

Development of eXeLearning-assisted E-Modules to Improve Students' Understanding of Uniformly Accelerated Motion Concepts

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Abstract: This study aims to describe the feasibility of eXeLearning-assisted e-modules on Uniformly Accelerated Motion material and describe increasing students' understanding of concepts after using eXeLearning-assisted e-modules on Uniformly Accelerated Motion material. The method used in this study is the Research and Development method with the ADDIE model. The subjects of this study were 32 students of class XI H SMAN 3 Kota Bengkulu. The data collection techniques are observation, interviews, expert validation, and tests. From the results of research conducted on the feasibility test, the results were obtained the average percentage of 5 aspects is 98.40% with a very decent category. Test results to determine the increase in students' understanding of the concept of eXeLearning-assisted e-modules on Uniformly Accelerated Motion material using N-gain calculations obtained an average pretest score of 52.31 and a posttest average of 91.40 and N-gain 0.81 of the high category. Thus, it can be concluded that after learning carried out using eXeLearning-assisted e-modules, there is a high increase in students' understanding of concepts in Uniformly Accelerated Motion material class XI SMAN 3 Kota Bengkulu.

Keywords: Concept Understanding; E-module; eXeLearning; Uniformly Accelerated Motion.

Introduction

The rapid development of technology has an impact on various aspects of life such as politics, economics, culture, art, and even in the field of education (Maritsa et al., 2021). Education is a field that is significantly affected by these technological developments. Law Number 20 of 2003 concerning the National Education system states that education is a process to help students develop their potential (Khuzaimah et al., 2022).

One of the components of education is the curriculum. The use of the developed curriculum is tailored to the needs of today's Education. The curriculum must be developed in line with the development of science, technology, and the demands of

competence that will be achieved as the goal of education so that human resource development can be fulfilled by the ideals of Indonesian Education (Puspita Sari & Setiawan, 2018).

The Merdeka Curriculum is a curriculum that is applied in Indonesia today. The Merdeka curriculum aims to strengthen critical thinking and comprehension skills, enhance creativity and innovation, and develop communication and collaboration skills. In the ongoing learning process, in the Merdeka curriculum, teachers must prepare learning aids including learning media (Sahara et al., 2023). Learning media is important in learning (Manggo & Ismaniati, 2018). Learning media is a tool used by teachers as an intermediary to deliver learning materials to students (Lu'Luilmaknun et al., 2021). Applying good and adequate learning media can

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increase student interest and motivation (Maryadi et al., 2019). If the use of learning media is less effective, it will impact students' understanding of concepts due to a lack of motivation to learn (Costley & Lange, 2017). Concept understanding is a person's ability to build knowledge to be more meaningful. Students who have an understanding of concepts will find learning carried out in the classroom will become easier. If the student's understanding of the concept is lacking, it will make it difficult for students to learn (Nurhilal et al., 2018).

Physics is a subject that studies phenomena in everyday life that have a high level of abstraction so that it will be more difficult to understand (Cynthia et al., 2023). Learning physics is not only emphasized on memorizing formulas but must also be equipped with understanding concepts (Thahir et al., 2020). Uniformly Accelerated Motion is a physics material whose understanding of the concept still needs to be improved. Uniformly Accelerated Motion is one of the subjects of kinematics material. Uniformly Accelerated Motion is a motion that has a fixed acceleration (a), and velocity (v) that changes with time (t), and moves on a straight trajectory (Prihatini et al., 2017).

Electronic modules abbreviated as E-modules are one of the learning media that are relevant to current times and can help to improve understanding of concepts (Sutopo & Setiadi, 2020). E-module is one of the electronic learning media that can be studied independently, designed completely and systematically in certain learning units, and presented electronically. E-module is an interactive learning medium and is equipped with video, audio, and animation to be able to add to the student learning experience (Rahayu, 2020). One of the advantages of e-modules is that they are more environmentally friendly because they do not use paper. However, to use the e-module, you must use a computer device or smartphone (Hadianto & Festiyed, 2020). E-modules as digital teaching materials must meet the eligibility requirements in terms of validity, implementation, practicality, presentation, and grammar as teaching materials (Prasetya, 2021).

