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Implementation of the Guided Discovery Learning Model Using Web-Based Learning Media to Improve Vocational School Students' Cognition

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ABSTRACT

Database subjects are considered difficult to understand because they are abstract and require students to learn, master, and understand the concepts of the subjects being taught. This study aimed to understand how the application of the guided discovery learning model using web-based learning media can improve the cognitive abilities of vocational students. The research method used is the Smart Learning Environment Establishment Guideline (SLEEG) and the pre-experimental research design type is one group pretest-posttest. The research subjects used were students of class XI RPL 1 at SMK Bina Wisata Lembang. The results obtained from this study through the calculation of the gain test resulted in an average gain of 0.50 and included the medium effectiveness criteria. Students respond to learning media with a percentage value of 85%, where this number is included in the very good category. So, the end of this study concluded that web-based learning media with the Guided Discovery Learning model can improve the cognitive skills of vocational students in database subjects.

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1. INTRODUCTION

Students are considered to have the most important position in the classroom. Thus, the educational process must support students to develop themselves naturally and effectively. The teaching process must be available anywhere and at any time and must be collaborated with by society, including parents, guardians, and others, to increase student potential (Petchtone et al., 2012).

Almost all aspects of the use of computer equipment in an organization or company are related to databases because databases are one component in every information system, and no information system can be created and run without the use of databases. Designing a database is very necessary because, by designing the database, the computerized system will avoid data anomalies (Khotijah, 2016).

A database is one of the productive subjects that needs to be mastered by students at the secondary level, especially in the vocational school of the Software Engineering skills program. This is an abstract material, so it requires intermediary media to create a good data model. Not a few students find it difficult to learn database lessons. The learning difficulties experienced by students in database lessons are in understanding material concepts, difficulty collaborating and interacting, as well as difficulties in problem-solving (Dahri, 2018).

Learning difficulties experienced by students can certainly influence student learning outcomes, both from a cognitive, psychomotor, and affective perspective. For vocational school students, cognitive abilities are also needed to provide a basis for students' understanding. The cognitive or knowledge domain receives more attention in the assessment of teachers in schools because the cognitive or knowledge domain is considered the domain most related to students' ability to master the content of teaching materials. The scores obtained by students become a reference for students' mastery of receiving lesson material (Fiteriani & Baharudin, 2017).

One learning model related to student activity and understanding that can be applied is the guided discovery learning model. Discovery learning has the advantage of making students more active in learning and being able to truly understand the concepts that have been studied, and the answers obtained will make students feel satisfied (Purwanto et al., 2012). According to Mayer, guided discovery learning is a learning model that aims to train students to discover concepts independently. Students play an active role in the learning process by answering various questions and solving problems to discover a concept. In the guided discovery learning model, the teacher presents various examples, guides students to find patterns in these examples, and provides conclusions when students can describe the ideas they have learned (Sulistyowati et al., 2012). Previous research also states that the application of the guided discovery learning model is the most effective in facilitating students to acquire knowledge (Akinbobola & Afolabi, 2010).

In implementing the guided discovery learning model, media is needed to support all stages of learning. The use of learning media can not only help teachers carry out learning but also help students understand the learning objectives better. Using web-based learning media makes it possible to support all stages of learning in the guided discovery learning model. Web-based learning itself is also often identified with e-learning, apart from using computers as a learning tool. It also utilizes the internet network to be able to access learning material regardless of time and place if it is connected to the internet network. The learning atmosphere of web-based e-learning will encourage students to play a more active role (Prasetio et al., 2012).

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Based on the explanation above, the aim of this research is to implement a guided discovery learning model using web-based learning media to improve vocational school students' cognition of database material. As the aim of this research, research contributions are needed to assist in the research process. The research contribution consists of learning design and learning media web, implementation of learning media using the guided discovery learning model, improving learning outcomes, and student responses to learning media. This paper begins with an introduction, followed by literature reviews and references that form the background of the research. After that, it continues with research methods, which discuss research procedures and data analysis. Then the results of the research are presented in the results and discussion. Finally, it ends with a presentation of the conclusions of the research.

