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Development of Flipbook Module for Basic Theory of Electricity and Materials to Improve Critical Thinking Skills at SMKN Tuban

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Abstract

The use of learning media and learning resources has an important influence on the success of learning to produce quality education by utilizing science and technology. One of the factors that influence the effectiveness of learning activities is learning media in the form of flipbook-based electronic modules that can be accessed by students independently and improve students' critical thinking skills. This study aims to determine the validity, practicality, and effectiveness of flipbook-based electronic modules to improve students' critical thinking skills. This research uses the development of the type of R&D (Research and Development) with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The population in this study were all students of class X-TITL 1 SMK Negeri 1 Tuban as many as 36 students. Data collection techniques were interviews, questionnaires, and documentation. Data analysis using paired sample t-test assisted by SPSS 25. The results showed that the value of t count > t table can mean that there is a significant difference from the application of electronic flipbook-based modules. The conclusion is that the t value is 14.476> t table 2.030 so it is found that the use of electronic flipbook-based modules is very effective in classroom learning, especially in the aspect of increasing critical thinking skills.

Keywords: *Development, Learning media, E-module, Flipbook, Critical thinking, ADDIE*

Abstrak

Penggunaan media pembelajaran serta sumber belajar memberikan pengaruh penting bagi keberhasilan pembelajaran sehingga menghasilkan pendidikan yang berkualitas dengan memanfaatkan ilmu pengetahuan dan teknologi. Salah satu faktor yang mempengaruhi efektiftas kegiatan pembelajaran adalah media pembelajaran berupa elektronik modul berbasis *flipbook* yang dapat diakses oleh siswa secara mandiri dan meningkatkan kemampuan berpikir kritis siswa. Penelitian ini bertujuan mengetahui kevalidan, kepraktisan, dan keefektifan elektronik modul berbasis *flipbook* untuk meningkatkan kemampuan berpikir kritis siswa. Penelitian ini menggunakan pengembangan jenis R&D (*Research and Development*) dengan model ADDIE (*Analysis, Design, Development, Implementation, and Evaluation*). Populasi pada penelitian ini adalah seluruh siswa kelas X-TITL 1 SMK Negeri 1 Tuban sebanyak 36 siswa. Teknik pengumpulan data berupa wawancara, kuesioner, dan dokumentasi. Analisis data menggunakan *paired sample t-test* berbantuan SPSS 25. Hasil penelitian menunjukkan nilai t hitung > t tabel dapat diartikan terdapat perbedaan yang signifikan dari penerapan elektronik modul berbasis *flipbook*. Kesimpulan didapatkan bahwa nilai t hitung 14.476 > t tabel 2.030 sehingga ditemukan hasil bahwa penggunaan elektronik modul berbasis *flipbook* sangat efektif diterapkan pada pembelajaran kelas terutama pada aspek peningkatan kemampuan berpikir kritis.

Kata kunci: Pengembangan, Media pembelajaran, E-modul, *Flipbook*, Berpikir Kritis, ADDIE

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INTRODUCTION

The quality of human resources is one of the determinants of successful national growth. Indonesia will get a demographic bonus in 2045 because almost 60% of the population is under 30 years old. This demographic bonus can be utilized to realize the success of Indonesia Emas 2024 (Puspa et al., 2023). Four factors must be met in effectively utilizing the demographic bonus, namely the quality of education, the quality of health, the availability of employment, and the consistency of the childbirth ratio (CBR) (Achmad Nur Sutikno, 2020).

The use of learning media and learning resources has an important influence on the success of learning to produce quality education. One of the factors that influence the effectiveness of learning activities is learning media. Learning media can be in the form of hardware or software that helps students understand the subject matter. At SMK Negeri 1 Tuban, effective learning media has not been applied to improve students' critical thinking skills in the era of globalization.

The results of observations obtained through the Need Assessment, that there are several obstacles faced by teachers of the Basic Expertise Program (DPK) 6 Basic Theory of Electricity and Materials at SMK Negeri 1 Tuban, namely the lack of student knowledge about electricity. Students tend to lack understanding of the basic theory and understanding of the use of formulas related to the topic. This is due to the lack of innovative learning media to support the student understanding process.

Without adequate learning media, students find it difficult to link theory with practical applications in everyday life. As a result, students' interest in reading the material decreases. Mastering 21st century skills is essential for individuals to succeed in facing challenges, problems, life, and careers (Redhana, 2019).

