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# IMPLEMENTATION OF INTERACTIVE MULTIMEDIA-BASED MICROLEARNING LEARNING WITH THE DISCOVERY LEARNING MODEL TO INCREASE CREATIVE THINKING OF VOCATIONAL STUDENTS

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## ABSTRACT

Logic gates are one of the materials in grade 10 vocational high school. Based on observations, students are having difficulties learning logic gates. The proposed solution to this problem is implementing Interactive Multimedia-based Microlearning. Microlearning divide learning content into small and focused segments which is easier for the students. The learning model used is Discovery Learning. The method used is R&D (Research and Development) and One Group Pretest–Posttest research design. The subjects in this research are students of class X RPL 2 at SMK Bina Wisata Lembang that consisted of 30 students. The results of this study proved that there is an increase in student creativity based on the pretest and posttest. The increase in students' creative thinking after using this learning media has an average gain of 0.56 which interpreted as a level of effectiveness of "Medium". In conclusion, the usage of Interactive Multimedia-based Microlearning with the Discovery Learning model can increase the creative thinking of SMK students in Logic Gate material.



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## 1. INTRODUCTION

E-learning does not always make the learning process optimal. As previous research indicated, some students who use e-learning systems are often distracted by many things outside of learning context, such as notifications from social media and online games. Therefore, presenting a material or content in e-learning becomes a challenge. It is crucial to develop a strategy which can present a good, interesting and easy to understand content for students amidst many distractions that can divert focus when learning (Sutanta, 2009). In the previous study conducted by Nugraha et al (2021), the results of the study showed that universities have the potential to develop teaching materials with various formats such as (1) podcasts, (2) PowerPoint slides, (3) infographics, (4) motion graphics, (5) explainer videos, and (6) interactive video conferencing and gamification, as a form of innovation in the learning process. Based on this, a new strategy emerged, namely Microlearning which is expected to help students achieve learning goals in e-learning.

These efforts are made to overcome learning problem that occurs due to the pandemic by utilizing information and communication technology. The development of teaching materials based on information and communication technology is one of them (Perry, 2017). Microlearning is explained as a small-scale learning method in which the content (object learning) is designed into small segments through a variety of media formats, so that the available information becomes "short content" (Gabrielli et al., 2005)

Utilizing microlearning with interactive multimedia is complex. With interactive multimedia-based Microlearning, learning content with a fairly long duration is presented into short videos with a duration of 1-5 minutes (Dolasinski &; Reynolds, 2020). With this, it is said to be able to make the learning process in e-learning more effective for 4 reasons, namely: (1) Learning content is made small and faster; (2) The content is not full of text alone, but with images; (3) Quick and brief; (4) Can be accessed at any time when needed (Susanti et al., 2018).

This Microlearning often goes hand in hand with Discovery Learning model, where the teachers not only provide material in the form of material, but they also guide students to find the intended information, and the students are also expected to be able to find the answer independently (Rutonga, 2017). Some of the advantages of the Discovery Learning model include: (1) Encourage students to think creatively; (2) Student can come up with their own hypothesis; (3) Students can develop rapidly according to each individual's abilities. Discovery Learning is expected to increase student creativity (Tumurun et al., 2016).

Based on the explanation above, the purpose of this study is to implement interactive multimedia-based Microlearning using discovery learning model to increase students' thinking creativity on logic gate material in vocational students. The multimedia will be presented as an interactive website which implement discovery learning model.

## 2. METHODS

This study uses R&D (Research and Development) methods to determine the effectiveness of using interactive multimedia-based Microlearning for learning Logic Gate. The development model used is the ADDIE development model. There are five stages in the ADDIE development process, namely, the analysis stage, the design stage, the development stage, the implementation stage and the evaluation stage (Ariantini et al., 2019). Referring to the five stages of the ADDIE (Analysis-Design-Development-Implementation-Evaluation) development model, the research procedure in the form of a flowchart is presented in **Figure 1**.