Applications that can be used to create e-modules are eXeLearning applications. The eXeLearning application is an application used to create website-based teaching materials that are made to make learning easier and fun (Rokhima et al., 2019). eXeLearning is an application to create website-based learning media without the user having to master programming languages. In the eXeLearning application, the user only opens the eXeLearning application and then fills in text, images, videos, and animations. It will automatically become a table of contents that connects all pages that have been created by the user (Prasetyani et al., 2019).

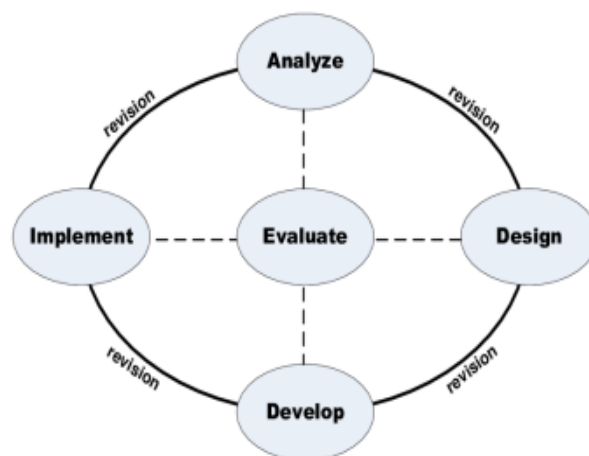
Based on the results of observations and interviews conducted at SMA Negeri 3 Kota Bengkulu, it was found

that 85.7% of respondents said that there was still a need to improve the use of learning media, and 71.4% of students said they still had difficulty in understanding physics material. Research relevant to this study is the research conducted (Muzijah et al., 2020) In his journal entitled "Development of E-modules using eXeLearning applications to train science literacy", from this research, it was obtained that the eXeLearning-based e-modules developed were categorized as feasible so that they could be used in learning and in learning there was an increase in learning outcomes after using eXeLearning-based e-modules.

Based on the above problems, it is necessary to develop a media that can be used in learning and the media can help improve students' understanding of concepts in physics lessons. Therefore, researchers will conduct research entitled "Development of eXeLearning-assisted E-Modules to Improve Students' Understanding of Uniformly Accelerated Motion Concepts in 11th Grade". This study aims to describe the feasibility of eXeLearning-assisted e-modules on Uniformly Accelerated Motion material and describe increasing students' understanding of concepts after using eXeLearning-assisted e-modules on Uniformly Accelerated Motion material.

Method

This research is Research and Development (RnD) research. RnD is a method used to develop and validate a product (Faidah et al., 2023). The model used is the ADDIE model. Analysis, Design, Development, Implementation, and Evaluation, these 5 stages are the stages of the ADDIE model (Ramadhan et al., 2023). The ADDIE model has simple stages and a systematic structure so that the ADDIE model is easy to understand and apply (Yulinda et al., 2023). Figure 1 is a stage image of the ADDIE model.



(Gustini et al., 2023)

Figure 1. Stages of the ADDIE model

The research was conducted at SMA Negeri 3 Kota Bengkulu which is located at Jl. RE. Martadinata No.41 Pagar Dewa, Selebar District, Bengkulu City. The research was conducted in the semester of the 2023/2024 academic year. The subjects of this study were 32 students of class XI H SMA Negeri 3 Kota Bengkulu. The selection of subjects in this study used the purposive sampling method. Purposive sampling is a sampling technique that fits the criteria so that the sample can represent the characteristics of the population (Lingga Iswara et al., 2022).

Data collection techniques used in this study consisted of observation, interviews, expert validation, and tests. The data collection instruments used in this study were observation sheets used during observation, interview sheets consisting of teacher interview sheets and student interview sheets, expert validation questionnaire sheets used to know product credentials, and pretest and posttest sheets. Pretest and posttest sheets are arranged based on indicators of understanding concepts. The indicators used are indicators of concept understanding according to the Ministry of National Education No. 506 / C / PP / 2004, namely restating a concept, group objects based on certain properties according to their concepts, giving examples rather than examples of concepts, conveying concepts in various forms of representation, develop necessary or sufficient conditions of a concept, and apply concepts or algorithms to problem solving (Andani & Desfitri, 2023).

The data analysis technique carried out consists of data analysis of the feasibility level of the product and analysis of test results. Analysis of product feasibility level data was obtained through validation tests by expert validators using validation questionnaire sheets with Likert scales as in Table 1.

Table 1. Scale Likert

Number	Category
4	Excellent
3	Good
2	Less
1	Very Lacking

(Dewi & Kamaludin, 2022).