Therefore, more serious and creative efforts are needed in creating learning media that can improve and improve students' critical thinking skills about electricity through an independent curriculum centered on developing 4C skills, namely critical thinking, communication, collaboration, and creativity (Indarta et al., 2022).

Students are conditioned in a learning environment that can develop critical thinking, problem-solving, creativity, innovation, collaboration, and communication skills needed for the 21st century. Learning with a scientific approach can develop the quality of student adaptability. The ability of 4C skills are needed to face the increasingly complex challenges of life and achieve success in the world of work for human resources.

Based on the results of observations by conducting Need Assessment and interviews with teachers majoring in Electrical Power Installation Engineering (TITL) at SMK Negeri 1 Tuban on February 22, 2024, it is known that class X TITL students are more motivated and enthusiastic to participate in the learning process when the teacher uses interesting learning media rather than the usual learning system, where only the teacher actively explains while students listen. This can certainly improve students' critical thinking skills.

The main problem is the unavailability of learning media in the form of flipbook-based electronic modules that can be accessed by students independently and improve student's critical thinking skills. For example, teachers can teach electrical circuit material by showing videos in class or by using additional simulations to make it easier for students to understand the material and increase enthusiasm for learning.

Thus, flipbook-based e-modules need to be applied to improve students' critical thinking skills in understanding material by utilizing science and technology (IPTEK) and various media components of learning support facilities. The researcher compiled the final project with the title "Development of Flipbook-Based Electronic Modules as a Basic Innovation in Basic Electricity Theory and Materials to Improve Critical Thinking Skills at SMK Negeri 1 Tuban", to know the validity, practicality, and effectiveness of e-modules.

RESEARCH METHODS

The type of research used is a type of R&D (Research and Development) research with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Diofanu et al., 2020). Researchers chose the ADDIE model in developing a flipbook-based e-module in the Basic Electricity and Materials Theory subject because the ADDIE model provides an opportunity to revise and evaluate so that the resulting e-module product is valid and reliable to be implemented.

The initial analysis stage involves identifying problems found in the field. The second stage is design or design which is carried out based on the results obtained from the analysis. Next is the development stage utilizing the results that have been obtained in the previous stages. Implementation is done by applying the learning media that has been developed directly in the classroom. The last stage is evaluation, which is the process of assessing the data that has been obtained from the implementation stage in the form of pre-test and post-test results (Diofanu et al., 2020).

The population in this study were all students of class X-TITL 1 SMK Negeri 1 Tuban, totaling 36 students with data collection techniques in the form of interviews aimed at finding out whether schools apply flipbook-based e-modules as learning media innovations in basic electrical engineering subjects, data collection in the form of questionnaires in the form of validation instrument sheets which include validation of media experts and material experts, student response questionnaires to determine the practicality of e-modules and pretest posttest questionnaires to determine the effectiveness of e-modules, and data collection in the form of a questionnaire in the form of a validation instrument sheet which includes validation of media experts and material experts, student response questionnaires to determine the practicality of e-modules, as well as 50 pretest and posttest questionnaires to determine the effectiveness of e-modules in improving students' critical thinking skills, and documentation to obtain data during the research which includes written sources, images, and works that contain information during the research.

Data measurements from the results of the assessment sheet will be evaluated by researchers and teachers to determine the validity of the flipbook-based e-module developed. Normality and reliability tests were carried out before testing paired t-tests on samples. The normality test used is the Kolmogorov-Smirnov test type because the data sample is < 100, namely 36 students processed using SPSS 25 software. Researchers used a pre-experimental design with a one-group pretest-posttest design model. The paired sample t-test test was conducted to determine a significant comparison of the pretest and posttest after the application of the flipbook-based e-module. Data analysis of student critical thinking skills assessment results with pretest and posttest scores through the N-gain test.

RESULTS AND DISCUSSION

Learning Module Development Results

This research and development was conducted in class X-TITL 1 SMK Negeri 1 Tuban. This research produces electronic flipbook-based modules that are effective and interactive in improving students' critical thinking skills. This research uses the research and development (R&D) method with the ADDIE model, namely analysis, design, development, implementation, and evaluation (Diofanu et al., 2020). The stages are as follows.

a. Analysis Stage

At the analysis stage, researchers provide a need assessment (needs analysis) and interviews with teachers majoring in electrical power installation techniques. This analysis is in the form of looking at the conditions and learning process in the class. In addition, at this stage, researchers also collect references to the subject matter that will be used in the development of electronic flipbook-based modules.