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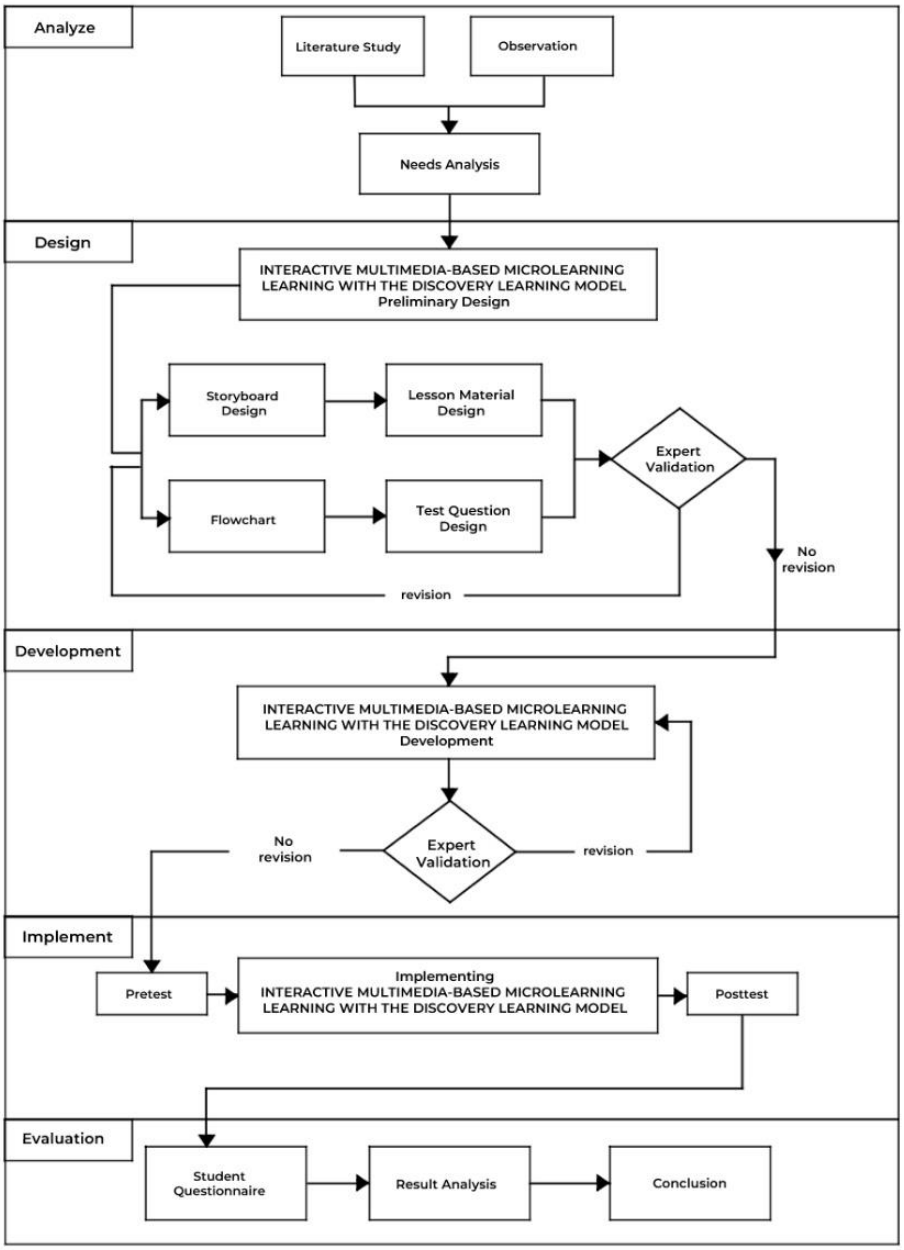


**Figure 1.** Research Procedure

The research procedure will be used as a reference in conducting research. This study used a pre-Experimental design (one group pretest – posttest). This research design has a pretest before treatment to be compared with posttest result after treatment. See **Table. 1** for the detail of the diagram of one-group pretest and posttest design.

