Improving student understanding in web programming material through multimedia adventure games

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Abstract. This study aims to make multimedia adventure games and find out the improvement of learners’ understanding after being given treatment of using multimedia adventure game in learning Web Programming. Participants of this study are students of class X (ten) in one of the Vocational Schools (SMK) in Indonesia. The material of web programming is a material that difficult enough to be understood by the participant therefore needed tools to facilitate the participants to understand the material. Solutions offered in this study is by using multimedia adventure game. Multimedia has been created using Construct2 and measured understood with method Non-equivalent Control Group Design. Pre-test and post-test has given to learners who received treatment using the multimedia adventure showed increase in understanding web programming material.

1. Introduction

Based on the results of field studies in one of the vocational schools in Indonesia, it was revealed that of the 27 students of class X who received a questionnaire, 11 students chose Web Programming subject as difficult vocational subjects, 7 students chose Basic Network, and the remaining students chose other subjects. It can be concluded about 31% of students have difficulty in web programming subject. This is reinforced by the data obtained based on interviews with one of the educators in the SMK that mentioned the subjects of web programming is one of the subjects difficult to understand by students. It shows that there are obstacles experienced by learners in the process of understanding the material in learning web programming. Referring from the questionnaire on web material considered difficult by the students, of 27 respondents, 10 respondents chose Table material, 10 respondents chose Form material and the other students chose other materials.

To improve the quality of learning, one of the aspects to consider is the use of technology and media in the learning process. One of the benefits of multimedia is to make it easier for learners to understand the material about computer instructions [1].

The use of multimedia in learning will make the students better understand the deeper material [2]. Learning media using games will provide tremendous motivation and potential in education [3]. The selection of multimedia for to children, adolescents and adults will certainly be different. Teenage students generally enjoy things related to games.

The use of adventure games for education has been discussed by several researchers (see Table 1).
Table 1. Implementation of Adventure Games on References

| Objectives                                      | References |
|------------------------------------------------|------------|
| edutainment application                        | [4]        |
| Learning arithmetic                             | [5]        |
| Introducing Music Interval and Ear Training     | [6]        |
| The education of natural disaster               | [7]        |
| Applied in E-Learning                           | [8]        |
| virtual biology laboratory                      | [9]        |

It can be concluded that the problems highlighted in this study is that in an effort to improve the quality of education, especially in terms of learning process, it is necessary to make a learning process that can attract attention and increase the motivation of learners. One of the solutions offered in this study is learning using multimedia on adventure game.

2. Methods
As aforementioned, this study aims This study aims to make multimedia adventure games and find out the increase in learners’ understanding after being given treatment of multimedia adventure game in learning Web Programming. The stages are presented in the following Figure 1.

![Figure 1. Chart of model construction](image)

The research consists of 2 stages are make multimedia adventure games and measure understanding student after using multimedia adventure games. The first stage to make multimedia adventure games using the application construct 2 then the media that has been made in the validation by the media expert.
The results of the media expert determine whether the media can be implemented to students on the web programming material. The second stage is measuring the improvement of students' skills by using methods Nonequivalent Control Group Design, measurement of students understanding using pretest and posttest to experiment and control class, the result of evaluation is then analyzed by using statistical method.

3. Results and Discussion
The learning multimedia was made based on the needs analysis, flowchart and storyboard made in the previous phases. The software used in the development of the learning multimedia was construct 2. This stage included the creation of multimedia interfaces in accordance with the needs that had been previously analyzed and tested on the feasibility.

3.1. Interface of learning multimedia based on adventure game
The interface and multimedia developed are as follows:

3.2. Multimedia feasibility test
After the multimedia had been completed then the multimedia feasibility test was conducted.
The test was divided into two, namely the feasibility test by media experts and by material experts. As for the test results by 3 media experts are as follows:

**Table 2. Media Feasibility Test Results**

| No | Aspect              | Items | Ideal Score | Score | %     |
|----|---------------------|-------|-------------|-------|-------|
| 1  | Presentation Design | 3     | 15          | 12    | 80    |
| 2  | Ease of Interaction | 3     | 15          | 13    | 86.67 |
| 3  | Accessibility       | 2     | 10          | 9     | 90.00 |
| 4  | Reusable            | 1     | 5           | 5     | 100   |
| 5  | Compliance Level    | 1     | 5           | 4     | 80    |
|    | Rata-rata           |       |             |       | 8.6   | 87.33 |

From these results then the data is translated using the interpretation scale as follows:

![Figure 8. Interpretation Scale](image)

The three media experts assessed that the multimedia was between the categories of "Good and Fair", but closer to Good. Then, the results of feasibility test conducted by two material experts are as follows:

**Table 3. Feasibility Test Results by Material Experts**

| No  | Aspect                | Items | Ideal Score | Score | %      |
|-----|-----------------------|-------|-------------|-------|--------|
| 1   | Quality of content    | 4     | 40          | 33    | 82.50  |
| 2   | Objective conformity  | 14    | 140         | 131   | 93.57  |
| 3   | Feedback              | 1     | 10          | 9     | 90.00  |
| 4   | Reusable              | 1     | 10          | 9     | 90.00  |
|     | Average               |       |             |       | 45.50  | 89.01  |

The two material experts of stated that are multimedia was categorized as between "Very Good and Good" but closer to Good.

Implementation phase was conducted in one of the Vocational Schools in Indonesia by taking a sample of two classes not randomly selected. Of the two selected classes, the experimental class received treatment of learning by using the learning multimedia adventure game, while the control class received conventional learning with multimedia PowerPoint.

The results of this study are presented by their respective classes. The number of respondents from each class is the same, i.e. 28 respondents. The results of the tests of the classes are as follows:

**Table 4. Test Results of Control Class**

| Class  | Pre-test       | Post-test      |
|--------|----------------|----------------|
|        | Highest Score  | Lowest Score   | Mean | Highest Score | Lowest Score | Mean |
| Control| 16             | 3              | 9.64 | 20            | 9            | 12.96 |
| Experimental | 14         | 4              | 9.5  | 24            | 13           | 17.32 |
Table 5. Normality Test of the Pretest

| Class     | Score | Critical Limit | Distribution |
|-----------|-------|----------------|--------------|
| Experimental | 0.071 | 0.05           | Normal       |
| Control   | 0.741 | 0.05           | Normal       |

Based on pretest results, the control class and experimental class’s data are normally distributed since in each class the significant value of 0.05 is smaller compared with the value obtained. The posttest results are also normally distributed. The result on posttest is as follows:

Table 6. Normality Test of the post-test

| Class     | Score | Critical Limit | Distribution |
|-----------|-------|----------------|--------------|
| Experimental | 0.229 | 0.05           | Normal       |
| Control   | 0.578 | 0.05           | Normal       |

The homogeneity test was done using SPSS version 23. The results are as follows:

Table 7. Homogeneity Test Results

| Type   | Score | Critical Limit | Homogeneity |
|--------|-------|----------------|-------------|
| Pretest | 0.728 | 0.05           | Homogenic   |
| Posttest | 0.684 | 0.05           | Homogenic   |

Table 8. Test Results of Difference of Means

| Type   | t Table Value | t Count Value | t Table Value | Decision |
|--------|---------------|---------------|---------------|----------|
| Pretest | -2.00         | 2.95          | 2.00          | Different|
| Posttest | -2.00         | -119.59       | 2.00          | Different|

From Table 8 it can be seen that both the means of pretest or posttest in the two classes are different. Only that in pretest, t count is larger than t table (2.95>2.00) hence there is difference between control and experiment class means, and since the t value is positive hence then the pretest mean of the control class is larger than the mean of the experimental class. Meanwhile, t count value of the posttest is smaller than the -t value of the table (-119.59 <-2.00) then there is difference between the two classes. The t value of control class’ mean is smaller than of the experimental class.

The gain index analysis is used to determine the improvement of learners’ learning outcomes using the multimedia adventure game compared with learners who received conventional learning with multimedia PowerPoint. The results of the gain index analysis are as follows:

Table 9. Results of Gain Index Analysis

| Class     | Ideal Score | Pretest Mean | Posttest Mean | Average Gain |
|-----------|-------------|--------------|---------------|--------------|
| Control   | 30          | 9.64         | 12.96         | 0.22         |
| Experimental | 30          | 9.5          | 17.32         | 0.50         |

Based on Table 9 It can be concluded that the gain value of the experimental class is larger than the control class gain value.

4. Conclusion
Based on the results, it can be concluded that from the observation instrument the application of the learning multimedia adventure game ran well and the multimedia was feasible to be applied in the learning process, the increase of the learners’ extrapolative understanding in learning Web Programming after using the developed learning multimedia is in the medium category. This is based
on the gain value of 0.50 (medium) obtained from the results of the gain index analysis against pretest and posttest in the experimental class.

5. References
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