2. METHODS

This research was carried out to find out the students' cognitive improvements after implementing the web-based guided discovery learning model. The methodology used in this research is the Smart Learning Environment Establishment Guideline (SLEEG) method. This research method is used because it aims to produce a product in the educational sector as well as test the effectiveness of the product. In this research, the solution to the problems described will be in the form of web-based learning media.

2.1 Research Design

The type of research design used in this research is a pre-experimental design with a one-group pre-test and post-test design. In this design, there is a pre-test before the treatment is given, and then after that, the post-test is given. Therefore, the results of the treatment can be known more accurately because they can be compared with the situation before the treatment was given. The design can be described as seen in **Table 1**.

Table 1. One-Group Pretest-Posttest Experimental Design.

Pretest	**Treatment**	***Posttest***
O_1	X	O_2

Information:
O1 : Pretest Score
X : Treatment
O2 : Posttest Score

This research consists of several steps or stages. The stages of the research process are shown in **Figure 1**.

2.2 Population and Sample

The population in this study were class XI students of the Software Engineering Skills Program (RPL) at SMKN Bina Wisata Lembang. The sample is part of the characteristics and numbers found in the population where the sample is used to represent the population. This research uses a purposive sampling technique to determine samples with certain considerations so that the sample selected is in accordance with the problem that has been explained. The number of samples in this research was 30 students, and then the research object was determined, namely improving student cognition on vocational school-level database material in the RPL Skills Program.

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2.3 Research Procedure

This research consists of several steps or stages. The stages of the research process are shown in **Figure 1**.