**Table 1**. One group pretest-posttest

| Pretest | Treatment | Posttest |
|---|---|---|
| O1 | X | O2 |
| Pretest | Treatment | Posttest |

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### 2.1. Analysis Phase

In the early stages of research, researchers conduct a literature study, collecting data and information. The literature studies include teaching and learning objectives, students, competency standards, facilities and infrastructure, educators and the environment. Researchers conducted literature studies from journals, library books and the internet. Furthermore, researchers conducted a field study in the form of observation to Bina Wisata Lembang Vocational High School and does an interview to the teacher about the condition of the school, the teaching and learning activities that has been carried out and also distribute survey questionnaires to students. This is done to find out the problems that occur in the teaching and learning process of students, the difficulties faced and the media used in learning. The researchers then study the curriculum used by schools to find out the teaching material. Based on the aforementioned studies, a need analysis is made to determine the next step.

### 2.2. Design Phase

At this stage, all the data that has been collected in the previous stage will be used to design the Microlearning learning that will be built. The preparation of the entire material is needed as material in the presentation of learning content that will be provided on the web and as a reference in the preparation of questions. The material to be used is a logic gate, then the material is reconstructed as videos, quizzes and infographics. Then the learning material will be validated by material experts to be tested for feasibility.

The media that will be used is in the form of a website, namely Moodle. To help the development process, flowcharts, storyboards, and Use Case Diagrams are created. The researcher then makes a user interface design for the media. There are two research instruments used, namely: 1) Material and media expert validation instruments and student responses to media based on LORI (Learning Object Review Instrument) (Nesbit, 2007). 2) Pretest and posttest question instruments.

### 2.3. Data Analysis Techniques

The test data of media and material expert validation instruments and student responses that have been obtained will be analyzed using the Likert scale. For instrument validation analysis, pretest and posttest questions are tested first to students and then analyzed using validity tests, reliability tests, difficulty tests and differentiating power tests. From the test results, questions which passed the test will be used in the pretest and posttest. Furthermore, the results of the pretest and posttest will be analyzed using the n-gain test to obtain conclusions from the results of this study. In **Table. 2**, the n-gain formula and the result of calculating the gain value is explained.

**Table 2.** Gain Index Classification

| Gain Value | Information | Gain Value |
|---|---|---|
| 0,70 < g < 1,00 | High | 0,70 < g < 1,00 |
| 0,30 < g < 0,70 | Keep | 0,30 < g < 0,70 |

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## 3. Results and Discussion

### 3.1. Development Stage

The next stage is the development stage which is the process of making multimedia products. In this stage, multimedia is developed according to the flowchart and storyboard that has been created at the design stage. The finished multimedia is tested by both by multimedia experts and material experts. Researchers will conduct expert validation tests to determine the feasibility of the multimedia created. Should some mistakes be found, improvements (revisions) are made until the multimedia is deemed feasible.

After expert validation, some mistakes are found and the researcher revised it. After several revisions, the final assessment by media experts resulted in media feasibility in the 'Very Good' category.

### 3.2. Implementation Phase

At this stage, researchers implement the teaching process to the syntax of the Discovery Learning model, starting with giving a pretest to determine students' initial comprehension abilities, then applying multimedia to learning, and ending with giving a posttest aimed at knowing the extent of student understanding after learning which will later affect student creativity. At the end of each meeting always ends with a brief evaluation of the material discussed at the meeting. The pretest and posttest questions given each consist of 20 essay questions related to Logic Gate material. The following is the application of the discovery learning model to learning using the multimedia:

a) Stimulus Stage
   At this stage, it is done by asking some questions and the teacher showing some examples and videos.
b) Problem Identification Phase
   At this stage it is presented in the form of elaboration of a problem by the teacher to be studied and the problem that will be answered when drawing conclusions at the last stage.
c) Data Collection Techniques
   To meet this stage, the application provides material content in the form of videos, quizzes and infographics as material for students to learn.
d) Data Processing Stage
   In the application, there is a quiz of several questions related to the material at the end of each material content. To answer these questions, students process the data obtained from the content provided. Then students can see the results in the form of scores they get and the answers to these questions.
e) Proof Stage
   To find out the results of the findings and learning outcomes of students, proof is needed by discussion and discussion with the teacher. Discussions can be carried out through chat or forums in the media.
f) Conclusion Stage
   At the end of learning, each student must fill in the conclusions of the learning that has been carried out through forums available in the media.

After completing the learning process along with the pretest posttest, students are given questionnaires regarding student responses to learning media that have been used during learning.

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### 3.3. Evaluation Phase

At this stage, pretest and posttest tests are carried out using 40 question instruments. The pretest test aims to determine the level of creativity of students' initial thinking before the implementation of learning with the help of learning media After the pretest is carried out, then learning is carried out using learning media about logic gates. After all the material is delivered, a Posttest is then carried out to determine the increase in students' thinking creativity towards logic gate material. The results of increasing students' thinking creativity can be seen in **Figure 2**.

a) Student Test Data Results

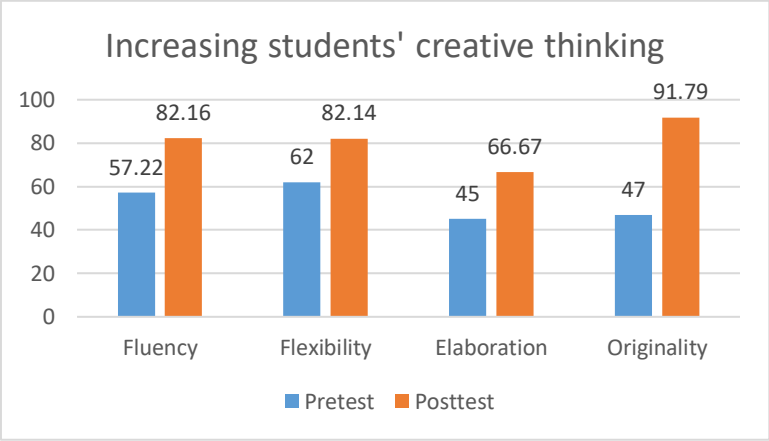


**Figure 2**. Increased Creativity of Student Thinking

The result is that most students experience an increase in thinking creativity. At the time of pretest the fluency indicator was 57.22, flexibility was 62, elaboration was 45, and originality was 47. And at the time of posttest the fluency indicator was 82.16, flexibility was 82.14, elaboration was 66.67, and originality was 91.79.

The improvement in learning outcomes is seen based on the grouping of upper, middle, lower categories then the calculation of the average n-gain for each group is carried out. The results can be seen in **table 3**.

