Articel, Mobile Learning Media for ComputerScience Course 2018

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Mobile Learning Media for Computer Science Course

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Abstract-"Data Structure" is of course an important area of knowledge in computer science, especially in computer programming. The impact of education and learning from this course is very important for computer software and hardware design and development. However, some students find it difficult to understand data structure knowledge and skills. Thus, after years of our teaching theory, the use of educational and learning technology media for smartphone-based data structures discussed in this paper. Learning media content contains learning concepts and theories, code and program scripts for each learning content, and visualized in animation. In our educational practices, we find that students' enthusiasm is aroused and the quality of learning achievement and learning efficiency increases.

Keywords—data-structure, mobile-learning, media, student

I. INTRODUCTION

In computer science terms, a data structure is a way of storing, compiling and managing data in a computer storage media so that the data can be used efficiently. In the application to programming techniques, the data structure means the layout of data that contains data columns, be it columns that appear by users or columns that are only used for user invisible programming purposes [1].

The importance of learning data structures and algorithms is that choosing the right data structures and algorithms can make the program more efficient, easy, and elegant. Besides that, another reason to study the data structure is to analyze the advantages and disadvantages of each data structure [2]. With a good data structure selection, complex problems can solved, so that algorithms can be use efficiently, important operations executed with smaller memory resources and faster execution times.

The data structure is one of the courses that get more attention from the Computer Science Lecturer and students. because this course is a lot of students make a failure in learning [3-4]. Various approaches methods, strategies, pattern, and technologies have used as a lecturer, but have not been able to be an appropriate solution to be generally applicable [3], [5].

Approach to various methods in an effort to increase motivation and quality of the learning process is very necessary for a lecturer to overcome Student Learning difficulties. One approach is to develop mobile learning media.

In our previous research, we have designed an instructional framework that focuses on visualizing contents media of data structures course [3], has measured availability of mobile networks for mobile learning tools [6], Measurement quality of service for mobile internet services [7], Comparison of TCP variants in Long Term Evolution (LTE) [8], and the performance rate for implementation of mobile learning in networks [9]. Assessment of user perceptions of mobile internet services performance [10], and [11] Broadband quality of service experience measuring mobile networks from consumer perceived.

This paper will discuss mobile learning media and the effect of using applications on student learning outcomes. The expected contribution of this studies to informed about the importance of mobile learning media as one approach method, to be a solution to student learning difficulties, will stimulate the spirit of student learning to learn to be easy and fun, stimulate student enthusiasm and efforts to improve the quality of achievement optimization learning(learning outcomes) and increased learning efficiency.

II. RELATED WORK

A. Mobile Learning App for Data Structure Course

Mobile learning media for data structure subjects it was develop by the author in an effort to help solve the problem of student learning difficulties in the learning process.
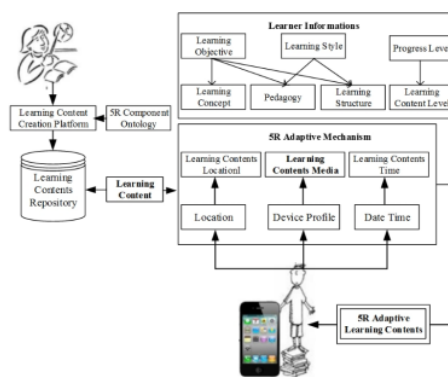

Fig. 1. Architecture of the development framework adopted from [12]

The mobile learning media Structure Data course we design based on syllabus / learning material, presentation of visualized content with dynamic examples and animations. Mobile learning media contains; concepts and theories, examples of code and algorithms, and visual animation. As in "Fig. 1" is the architecture of the development framework adopted from [12]. Furthermore, the mind-map contents of the material mobile learning media presented in "Fig. 2.
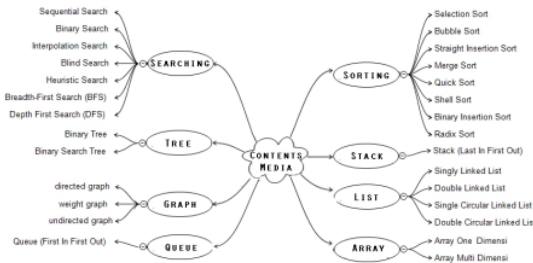

Fig. 2. Mind-map contents of the material in the mobile learning media.