The validation data is then analyzed using Formula 1.

$$P = \frac{\sum x}{\sum x_i} \times 100\% \quad (1)$$

Information:

P : Eligibility percentage

$\sum x$: Number of scores obtained

$\sum x_i$: Total overall score

(Husniyah & Ramli, 2023).

After calculating using the formula, then to find out the feasibility level of the product developed, the feasibility category is used. Eligibility categories can be seen in Table 2.

Table 2. Eligibility Categories

Number	Eligibility Category
81%-100%	Very Worth It
61%-80%	Proper
41%-60%	Pretty Decent
21%-40%	Less Decent
$\leq 20\%$	Very Lacking

(Fitriani, 2019).

Analysis of test results using posttest and pretest to determine the increase in students' understanding of concepts before and after using learning media. Assessment of improvement in pretest and posttest results using N-gain analysis. Here is the N-gain Formula used (Formula 2).

$$N - gain = \frac{\bar{X}_{\text{posttest}} - \bar{X}_{\text{pretest}}}{\bar{X}_{\text{max}} - \bar{X}_{\text{pretest}}} \quad (2)$$

(Dewitasari & Rusmini, 2023).

After N-gain is obtained, then N-gain is categorized in table category 3.

Table 3. N-gain Category

Limitation	Category
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Keep
$g < 0.3$	Low
$g = 0$	No improvement
$g < 0$	There is a decrease

(Silfiani et al., 2022).

Result and Discussion

Analysis

The Analysis stage is the initial stage, which is analyzing what problems occur (Anggraini et al., 2023). At the analysis stage, observation and interview activities are carried out. Observations are carried out directly at school using observation sheets. Then the interview activity was carried out by interviewing 6 students and 1 teacher of SMA Negeri 3 Kota Bengkulu using data collection instruments, namely student interview sheets and teacher interview sheets. Based on the results of the interview, it was found that 85.7% of the speakers said that there was still a need to improve the use of learning media and 71.4% of respondents said that students still have difficulty in studying physics.

Design

This design stage aims to design a conceptual framework for E-module development based on the results of the analysis stage. Design is done by first looking for reference books related to the material Uniformly Accelerated Motion. After that, determine the design of the e-module so that the e-module is arranged systematically. E-modules in design consist of a cover, introduction, learning activities 1 and 2, learning videos, practicum, summary, quizzes, practice questions, references, and e-module guides. Figure 2 is the design of the e-module.

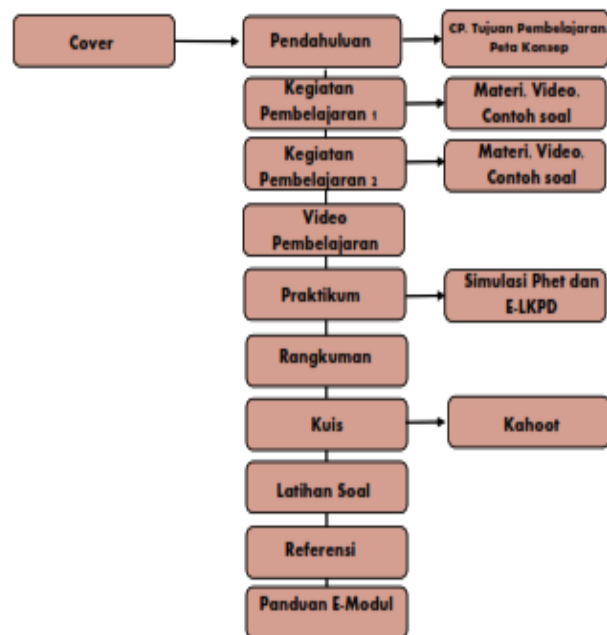


Figure 2. Design E-module

Development

The development stage is the stage that contains the realization of product design at the design stage (Pabri et al., 2022). In this development stage, the framework that was originally still conceptual was realized into an e-module using the eXeLearning application so that it is ready to be implemented. The results of eXeLearning application-assisted e-module development can be seen in Figure 3.