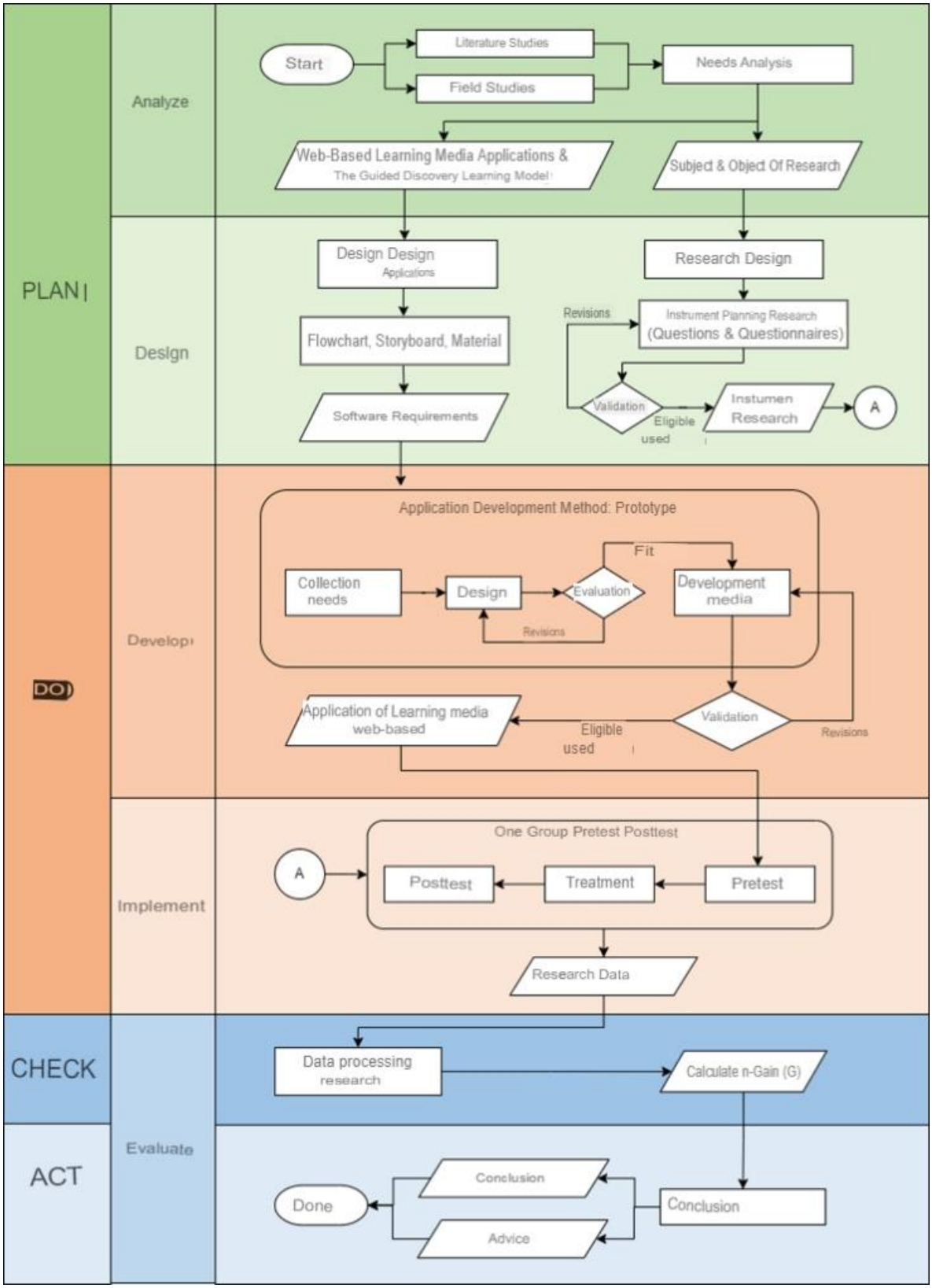

Figure 1. Research Procedure.

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2.4 Research Instruments

The research instruments used in this research are as follows:

(i) Material and media expert validation instruments created based on the Learning Object Review Instrument (LORI) (Nesbit *et al*., 2009)

(ii) Pre-test and post-test question instruments in multiple-choice form

(iii) Student response instruments created based on the Technology Acceptance Model (TAM)

2.5. Data Analysis Technique

Media and material expert validation instrument data tests, as well as student response instruments, will be analyzed using a rating scale with answer options using a Likert scale. Meanwhile, for the student test instrument, the pre-test and post-test questions were tested first on students and then analyzed using validity tests, reliability tests, difficulty level tests, and discrimination tests. From the results of the data analysis, questions will be obtained that will be used in the pretest and posttest. Next, the results of the students' pre-test and post-test will be analyzed using the n-gain test to obtain conclusions about the results of the tests. The following formula for calculating n-gain and the results of calculating the gain value can be classified in Equation 1 and Table 2 (Hake, 1998).

$$G = \frac{skor\ posttest - skor\ pretest}{skor\ maksimum - skor\ pretest}$$

Equation 1.

Table 2. Gain index classification.

G Value	Criteria
G < 0.3	Low
0.3 ≤ G ≤ 0.7	Medium
G < 0.7	High

3. RESULTS AND DISCUSSION

3.1 Analysis Stage

In the beginning, literature studies and needs analysis are carried out to meet the initial requirements before producing the web-based learning media that apply the guided discovery learning model. Researchers also collected data regarding the field conditions through teacher interviews to identify needs and problems in designing and implementing this learning medium.

3.2. Design Stage

Based on the results of the needs analysis, the database materials that will be used are ERD, DDL, and DML in accordance with the basic competencies of this subject. Next, the material will be arranged well and orderly and will be made into text, slides, and videos. The learning materials will then be validated by material experts to assess their suitability. The media developed in this research is Moodle-based. This medium will first define functional and non-functional requirements and limitations on the medium to determine software requirements. To assist the development process, flowcharts, storyboards, and use case diagrams were created that describe the application process. Following that, the user interface design is created to be an initial description of the user interface for the application that will be used.

