



# Development of E-Modules Based on Exe-Learning on Topics of Reaction Rate Against Student Learning Outcomes Mechanical Engineering

Mastiur Verawaty Silalahi

Manajemen Pengelolaan Sumberdaya Perairan  
Universitas HKBP Nommensen Pematangsiantar, Indonesia  
[mastiur.verawaty@gmail.com](mailto:mastiur.verawaty@gmail.com)

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## ABSTRACT

### **Keyword:**

Exe-learning;  
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Rate Reaction;  
Research and  
Development (R&D).

The research was conducted at the University of HKBP Nommensen Pematangsiantar. The purpose of this research: (1) to determine the feasibility analysis of the feasibility of developing the exe-learning media on the reaction rate material by expert validators, (2) to determine the student's response to the feasibility of developing the ex-learning media on the reaction rate material, and (3) To determine the effect of the use of exe-learning media on the learning outcomes of mechanical engineering study program students at University of HKBP Nommensen Pematangsiantar. Data collection techniques using a questionnaire. And data processing using descriptive methods. Based on the results of this researches; (1) The level of feasibility analysis according to expert validator for the development of exe-learning media on the rate material is said to be a valid media category because the overall percentage of each overall assessment of the four aspects of development is 87.20% and lies in the range of 80% until 100% with a valid category, (2) Student responses to the level of feasibility of developing ex-learning media on the reaction rate material said the media category was valid because the average percentage of each overall from the assessment of the four aspects of development was 86.35% and located in the range of 80% until 100% with a valid category. And (3) Learning outcomes using exe-learning media are higher than using power points (contextual) with 80% and 66% increase in learning outcomes.



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## A. INTRODUCTION

Education has a very important role in shaping the quality of human resources (HR). In the current era of globalization, the preparation of excellent human resources is a key element in the face of intense competition in the world of work. Education plays an important role in creating quality human beings. The purpose of education is provide skills to the future. While the function of education is build character of learners in order to have high integrity with good character and love of the nation. One of the efforts to follow up the improvement of education in Indonesia is by improving the learning process. Learning process is one part that can not be separated from education. The learning process is a complex activity involving various learning

support components to create a system, so that the learning objectives can be achieved (Science et al., 2017).

Chemistry is one of the branches of science that underlies the development of advanced technology and the important concepts in everyday life. The nature of chemistry includes two things, namely chemicals as product and process. Chemicals as product includes a collection of knowledge that consists of facts, the concepts and principles of chemistry. Chemicals as process includes the skills and attitudes that are owned by the scientists to acquire and develop knowledge of chemistry. One of the ways to perform the skills of the process is through practicum. Practicum is an important activity to be undertaken to improve the ability of students in the aspects of knowledge, attitudes and skills. Through practicum learners are also trained to develop the ability to solve the problem with the scientific approach (Ratmini, 2017). Chemistry is part of the natural science branch that deals with changes in substances, substance structure, properties of substances, principles, laws that explain changes in substances, as well as theories and concepts that describe the process of changing substances (Effendy, 2016).

One of chemistry topic that need to be understand through the fourth level of multiple representation is 'rate of reaction' topic. 'Rate of reaction' concept is largely abstract and needs to be supported by visualizing the abstraction in various representations to achieve conceptual understanding. The Rate of reaction topic involves in several concepts such as the concept of chemical reaction, collision theory, factors affecting rate of reaction, equation of rate of reaction and level of reaction. Macroscopic aspect can be directly observed from the experiment about the factors affecting rate of reaction. While, the sub-microscopic aspect could be learned by the collision theory and the application on the rate of reaction factors. Furthermore, the symbolic and mathematics aspects learned through the formula, table, and graph of the rate of reaction concept, enthalpy and activation energy, rate of reaction equation, and the reaction order. Hence, the teacher should assess the students' understanding in rate of reaction topics that covered these fourth level of multiple representation (Wiyarsi et al., 2019).

The development of information and communication technology has brought enormous changes to the progress of the world of education. Along with these developments, learning methods have also developed more, both personal learning methods and the learning process. The form of the development of information technology that is applied in the world of education is e-learning. Learning by using web or electronic learning (e-learning) has unlimited space and time to provide an effective learning whenever we want to access it if we have computer, tablet, and mobile phone that connected to the internet. As well as student-teacher interaction become easier in real time. Some previous studies have showed that Moodle as an e-learning media give positive contributions to help students build their knowledge and to promote students' positive attitude in direct the discussion and cooperating with their partners (Samsudduha et al., 2013).

