase in student interest in learning.

The research procedure includes 5 stages including :1) Analysis, at this stage the researcher analyzes needs such as gap analys, analys of stiudent characteristics, source analysis, syllabus analysis, KD, KI and reference analysis. 2) Design, at this stage researchers compile a list of tasks, analyze content and create an e-module design. 3) Development, at this stage the researcher starts making the e-module then validates it with media and material expert validators then revises the e-module. 4) Implementation, e-module teaching material that have been validated can then be used in learning activities with a sample of 1 class, then give pretest

question. 5) Evaluation, at this stage the researcher tests the achievement of student's understanding of acid-base material after using the e-module by giving a post-test.

Data analysis in this research uses qualitative descriptive analysis that describes the results of product development in the form of e-module teaching materials based on project-based learning. The data collected can be grouped into two, quantitative data in the form of numbers and qualitative data in the form of words. Qualitative data will be analyzed logically, while quantitative data will be analyzed using average calculation. Learning outcome data were analyzed using the N-Gain test, e-module feasibility data and learning interest were analyzed using the average technique, and learning interest and learning outcomes were analyzed using a correlation test using the product moment formula which previously would be analyzed using the normality test, regression linearity test and product moment correlation test.

Research Results and Discussion

The main result of this research is a PjBL-based chemistry e-module product. This research was conducted at SMA Negeri 1 Stabat, which is located at Tilak Sei Renggas I, Medan city, North Sumatera, involving 1 class that was treated with learning using project-based learninig-based e-modules that had been developed on reaction rate material in the odd semester of the 2023/2024 academic year. This project-based learning-based e-module was developed using the ADDIE model which consists of 5 stages, such as analysis, design, development, implementation and evaluation.

Validity Test

The results of e-module validition by material experts and media experts showed a good results. Validator assessed the suitability of e-modules to be used as research materials by assessing several aspects, such as curiculum suitability, material accuracy, clarity of evaluation, accuracy of material presentation and suitability with writing rules. The results of the assessment of material and media expert validators can be seen in figure 1 and figure 2.
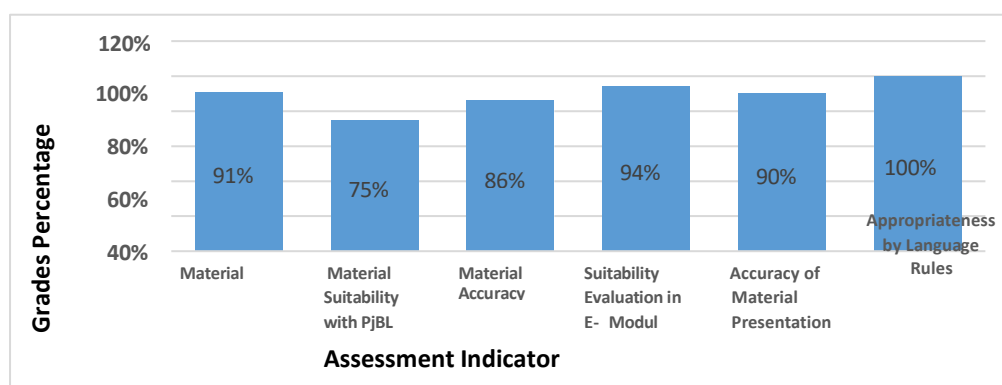

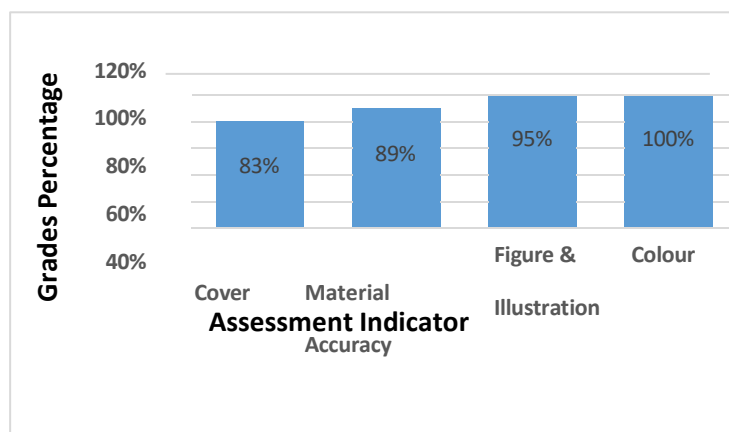Figure 1. Graph of material expert assessment

Figure 2. Graph of Media Assessment

E-modul considered valid if they meet the criteria of feasible and very feasible. On the calculation of the score given by the validator on the material assessment aspect, the average percentage is 89% which can be said to be "very feasible". For the media assessment aspect, the average percentage is 92 % which can be considered to be "very appropriate".