**Table 3.** Pretest and Posttest results based on gain.

| No. | Respondent | Grade | | N-gain Value | Group (based on N-gain) | Average n-gain per Group |
|---|---|---|---|---|---|---|
| | | Pretest | Posttest | | | |
| 1 | Student 1 | 71 | 85 | 0,48 | | |
| 2 | Student 2 | 70 | 85 | 0,50 | | |
| 3 | Student 3 | 68 | 80 | 0,38 | Upper | 0,49 |
| 4 | Student 4 | 66 | 86 | 0,59 | | |
| 5 | Student 5 | 65 | 83 | 0,50 | | |
| 6 | Student 6 | 63 | 85 | 0,60 | Middle | 0,54 |
| 7 | Student 7 | 63 | 83 | 0,53 | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | Student 8 | 63 | 78 | 0,40 | | |
| 9 | Student 9 | 60 | 79 | 0,47 | | |
| 10 | Student 10 | 60 | 80 | 0,50 | | |
| 11 | Student 11 | 60 | 84 | 0,59 | | |
| 12 | Student 12 | 59 | 78 | 0,45 | | |
| 13 | Student 13 | 58 | 80 | 0,53 | | |
| 14 | Student 14 | 56 | 83 | 0,60 | | |
| 15 | Student 15 | 56 | 80 | 0,54 | | |
| 16 | Student 16 | 56 | 79 | 0,51 | | |
| 17 | Student 17 | 56 | 83 | 0,60 | | |
| 18 | Student 18 | 55 | 78 | 0,50 | | |
| 19 | Student 19 | 54 | 80 | 0,57 | | |
| 20 | Student 20 | 54 | 75 | 0,46 | | |
| 21 | Student 21 | 54 | 79 | 0,54 | | |
| 22 | Student 22 | 53 | 76 | 0,50 | | |
| 23 | Student 23 | 49 | 83 | 0,66 | | |
| 24 | Student 24 | 49 | 75 | 0,51 | | |
| 25 | Student 25 | 49 | 81 | 0,63 | | |
| 26 | Student 26 | 48 | 78 | 0,57 | Lower | 0,65 |
| 27 | Student 27 | 46 | 81 | 0,65 | | |
| 28 | Student 28 | 43 | 85 | 0,74 | | |
| 29 | Student 29 | 41 | 84 | 0,72 | | |
| 30 | Student 30 | 40 | 75 | 0,58 | | |
| | Average | 56,04 | 80,54 | 0,55 | | 0,56 |

Based on the table above, there is an increase in students' posttest scores after using learning media compared to the scores obtained before learning with learning media as evidenced by the difference between the average pretest score and the average posttest score of 80.54.

The highest gain value from the pretest-posttest results was obtained by the "Lower" class, which was 0.65 which was categorized into a moderate increase in gain, for an increase in the "Middle" class was categorized as medium with a gain value of 0.54. While the increase for the upper class only obtained a gain value of 0.49 in the medium category. The overall gain value of 0.55 is categorized as “Medium”, and for the average gain value per group, a gain value of 0.56 is also categorized as “Medium”.

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b) Results of Student Responses to multimedia

Student responses to learning using interactive multimedia web-based learning are obtained from the student response instrument given to students in the experimental class made based on LORI (Learning Object Review Instrument).

For the results of media validation by students, validation scores from design aspects were obtained by 80%, ease of interaction by 80%, accessibility by 88%, learning by 83.86% and motivation by 77%. From these five aspects, a percentage of 84.69% can be interpreted that the treatment that has been carried out is included in the "Very Good" category.

## 5. CONCLUSION

Based on the results of the research that has been carried out and the discussion that has been described, it can be concluded that the research on the Application of Microlearning Learning based on Interactive Multimedia with the Discovery Learning model is to increase the creative of thinking of vocational high school students.

Research using the Discovery Learning learning model applied in interactive multimedia-based Microlearning learning on the web and is expected to increase student creative thinking as evidenced by pretest and posttest. The results obtained are that most students experience an increase in creative thinking. At the time of pretest the fluency indicator was 57.22, flexibility was 62, elaboration was 45, and originality was 47. And at the time of posttest the fluency indicator was 82.16, flexibility was 82.14, elaboration was 66.67, and originality was 91.79. Overall, the increase in students' thinking creativity after using this learning media has an average gain value of 0.56 which can be interpreted as a moderate level of effectiveness. Therefore, it can be concluded that the influence of the Discovery Learning model applied in web media on increasing students' thinking creativity in logic gate material is “Medium”.

Students' responses to learning media also showed a good results. Responses were collected using questionnaires referring to LORI (Learning Object Review Instrument) consisting of Presentation Design (Persentation Design), User Interaction (Interaction Usability), Accessibility (Accessibility), Learning (Learning Goal Alignment) and Motivation (Motivation). The results of student responses to this media resulted in an average presentation design of 88%, user interaction of 86.6%, accessibility of 88%, learning of 83.6% and motivation of 77%.

## 6. AUTHORS’ NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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