B. The Student Learning Outcomes

The Learning Outcomes are an explicit description of what a learner should know, understand and be able to do as result of learning [13]. The student learning outcomes on the object of research have decreased of the value of learning at the end of the lecture many students who have failed in the course learning process [14]. The large number of students who fail to follow this course will affect the quality of learning.

The low student learning outcomes in each year in the informatics department are presented in TABLE I.

TABLE I. THE STUDENT LEARNING OUTCOMES FOR 2 ACADEMIC YEARS

Academic Year	Grade					Sum
	A	*B*	*C*	*D*	*E*	
2015/2016	11	32	87	79	18	227
2016/2017	22	20	45	81	9	177

ᵃ Source: Academic Information System

III. RESEARCH DESIGN AND METHODOLOGY

This study requiring design and development of mobile learning tool for data structure courses intended for an Undergraduate Degree of informatics engineering class, the tool it designed with the initial objective of creating an instructional assistant for the students of the Informatics Engineering course at Mulawarman University. The ultimate goal is to develop and implement the mobile learning based on Android as a learning resource to support in an effort to increase student interest and creativity in learning of data structure courses.

A. Research Methodology

Research methodology in the paper uses of approaches educational Research and Development (R&D), to develop and validate mobile learning. The steps of this process are referred to as the R & D cycle, which consists of studying research findings pertinent to the product to be developed, developing the product based on the finding, field testing it

in the setting where it will be used eventually, and revising it to correct the deficiencies found in the field testing stage. Indicate that the product meets its behaviorally defined objectives [13].

B. Research Design

The design of this research using Quasi-Experimental Design [15]. The research design begins by determining the population and selecting samples from the existing population with Cluster Purposive Sampling. In the design, there are two groups are each chosen randomly. The same material used for both groups is about Searching and Sorting, but in the experimental class used mobile learning media app, while in the control class applied conventional learning model.

TABLE II. RESEARCH DESIGN WITH CONTROL GROUP DESIGN

Group	treat	Post Test
Experiment	X_1	Test
Control	X_2	Test

C. Population and Sampling Techniques

The population in this study is all students who program the course Data Structure Academic Year 2017/2018. The population is Student Generation 2017, which consists of 4 classes i.e. class A, B, C and D. Samples taken in this research consist of 2 classes that class A as control class and class B as experiment class. The sampling technique used is a quasi-experimental design. Samples taken in this research using Cluster Purposive Sampling method.

D. Conceptual Definition

- Learning using media, learning uses this media where Lecturers use the media with the tool of Mobile Learning App to explain teaching materials.

- Conventional learning, a lesson that emphasizes the involvement of Students in Lecturer-centered activities. In conventional learning, the teacher uses several methods, such as lecture method, practice method and assignment method.

- Learning outcomes, the abilities that are owned by the Students after receiving their learning experience. Learning outcomes obtained from the Student's effort after following the learning process by using the learning result test on the subject of Searching and Sorting.

E. The Operational Definition of a Variable

In order not to give rise to multiple interpretations and to avoid misinterpretation of the terms used in this study, the following operational definitions are given:
- (X) The independent variable is a learning model using mobile learning media and Conventional Learning.

- (Y) The dependent variable is the learning outcomes of the Students of the experimental class and control class groups in the Student.

F. Data Collection Technique

Methods of data collection conducted in this research are:

- Documentation, the preliminary data on the academic ability of the Student obtained from the data of daily test results from the lecturers before the treatment is done. Daily data on the material is the initial capability, and used for the formation of the group in the learning that will take place in the class.

- The test, this data was taken after each group received treatment, using mobile learning media in the experimental class and conventional learning in the control class. The final test result data will be processed, and analyzed and then concluded whether there are differences in learning outcomes between the two treated groups.

Before the test is used as a research instrument, the test is first tested and then the item is analyzed. For the analysis of the degree of difficulty [16], [17], distinguishing, and reliability of multiple choice items [17].

G. Data Analysis Technique

- Descriptive statistics, used to describe data that is calculate the average value and standard deviation of a data. The data analyzed were preliminary test score data given in the study population, then selected two classes whose mean value of the initial test had significant differences.