Practically Test

Meanwhile, the results of the practicality assessment based on the responses of teacher and students also showed a good result. After giving the assessment and suggestions, the researcher revised some of the teacher's suggestion such as writing errors, decorative composition and material content. The following graphs of the results of the teacher response assessment and student response can be seen in Figure 3 and Figure 4.
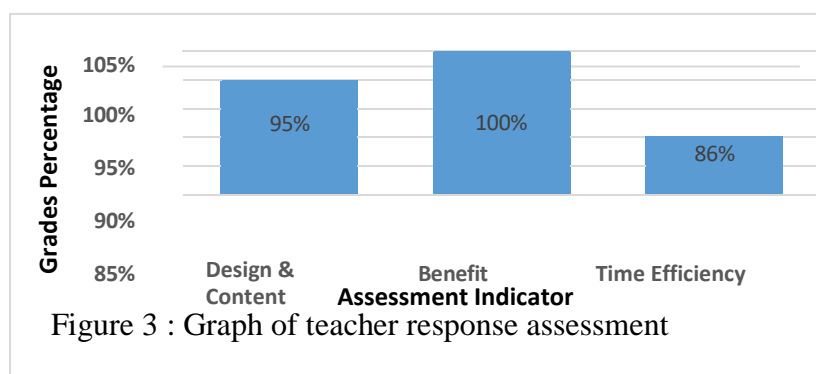

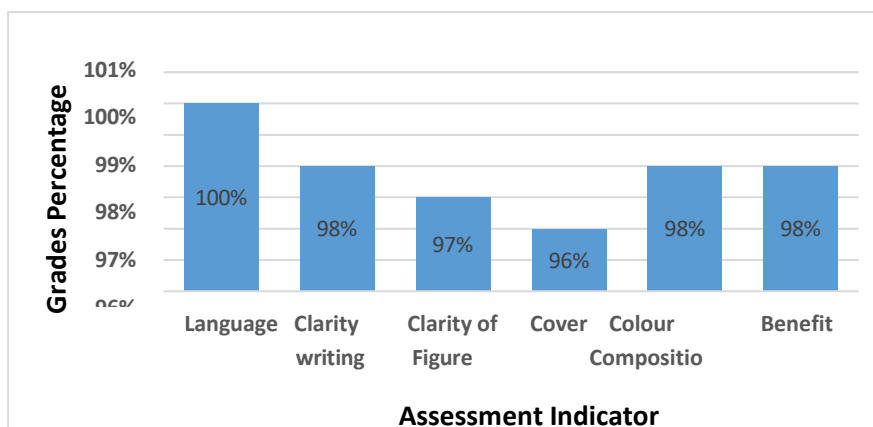Figure 3 : Graph of teacher response assessment

Figure 4. Graph of student response assessment

E-modules are considered to be practical if they meet the criteria of feasible and very feasible. Based on the calculation of the grades given, the average percentage is 94% and can be considered to be "very feasible" and based on student responses, the average percentage is 98% whis is included in the "very feasible" criteria.

Effectiveness Test

After carrying out treatment and giving pretest and posttest questions obtained N-Gain score data with an average pretest score of 58 and an average posttest score of 93. From these results, it can be seen that the N-Gain score obtained is 0.83 which can be categorized as Effective. N-Gain score data based on the average pretest and posttest scores can be seen in table 1.

Table 1. N-Gain Score Result Data

No	Average	Grade	N-Gain	Category
1	Before Learning	58	83%	Effective
2	After Learning	93		

➤ **Study Interest Test**

From the research result, the percentage obtained at meeting 1 was 88%, then increased at meeting 2 by 91%. Thus the average percentage of the 2 meetings was 89.5%. for more details about the percentage of interest in learning can be seen in table 2.

Table 2 Persentage of Learning Interest

No	Activities	Average	Category
1	Before Learning	88%	Very High
2	After Learning	91%	

Normality Test

Before knowing the relationship between interest in learning and learning outcomes, the first thing to be tested is the normality test, which is to measure whether the data has a normal distribution. The following list of normality test table can be seen in table 3.

Table 3. Normality Test Data

No	Data	Total	Var(U)	Zhitung	ZTable
1	Learning Interest	900	4575	6,653	1,96
2	Learning Outcomes	0			

Linearity Test

The linearity test was conducted using analysis of variance. Retrieval test. This linear decision means that if Fcount> Ftable then the data has a linear and significant relationship. The following linearity test table is shown in table 4.

Table 4. Linearity Test Table

Source of Diversity	Db	JK	KT	Fcount	Ftable
Regression (R)	1	0,001	0,001		
Residual (S)	28	72	36	12,72	4,20
Total	29	72,001			

Based on the table above, it can be seen that the value of Fcount> Ftable is at the 5% significance level, which means that there is a linear and significant relationship between variable X and variable Y.

Correlation Test

In this research there are 2 variables, namely learning outcomes (X) and learning interest (Y). The correlation result obtained between the two variables is 0.64713648544903. Correlation results data can be seen in table 5.

Table 5. Correlation Test Table

No	Data	*Learning Outcomes*	*Learning Interest*
1	*Learning Outcomes*	1	
2	*Learning Interest*	0.64713648544903	1

After analyzing using the Product Moment formula, the posttest scores of 30 students and the average grade of student collaboration skills from meetings 1 and 2 were analyzed for correlation and obtained a calculated grade of 0.64713648544903. The results obtained were consulted with the product moment point price with N = 36 at the real significance level = 0.05, obtained rTable = 0.361. Because rcount> rtable, Ho is rejected. Thus, it can be concluded that there is a positive and significant relationship between

learning interest and learning outcomes using project-based learning-based e-modules on reaction rate material.

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