Based on the results of observation and analysis activities with teachers in class X-TITL 1, it was decided that researchers continue the development of flipbook-based e-modules with the help of JavaLab simulations, especially in the basic material of the 6 basic theories of

electricity and materials. This is applied to increase students' enthusiasm and critical thinking skills. The next activity is to collect references to support learning and make flipbook e-modules such as curriculum, electro-subject syllabus, and learning support books.

b. Design Stage

This stage contains the process of designing an interactive electronic flipbook module as a solution to the problem formulation of making e-modules. The purpose of making e-module flipbooks is used as a support for more effective student learning to improve critical thinking skills. This design stage includes the creation of interactive learning flipbook e-modules including setting the objectives of making interactive learning modules for basic electrical theory materials and materials according to student needs, making flowcharts for the flow of learning modules, making storyboards as an initial concept for making learning modules, collecting design objects according to the material in the learning module, and preparing instruments to test the feasibility and effectiveness of learning e-modules as a learning resource for students.

c. Formulation of the Purpose of Making Flipbook E-modules

The ABCD (Audience, Behavior, Condition, and Degree) approach is used by researchers to formulate objectives. Audience focuses on the tasks and commands given to students, while Behavior assesses the new abilities students must master after using the flipbook e-module. Condition pertains to the supportive circumstances for applying the e-module in class, in line with the learning objectives. Lastly, Degree involves specific criteria used as a measuring tool for learning assessment..

d. Flowchart Creation

The flowchart explains the flow of development that will be carried out including the initial stages through analysis in the form of observations in the field, then design or design the development of e-modules that will be applied in the classroom. Furthermore, development or broad-scale development by correcting revisions or deficiencies of e-modules, continued at the implementation stage in the field using a predetermined population. Then finally evaluate the use of e-module flipbooks in class on basic material for the basic theory of electricity and materials that are refined so that they can be applied sustainably.

e. Storyboard Creation

Storyboard is a description of the activities that the author will carry out in the process of developing flipbook-based e-modules. The existence of a storyboard will make it easier for writers to be consistent from stage to stage.

f. Collection of Research Objects

This stage is in the form of collecting devices used in making flipbook e-modules. The components needed in this case such as the material included in the e-module, syllabus, learning outcomes, learning objectives, and attractive images to support student interest in learning.

g. Preparation of Validity Test Instrument

The research instrument is presented in the form of a questionnaire which is used as a measuring tool for the feasibility of developing flipbook e-modules. The instrument will be distributed to media experts, material experts, and respondents using answers in the form of a checklist (√). The results of the assessment of material experts, media, student questionnaires, and pre-test post-test questionnaires were assessed by Ir. Fendi Achmad, S.Pd., M.Pd as Validator 1, Marjiyanto, S.pd as Validator 2, and Endah Sulistyoningsih, S.T as Validator 3.

h. Development Stage

This stage contains activities to assemble all components supporting e-module flipbooks such as learning materials, images, learning outcomes, learning objectives, and the amount of time allocation. Making e-module flipbooks is used with the help of JavaLab simulations that make it easier for students to access and more interactive.