- Inferential statistics, to perform hypothesis testing, first testing requirements analysis. before performing t test done first test of normality and homogeneity test two variance.

- Normality test, used to determine whether the data to be analyzed is normally distributed or not abnormally distributed, using the normality test [18]. The technique of calculating the normality test of this data using SPSS program.

- Homogeneity test, t test can be divided into two groups, t test with homogeneous variance and t test of heterogeneous variance. Homogeneous or heterogeneous variance is calculated using the F test [19].

- Hypothesis Testing, when the sample comes from population with homogeneous variance, then t test [20], [21] is used.

Statistical Hypothesis in this study using SPSS computer program, then in draw the conclusion as follows:

- If sig> α then Ho rejected, means there are differences in student learning outcomes using mobile learning media applications with Conventional Learning.

- If sig ≤ α then Ho accepted, means there are no differences in student learning outcomes using mobile learning media applications with Conventional Learning.

IV. RESULTS AND DISCUSSION

A. Initial Value Data

Based on the results of the test obtained descriptive data shown in TABLE III and TABLE IV. TABLE III, it shows that the highest value of the control group is higher than the experiment group value, and the experiment group's lowest value is higher than the control group.

TABLE III.   PRE-TEST SCORES

| Group | Data Test Value | | | |
	Average	Standard Deviation	Highest Value	Lowest Value
Experiment	53.77	9.62	75.00	34.00
Control	52.27	9.20	76.00	33.00

Based on the post-test results obtained descriptive statistics of experimental class and control group can be seen in Table IV.

TABLE IV.   POST-TEST SCORES

| Group | Data Test Value | | | |
	Average	Standard Deviation	Highest Value	Lowest Value
Experiment	81.03	11.57	98.00	55.00
Control	75.50	11.84	95.00	50.00

TABLE IV, it shows that the highest value of the experiment is higher than the control group value, and the lowest control value is lower than the value of the experimental group.

B. Inferential Analysis

- Preliminary Test Data Value Analysis

TABLE V.   TESTS OF NORMALITY

| Group | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
	Statistic	df	Sig.	Statistic	df	Sig.
Experiment after treat	.105	30	.200*	.950	30	.171
Control after treat	.155	30	.065	.939	30	.085

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Test Data Normality in TABLE V, from the test results using SPSS 24 obtained value for the test results of the initial experimental group of 0.899 because the value of sig = 0.899> 0.05 then Ho accepted. That is, the initial value data is normally distributed. While the results of the initial test of the control group obtained a significant value of 0.555 because the value of sig = 0.555> 0.05 then Ho accepted. This means that the initial test data is also normally distributed.

Data Homogeneity Test, homogeneous or heterogeneous two variance were calculated using the F test. Based on the results of manual calculations obtained: F count = 1.119, F0.05 = 1.85. Since F count <Fα then H0 is accepted i.e. the two samples of the population with homogeneous variance.

The t test used is a free two-t test that aims to compare two mean values. Based on the results of manual calculations, to determine the differences in the use of conventional learning model and learning using the media of mobile learning app in the data structure course used two-averaged test with the criteria of hypothesis given that H0 accepted [15]. $T_{table} = \pm 1.699$, $T_{count} = 0.621$.

$$-1.699 \leq t_{count} \leq 1.699$$

Because the value of T count is less than T table then H0 is accepted, this means the average of group learning result using conventional learning model there is no difference with mean of learning result using media of mobile learning app.

- Post Test Data Value Analysis

Test Data Normality in TABLE V, from the test results using SPSS 24 obtained value for the test results of the initial experimental group of 0.171 because the value of sig = 0.171> 0.05 then Ho accepted. That is, the initial value data is normally distributed. While the results of the initial test of the control group obtained a significant value of 0.085 because the value of sig = 0.085> 0.05 then Ho accepted. This means that the initial test data is also normally distributed.

Data Homogeneity Test, homogeneous or heterogeneous two variance were calculated using the F test. Based on the results of manual calculations obtained: F count = 0.955, F0.05 = 1.85. Since F count <Fα then H0 is accepted i.e. the two samples of the population with homogeneous variance.