3.1. Development Stage

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In this stage, the learning medium is developed based on flowcharts and storyboards. The other required kinds of equipment that were already created at the design stage, as well as instruments that have been validated by experts, are added to the media. At this stage, there is also a development process that produces a structured web from the login, learning, and logout processes. The first step is preparing and installing the software. The next step is to carry out media development by including material content in the form of videos, text, slides, and questions that have been prepared in the previous stage. Afterward, several activities were added based on the stages of the guided discovery learning model. Furthermore, black box testing is carried out to find out whether the functional parts of the application are as expected or not. Finally, after the media had been developed and went through several revisions, an assessment by media experts was obtained of 91.4%, which was included in the 'Very Good' category.

3.2. Implementation Stage

At this stage, the researcher carried out an implementation that began with a pre-test to determine students' initial understanding abilities. The students then learned using a web-based learning media application with a guided discovery learning model (GDLEARN). At the end of each meeting, it always ends with a brief evaluation of the material discussed. After the learning process was finished, a post-test was given to find out the extent of students' understanding after learning. In the end, responses to learning media were collected from the students in class XI at SMK Bina Wisata Lembang.

The pretest and posttest questions each consisted of 20 multiple-choice questions related to ERD, DDL, and DML material. The following is the application of the guided discovery learning model to learning using the GDLEARN media application.

3.2.1. Stimulus level

At this stage, the teacher asks several questions and tells stories by showing several examples and videos.

3.2.2. Problem Identification Stage

The teacher is presented with a description of a problem that will be studied and the problems that will be answered to draw conclusions at the last stage.

3.2.3. Level of Data Collection

To fulfill this stage, the application provides material content in the form of videos, slides, and text as material for students to learn.

3.2.4. Data Processing Stage

In the application, there is a quiz with several questions related to the material at the end of each. To answer these questions, students process the data obtained from the content provided. Then students can see their results and solutions to the answers to these questions. Apart from that, students can also repeat the quiz again to improve their understanding of the learning material.

3.2.5. Level of Evidence

Proof is required through discussion and conversation with the teacher to determine the results of students' discoveries and learning outcomes. Discussions can be carried out via chat or forums in the media.

3.2.6. Conclusion Level

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At the end of the lesson, 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 pre-test and post-test, students are given a questionnaire regarding their responses to the learning media that have been used during the learning.

3.3. Evaluation Level

At this stage, the researcher processed the data results from the pretest, post-test, and student response questionnaires from the implementation stage. Then, based on the results obtained from this instrument, researchers will find out the advantages and disadvantages of this web-based learning medium, which will be used as a recommendation for further research. In addition, the researcher draws conclusions based on the data obtained from all stages of the research and provides suggestions on aspects of the research that can be used as input in the process of developing better web-based learning media.

3.3.1. Student Test Data Results

Based on the experiments that have been carried out, pretest and posttest data were obtained. The results of comparing the average pretest and posttest scores are used to calculate n-gain. N-gain was carried out to determine the increase in students' understanding of learning using media. The data obtained was divided into several group boundaries, namely lower, middle, and upper. Then the average n-gain was calculated for each group. The results can be seen in **Table 3**.

From the data above, it was found that there was an increment in students' post-test scores after using learning media compared to the scores obtained before learning with learning media. It is proved by the difference between the average pre-test score and the average post-test score, namely 29.5, with a percentage increase of 74%, as seen in Table 3. The highest gain value from the pre-test and post-test results was obtained by the "Upper" class, namely 0.58, which is categorized as a moderate gain increase. While the increase in the "middle" class was categorized as medium with a gain value of 0.51, the increase in the lower class obtained a gain value of 0.42 in the "medium" category. So, we get an overall average gain value of 0.50, which is categorized as "medium".

Table 3. Gain Test Results Data.