Figure 1. Cover Flipbook Module

Figure 2. Instructions for Use of Module

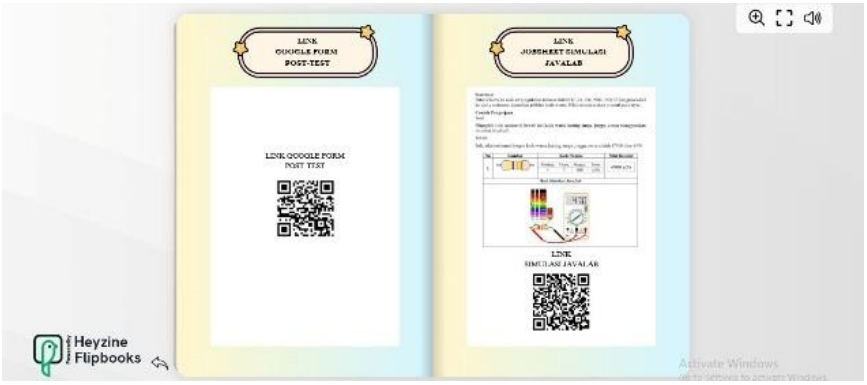

Figure 3. Materials Page

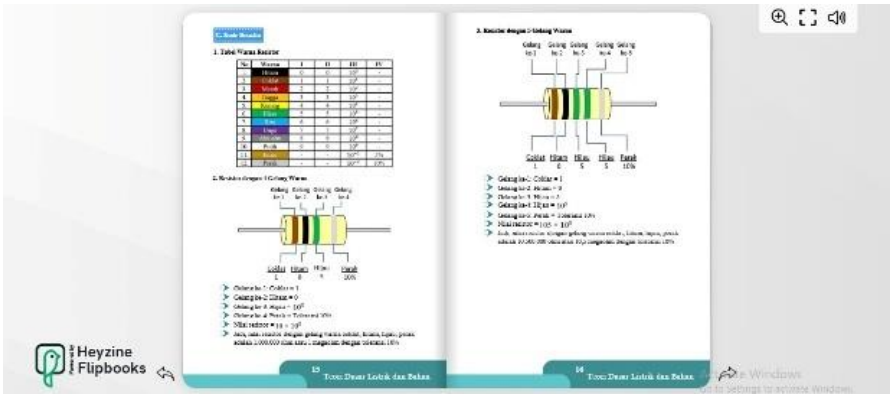

Figure 4. Assessment Page

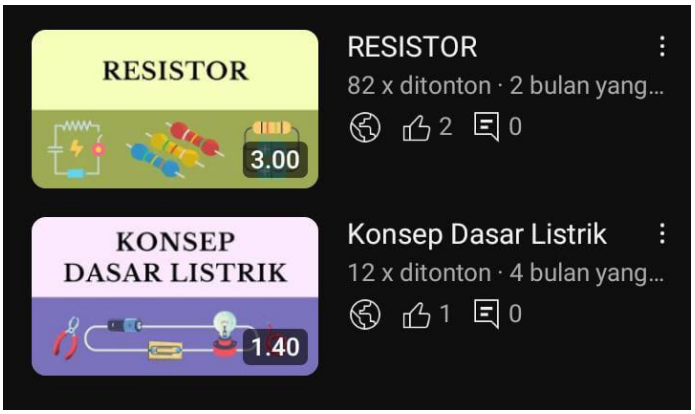

Figure 5. Material from Animation Video on YouTube

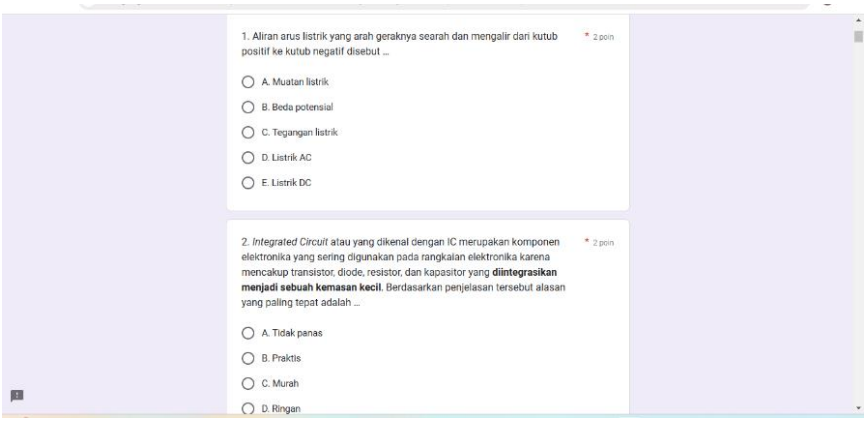

Figure 6. Pre-test and Post-test

i. Implementation Stage

The electronic development of flipbook-based modules was implemented at SMK Negeri 1 Tuban in class X-TITL 1 which amounted to 36 students. This implementation process took place from early November to the end. The implementation of the flipbook-based electronic module test is in the classroom and is accessed directly by students. Before using the e-module flipbook, students first follow the procedures or steps of use that have been given by the author in the form of a job sheet.

At the same time, researchers also explain how to use and deliver material regarding the basic skills program 6 basic theory of electricity and materials so that it is easily understood by students. After using the flipbook-based electronic module, the researcher provides a questionnaire as a learning evaluation or pre-test and post-test of the application of the module provided. The questionnaire given to students consists of 50 questions about the basic theories of electricity and materials, JavaLab simulation, and a response questionnaire to the use of the electronic flipbook module.

j. Evaluation Stage

The evaluation stage is used to determine the practicality of using flipbook module electronic products for students in fulfilling their learning. The practicality of the product aims to determine the percentage value of the practicality or usefulness of the flipbook-based electronic module in the learning process of basic material for the basic theory of electricity and materials. The instrument used in seeing these results is a student response questionnaire in class X-TITL 1 SMK Negeri 1 Tuban with 36 participants.