- T test to Determine the Difference between the Experiments group and the Control group

Based on the results of manual calculations, to determine the differences in the use of mobile learning models and conventional learning on the material Searching, and Sorting, used two average difference test obtained:

T count = 1.830

T table = 1.699

Since the value of t count is more than T table then H0 is not accepted, this means the average of learning result by using mobile learning media is different with the average of learning result of conventional learning, or there is a real difference between mean of learning result by using mobile learning media with conventional learning. This difference shows that learning outcomes using mobile learning media are better than Conventional Learning Outcome this is supported by the average learning outcomes of each group, for the experimental group and the control group.
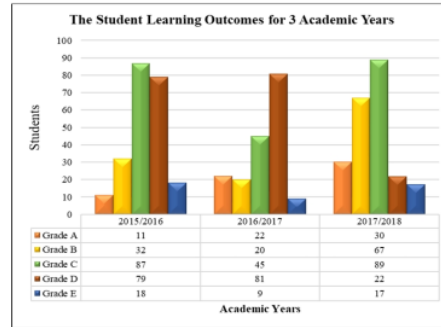

Fig. 3. Comparison of student learning outcomes for 3 academic years

Utilization Mobile-based learning technology to be one solution in helping teachers become teaching tools that can be packaged into a media of learning whenever and wherever students can use, it should be the teachers apply the mobile learning technology.

Since this year (academic year 2017/2018), we have taken advantage of mobile learning media applications that we have developed. The media influence can significantly increase to the student Learning Outcomes, particularly in the Data Structure course. Improvements in student learning outcomes are presented in "Fig. 3".

The low learning outcomes of students from year to year in the field of informatics at the university where the author teaches [14], [22], various approaches and learning models have been applied, but changes in student learning outcomes are not significant, one of the factors caused by the difficulties of Student learning in the Data Structure Course.

V. CONCLUSION

This study discusses differences in learning outcomes in the data structure between students taught using mobile learning media and conventional learning on the subject matter of Searching and Sorting Academic Year 2017/2018.

This study required 2 samples of the group, one group as the experimental class and one other class as the control group. In the Informatics department for the class of 2017 consists of 4 classes. Because it takes only 2 classes, then from 4 classes taken 2 classes by looking at the difference in the average value of the exam to be made in the experimental class and control class. From the test results in the previous material, it was found that the results showed that the experimental group and the control group came from the same initial condition, after the normality test and homogeneity test showed that both samples were normal distribution and there was no difference of variance. Then in the experimental group conducted treatment with the given mobile learning media while the control class is given the conventional learning treatment.

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experimental group and the control group came from the same initial condition, after the normality test and homogeneity test showed that both samples were normal distribution and there was no difference of variance. Then in the experimental group conducted treatment with the given mobile learning media while the control class is given the conventional learning treatment.

The learning process in the experimental group is given treatment with mobile learning media, where the students are required to take an active role in teaching and learning process. While the learning process in the control group with conventional learning, Lecturers explain about the material and Students listen to the explanation and asked if there is material that has not or less understood.

After both classes have been treated in the teaching and learning process, both groups are given a test for the evaluation of learning outcomes or final tests in the material. The average final test result obtained for the experimental group was 81.03 and for the 75.50 control group. This means the average experiment group is higher than the control group average. It is also clarified by t-test results where t-count value is 1.830 with t table 1699, because the value of t-count 1.830> t-table 1.699, means H0 rejected and Hi accepted means there are differences in student learning outcomes between conventional learning by using mobile learning media.

Based on the normality test and homogeneity test, it was found that the evaluation data of the results of the two groups, namely the experimental group and the control group are normally distributed and the variance of the two homogeneous groups. The results of the analysis show that for the experimental group obtained the probability value 0.171 with a significant level of 0.05. This means the experimental group is normally distributed. For the control class obtained probability value of 0.085 with a significant level of 0.05. This means the control group is normally distributed. For homogeneity test, based on the calculation results obtained values F count = 0.955 and F table = 1.85 with $\alpha = 0.05$. Because F count <F table it can be concluded that both groups are homogeneous.

This shows that in teaching and learning process, teachers who teach using instructional media more support in improving to the student learning outcomes, compared with teachers who use conventional learning model. Based on the results of the above discussion it can be concluded that there are differences in learning outcomes between students who were taught using mobile learning media with students taught with conventional learning. Where learning using media is better than conventional learning.

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