No	Respondent	*Pretest* Score	*Posttest* Score	n-Gain	Group	Gain Average
1	R16	60	80	0.50	Upper	0.58
2	R21	60	90	0.75		
3	R27	60	85	0.63		
4	R1	55	75	0.44		
5	R22	55	80	0.56		
6	R6	50	85	0.70	Middle	0.51
7	R11	50	70	0.40		
8	R12	50	65	0.30		
9	R23	50	85	0.70		
10	R9	45	75	0.55		
11	R13	45	65	0.36		
12	R17	45	80	0.64		
13	R30	45	70	0.45		
14	R7	40	60	0.33		
15	R18	40	75	0.58		
16	R19	40	80	0.67		

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No	Respondent	*Pretest* Score	*Posttest* Score	n-Gain	Group	Gain Average
17	R20	40	65	0.42		
18	R2	35	70	0.54		
19	R15	35	60	0.38		
20	R26	35	75	0.62		
21	R29	35	75	0.62		
22	R4	30	60	0.43		
23	R8	30	70	0.57		
24	R28	30	55	0.36		
25	R5	25	45	0.27	Lower	0.42
27	R24	25	65	0.53		
28	R3	20	55	0.44		
29	R10	20	60	0.50		
30	R25	20	50	0.38		
	Average	**39.83**	**69.33**	**0.50**		

3.3.2. Student Response Results

At this stage, the researcher reviews the responses from the results of student assessments of the learning media that the researcher has created. After learning using media with a guided discovery learning model, students are given a questionnaire with student response instruments created based on the Technology Acceptance Model (TAM) to see student responses to the media.

From the results of the responses to the Perceived Usefulness aspect, they got an average rating of 128 with a percentage of 82.67% included in the "Very Good" category. In the Perceived Ease of Use aspect, they got an average rating of 131, with a percentage of 85% included in the "Very Good" category, then the Attitude aspect got an average rating of 127.3 with a percentage of 82% in the "Very Good" category, and finally the Intention to Use aspect got an average rating of 126.3 with a percentage of 81.67%, which is in the "Very Good" category. Overall, a percentage of 83% was obtained from these four aspects, which can be interpreted as meaning that the treatment that has been carried out is included in the "Very Good" category (see **Figure 2**).

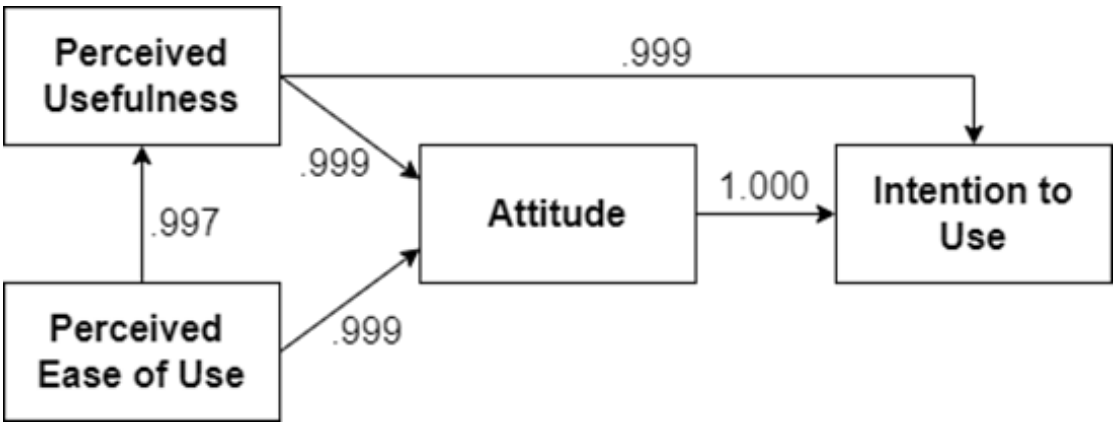

Figure 2. Correlation of TAM Aspects.

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4. CONCLUSION

Based on the results of research that has been conducted regarding the implementation of the guided discovery learning model using web-based learning media to improve vocational school students' cognitive abilities in database material, it was concluded that there was an increase in students' understanding or cognitive abilities after using this learning medium with an average gain value of 0.50, which can be interpreted as a level of effectiveness that is classified as "medium". Then, based on the results of student responses to the learning media used in the guided discovery learning model, the overall average percentage was 85%, which is in the "Very Good" classification.

5. 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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