The results of the percentage of practicality that has been filled in by students as a whole is 83.3% so it is in the “Very Practical” category. The percentage table for each question is as follows.

Table 1. Results of Practicality of Flipbook Module

Categories	Percentages	Criteria
Question 1	81,6%	Very Good
Question 2	86,6%	Very Good
Question 3	86,1%	Very Good
Question 4	86,1%	Very Good
Question 5	77,2%	Good
Question 6	82,2%	Very Good
Question 7	83,3%	Very Good
Question 8	83,8%	Very Good
Question 9	83,8%	Very Good
Question 10	82,7%	Very Good

Based on the table above, it is known that the components of the student response questionnaire on average get "very good" criteria. Thus, it can be concluded that students are enthusiastic so flipbook-based electronic module products are said to be very practical.

Table 2. Pre-test and Post-test Score Category

Categories	Pre-test Score	Post-test Score
Sample Quantity	36	36
Highest Score	80	96
Lowest Score	32	62
Average	55.50	82.61
Standard Deviation	12.760	7.954

The effectiveness of the product is measured using the test method with an instrument in the form of 50 multiple-choice questions distributed to class X-TITL 1 SMK Negeri 1 Tuban. This process takes place with 2 tests, namely the pre-test at the beginning before the use of the flipbook-based e-module model, and the post-test when already using the flipbook in the learning process of the basic theory of electricity and materials. The difference in the time of giving the pre-test and post-test aims to determine the level of effectiveness of the flipbook-based e-module in supporting learning and improving critical thinking skills.

Discussion

Based on the results of data analysis by normality test and reliability test, it can be seen that the development of electronic flipbook-based modules is to the needs of students at SMK Negeri 1 Tuban. This is shown when students take part in class learning more enthusiastically and actively when using flipbook products. In addition, based on the results of research in the field, prove that flipbook e-module products are effectively applied to improve critical thinking skills. This is evidenced by the average difference from the pre-test of 55.50 to 82.61 when already implementing the flipbook. The results are also supported by the paired sample t-test hypothesis test with a significance value of $0.00 < 0.05$ and t count > t table. Thus, it can be concluded that there is a significant difference between the pre-test and post-test.

In terms of practicality, this learning product meets and supports learning with an assessment of the practicality of use getting 83.3% of students' responses. Another supporting opinion is Diofanu's research (2020) which states that the development of interactive digital modules if it is said to be feasible and valid by media experts and material experts, will be suitable for use in the learning process. In addition, Anastasya's research (2020) also revealed that learning using digital modules can improve student understanding compared to using paper. Therefore, it is hoped that this development innovation will be able to help the student learning process to understand the basic material of the basic theory of electricity and materials.

CONCLUSION AND RECOMMENDATIONS

Based on the research and discussion results regarding the development of electronic flipbook-based modules, it can be concluded that the media in the form of electronic flipbook-based modules is suitable for use in the learning activities in class X-TITL 1 at SMK Negeri 1 Tuban. This is evidenced by the average validation results from media and material experts, which produced responses above 80%, indicating that the media is valid for use. Additionally, this learning media is practical to use, as shown by the overall practicality percentage filled out by students, which reached 83.3%, placing it in the "Very Practical" category. Furthermore, the media is effective in the learning process, as proven by the paired sample t-test results with a significance value of 0.00 < 0.05 and t-count > t-table, indicating a significant difference between the pre-test and post-test results. Therefore, the flipbook-based module has been proven to be effective, practical, and valid for use in learning.

After conducting research with the title "Development of Flipbook Module for Basic Theory of Electricity and Materials to Improve Critical Thinking Skills at SMK Negeri 1 Tuban", it can be seen that the development of learning media in the form of electronic modules has several advantages, namely attracting students' interest in learning the topic of basic electrical theory and materials, this media is practical because students can access e-modules anywhere and anytime as long as they are connected to the internet network, effective in improving students' critical thinking skills, the content in the material also varies consisting of animated videos and jobsheet simulations with JavaLab which makes this media different from previous research.

The recommendation for researchers on electronic learning media flipbook-based modules in this study is that researchers can develop this electronic module by adding variables related to other 4C skills that are not used in this study.

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