Media as a technique used in order to further streamline communication between teachers and students in the process of education and teaching in school (Uli et al., 2017). Among the authoring tools available today, exe-learning (e-Learning XHTML) stands out by allowing teachers to develop and publish educational materials using various media. It is an open source tool and free. It is available for download in versions of Windows operating systems, Linux and Macintosh (Federal et al., 2012). The exe-learning program is an abbreviation of e-learning XHTML editor, which is a program used to make Web-based teaching materials designed to deliver teaching materials to be easier and more interesting. E-learning material does not have to be distributed online but can also be done offline, by using CD/DVD media including e-learning patterns. In supporting the development of web-based learning media, researchers

used an open source application that was in line with e-learning standards, exe (e-learning XHTML editor) (Hamdani, 2011). Exe-learning is an application designed to create a web-based learning media without having to master a programming language. In addition, exe-learning media provides a variety of i-Devices that allow to insert a variety of animations, simulations, quizzes, practice questions with feedback and so on. According to (Copriady, 2014) the use of exe-Learning media in learning can improve student learning outcomes.

Exe-learning has developed to solve some bandwidth limitations. There are many web authoring software requires fairly steep learning curve, not intuitive or not designed to publish the learning content. As a result, teacher and academics cannot adopt the technology to publish online learning material. Exe-learning was built to provide intuitive and easy tool for teachers to publish professional webpage for teaching and learning. Most of content management and learning system management utilize a web server centered model, so it need to connectivity for authoring. This problem gives an obstacle to the writer who has low connection in bandwidth or does not have connectivity. Exe-learning has been developed as an authoring offline tool without requirement to connect with bandwidth. Exe-learning facilitates user to create an appropriate learning structure fit with their content needed and build the flexible, easy, and renewable resources (Nurdin & Setiawan, 2016).

Supporting research can be seen from several previous studies, among others: According to (Azizah et al., 2017) with the title "The Use of Problem-Based EXE-Learning Internet Media on Environmental Change Material to Improve Student Learning Outcomes" explains that student learning activities using exe-Learning internet media has increased at each meeting and its indicators. According to (Teknologi et al., 2010) with the title "Utilization of the Exe Application Program (E-learning XHTML Editor) in Preparing Learning Media in Schools" explains that this application program is an open source that is easy to use both by people who do not understand programming languages though. With this program, it is hoped that teachers in schools, especially chemistry teachers, can create an interactive learning media so that it attracts interest and improves students' understanding of chemistry and creates a pleasant learning atmosphere. And According (Jahro & Ridho, 2015) with the title "Application of the Problem Based Learning Model Using Exe Learning Media to Improve Learning Outcomes and Student Collaboration on Hydrocarbon Topic" explains that the researcher concludes that improvement of student learning outcomes and collaboration which is taught by applying a model PBL uses more exe learning media higher than improvement in learning outcomes and student collaboration taught with apply the PBL model without media exe-learning. And based on calculations correlation was found that there is a relationship positive between student collaboration activities.

To take advantage of information technology that supports learning and is right on target, information technology-based learning is needed, one of which is exe-Learning learning media. In this study students are free to study learning materials, answer quiz questions, watch learning video shows. Everything is included in an application called exe-learning. This exe-Learning learning is expected to be able to maximize the use of technology to support learning success.

## **B. METHODS**

This research is research and development. Research development is a research method that develops a product by conducting stages of research, validating and then developing a product. According to Borg and Gall, development research is a research design aimed at develop and validate products education. Use educational products according to them not only limited to the

development of teaching materials, for example textbooks, learning films, but also the development of procedures and learning processes, for example methods and organizing learning (Brog, 1983). Development research serves to validate and develop products. Validating the product, it means that the product already exists, and researchers only test the effectiveness or validity of the product. The purpose of this research include: (1) to find out the feasibility analysis of the feasibility of developing the exe-learning media on the reaction rate material by expert validators, (2) to determine the student's response to the feasibility of developing the ex-learning media on the reaction rate material, and (3) To determine the effect of the use of exe-learning media on the learning outcomes of students of mechanical engineering study programs at University of HKBP Nommensen Pematangsiantar.