The initial display of the e-module has a cover and a table of contents that connects all pages on the e-module. After the cover, there is an Introduction which contains introductory material, learning outcomes, and learning objectives. Furthermore, namely Learning Activities, the menu for Learning Activity 1 and Learning Activity 2 contains material, video examples in everyday life, and sample questions. A learning video menu that explains Uniformly Accelerated Motion material that students can use for independent learning. The Practicum menu contains Phet Simulation and Student Worksheets using Liveworksheets. The

Summary menu contains a summary of the material Uniformly Accelerated Motion. In the quiz menu, quizzes are using Kahoot. The Practice menu contains 10 questions that can be used to practice students' abilities. Then, on the reference menu, there is a source material used in making e-modules. The last menu is the e-module guide menu contains a guide to the use of the e-module.

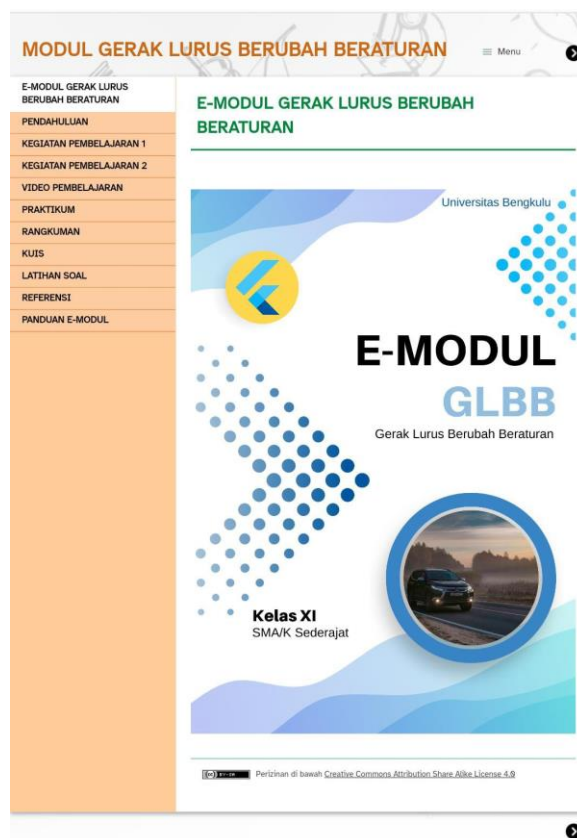


Figure 3. Initial view of the e-module

Products that have been developed are then validated. Validation is performed by 3 validators using a validation questionnaire sheet. The validation questionnaire sheet consists of 5 aspects, namely content feasibility, presentation feasibility, language, media feasibility, and concept understanding indicators. The results of validation by 3 data validators are seen in Table 4.

Table 4. Due Diligence Results

Aspects	Percentage (%)	Eligibility Category
Content Eligibility	99.24	Very Worth It
Serving Eligibility	94.44	Very Worth It
Language	100	Very Worth It
Media Credentials	98.33	Very Worth It
Concept comprehension indicators	100	Very Worth It
Average	98.40	Very Worth It

Table 4 shows that the content feasibility aspect has a percentage of 99.24%, the presentation feasibility aspect has a percentage of 94.44%, the linguistic aspect has a percentage of 100%, the media feasibility aspect has a percentage of 98.33%, and the concept understanding indicator aspect has a percentage of 100%. The average percentage of these 5 aspects is 98.40% with a very decent category.

Implementation

E-modules that have been validated are then implemented. The implementation was carried out at SMA Negeri 3 Kota Bengkulu in class XI H with a total of 32 students. This implementation is carried out to see an increase in students' understanding of concepts after learning using e-modules. The initial stage of implementation is by providing Pretest questions to grade XI H students of SMA Negeri 3 Kota Bengkulu to find out students' understanding of concepts on the Uniformly Accelerated Motion before learning to use the Uniformly Accelerated Motion e-module. After that, learning was carried out using the e-module material Uniformly Accelerated Motion. The final stage of implementation is to provide posttest questions to determine the increase in students' understanding of concepts after learning to use the Uniformly Accelerated Motion e-module. The pretest and post-test results of students on each indicator can be seen in Figure 4.