The research was conducted at University of HKBP Nommensen Pematangsiantar, North Sumatra. The population in this research were chemistry lecturers at the University of HKBP Nommensen Pematangsiantar and students at the Faculty of Engineering and management of water resources (FTPSDP). The research sample was taken by purposive sampling. The sample in this research were students in the mechanical engineering study program at University of HKBP Nommensen Pematangsiantar and 10 Expert Validators who were Lecturers in Chemistry at State University of Medan and Chemistry Lecturers at University of HKBP Nommensen Pematangsiantar.

The data collection instrument in this study was to use a validation sheet in the form of a questionnaire based on a Likert scale to measure the attitudes, perceptions and opinions of a person or group of people towards the potential and problems of an object, the design of a product, the process of making products and products that have been developed. Validation sheets consist of 2 types, namely the expert validation sheet and the student response sheet. The data analysis technique used in this research is descriptive analysis, namely by calculating the percentage of the validation results and the student response value.

**Table 1.** Criteria for Eligibility of Percentage Analysis

Percentage	Note
80,00 - 100	Good / Valid / Eligible
60,00 - 79,99	Fairly Good / Fairly Valid / Fair enough
50,00 - 59,99	Poor / Invalid / Inadequate
0 - 49,99	Not Good (Revision)

(Riduwan, 2011)

## C. RESULT AND DISCUSSION

### 1. The results of the questionnaire by the expert validator

Media that have been developed are then validated by 10 expert validators. Validation is a valid evaluation of the product. Product evaluation in the form of exe-learning media on learning the reaction rate material in the form of construct validity and content validity includes 4 aspects, namely design aspects, pedagogical aspects, content aspects, and Media that have been developed are then validated by 10 expert validators. Validation is a valid evaluation of the product. Product evaluation in the form of exe-learning media on learning the reaction rate material in the form of construct validity and content validity includes 4 aspects, namely design aspects, pedagogical aspects, content aspects, and aspects of user convenience. Results of the average assessment of each aspect were obtained from all four aspects by the expect validator can seen in Table 2.

**Table 2.** The results of the questionnaire by the expert validator

No.	Type of Aspect	Percentage	Category
1	Design aspects	86,40%	Valid
2	Pedagogical aspects	87,20%	Valid
3	Content aspects	89,19%	Valid
4	Aspects of user convenience	86%	Valid
Average Percentage		87,20%	Valid

## 2. The results of the questionnaire by student response

The developed media was then given to students of Mechanical Engineering study programs at University of HKBP Nommensen Pematangsiantar. Product evaluation in the form of exe-learning media on learning the reaction rate material includes 4 aspects, namely design aspects, pedagogical aspects, content aspects, and aspects of user convenience. Results of the average assessment of each aspect were obtained from all four aspects by student response can seen in Table 3.

**Table 3.** The results of the questionnaire by student response

No.	Type of Aspect	Percentage	Category
1	Design aspects	84%	Valid
2	Pedagogical aspects	86%	Valid
3	Content aspects	89,80%	Valid
4	Aspects of user convenience	85,60%	Valid
Average Percentage		86,35%	Valid

## 3. Effectiveness of Exe-Learning Media Against Student Learning Outcomes in Mechanical Engineering Program

Overall students who learn to use media exe-learning get higher N-Gain learning outcomes (0.80) with a percent increase in learning outcomes 80% compared to students who are taught using power points with learning outcomes (0.66) with percent an increase in learning outcomes of 66% in the material reaction rate.

## D. CONCLUSION AND SUGGESTIONS

Based on the above research it can be concluded that the level of feasibility analysis according to expert validator for the development of exe-learning media on the material rate is said to be a valid media category because the overall percentage of each overall assessment of the four aspects of development is 87.20% and lies in the range of 80% until 100 % with valid categories.

Student responses to the level of feasibility of developing ex-learning media on the reaction rate material are said to be valid media categories because the average percentage of each overall from the assessment of the four aspects of development is 86.35% and lies in the range of 80% until 100% with a valid category.

Learning outcomes using exe-learning media are higher than using power points (contextual) with 80% and 66% increase in learning outcomes. And then, exe-learning media can used as good learning media to teach rate reaction.

From this study, researchers also gave several advices, among others: Lecturers can create interactive media for students on other basic chemical materials; Other researchers are expected to be able to conduct media development research for other chemical materials; For students, it is used as a medium that can facilitate the learning process, especially the reaction rate material..

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