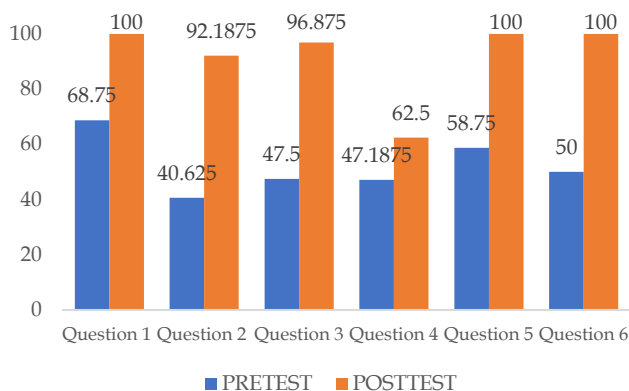


Figure 4. Pretest and Posttest Charts

Based on Figure 4, namely the pretest and posttest graphic images, it can be seen that there is an increase in each indicator. In question 1 with the indicator restating a concept, the pretest average is 68.75 and the posttest average is 100. In question 2 with indicators classifying objects in certain properties, the pretest is 40.625 and the posttest is 92.1875. In question 3 with indicators providing examples and non-examples of concepts, the average pretest is 47.5 and the average posttest is 96.875. In question 4 with indicators presenting concepts in various forms of representation, the pretest average is

47.1875 and the posttest average is 62.5. In question 5 with indicators developing the necessary and sufficient requirements of a concept, an average pretest of 58.75 and an average posttest of 100 were obtained. Then in question 6 with indicators applying concepts or algorithms to problem solving, the average pretest is 50 and the average posttest is 100. Based on the graph, it can be seen that question 2 with indicators classifying objects in certain properties has the highest increase, while in 4 with indicators presenting concepts in various forms of representation has the lowest percentage when compared to the other 5 indicators.

Based on the results of the post-test and pretest, N-gain calculations are carried out to determine the increase in students' understanding of concepts. The N-gain value obtained can be seen in Table 5.

Table 5. N-gain result

Data	Pretest	Posttest	N-gain	Criterion
Min. value	10	80		
Max value	70	100		
Average	52.31	91.40	0.81	High

In Table 5, the average pretest score is 52.31 the posttest average is 91.40 and N-gain is 0.81 with the height increase category. Based on the N-gain value obtained there is a high increase after learning to use e-modules on Uniformly Accelerated Motion.

Evaluation

The Evaluation Phase is carried out at each stage of ADDIE. At the analysis stage, an evaluation was carried out aimed at obtaining a solution, namely in the form of developing eXeLearning-assisted e-modules. At the Design stage, revisions were made to the product design, namely adding e-module guidelines to the e-module design to make it easier to use e-modules. Product revisions are carried out at the development stage. Revisions are carried out by the criticisms and suggestions given by validators on the validation questionnaire suggestion sheet. The revision note given is that there is a need to add references with the latest references and improvements to the material and sample questions to be more accurate. Improvements are made to make media ready and feasible to use to improve students' understanding of concepts. During the implementation stage, there were obstacles, namely 6 out of 32 students had difficulty accessing the e-module because the internet network of the 6 students was inadequate.

Based on the research conducted, it was obtained that the eXeLearning-assisted e-module learning media developed was suitable for use in learning and after learning using eXeLearning-assisted e-modules, an increase in understanding of concepts in Uniformly

Accelerated Motion. This is by the research conducted by Andila et al., (2021) with the title "Development of Contextual Based E-Modules Using eXeLearning Applications on Work and Energy Materials" It was obtained that the developed media was suitable for use in learning.

Conclusion

Based on research that has been done it can be concluded that the eXelearning-assisted e-module on the Uniformly Accelerated Motion material developed obtained the results of the content feasibility aspect has a percentage of 99.24%, the presentation feasibility aspect a percentage of 94.44%, the linguistic aspect has a percentage of 100%, the media feasibility aspect has a percentage of 98.33%, and the concept understanding indicator aspect has a percentage of 100%. The average percentage of these 5 aspects is 98.40% with a very decent category. The understanding of students' concepts after using eXelearning-assisted e-modules on the Uniformly Accelerated Motion material has increased, namely obtaining an average pretest score of 52.31 and a posttest average of 91.40 and N-gain of 0.81 with a high category. Thus, it can be concluded that after learning carried out using eXeLearning-assisted e-modules, there is a high increase in students' understanding of concepts in Uniformly Accelerated Motion in class XI SMA Negeri 3 Kota Bengkulu.

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Author Contributions

Conceptualization, E. N, E. R, R. M.; methodology, E. N, E. R, R. M.; validation, E. R and R. M.; formal analysis, E. N.; investigation, E. N.; resources, P. M. Z. and T. R.; data curation, E. N.; writing—original draft preparation, E. N.; writing—review and editing, E. R and R. M.; visualization, E. N. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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