

## The Effectiveness of Android Based Digital Arithmetic Learning Media with Discovery-Based Learning Model to the Learning Achievement of Computer System Subject of Grade X of Multimedia Class at Vocational High School in Surakarta

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### Abstract:

The purpose of this research is to determine (1) the effectiveness of the use of learning media based on android Arithmetic Digital with discovery-based learning model to learning achievement of computer system grade X of multimedia class at vocational high school 6 Surakarta, (2) the differences in students' achievement between the control class and experimental class were given the action of using Android learning media with discovery-based learning model. The population of this research is students of grade X of Multimedia class at Vocational high school 6 Surakarta. This study uses an experimental quasi-approach. The techniques of data collection in this study using the test method to determine the results of pretest and post-test. The observation method is to know the difference of student activity of control class and experiment class. Data analysis used was non-parametric test by using Mann Whitney test and Wilcoxon rank test.

Based on the research, it can be concluded that the Android-based learning media with discovery-based learning model more effective in improving learning achievement compared with the conventional model. This is evidenced by the Wilcoxon sign rank test which gives a result of the significance of  $0.000 < 0.005$ , which means there is a difference in mean values between the two classes. The experimental class got a higher average score that is 84.14 and the control class is 67.59. The result of this research is also reinforced by student gain index analysis, with gain of experimental class that is 0,70 which mean inclination category of high learning achievement while the gain's improvement of control class is equal to 0,40 which means inclusive category of improvement in learning achievement, this matter because in the model of discovery-based learning able to improve student activeness in learning as well as to develop student's way of learning by finding their own, and self-investigate. And combined with the right learning media such as Android, will increasingly foster student interest in learning.

**Keywords:** Effectiveness, *Android*, Digital Arithmetic, discovery-based learning Model, students' achievement

## Introduction

The rapid development of Information and Communication Technology (ICT) has had an impact on various aspects of life. With the presence of ICT is able to contain various information that we can be reliable of, whenever and wherever. One of them, ICT is a very important role in education aspect. Technology in education now has an important role in the implementation of learning. According Januzweski and Molenda (2008) defines educational technology as a means of "ease of learning" learners. Matsuo and Sakat (2012) also argue that using technology-based media can improve the motivation of learning and learning to be more attractive, interesting, and fun. The new trend in the world of ICT today is Mobile Learning, which is learning by using portable media such as PC tablet and handphone. Mobile Usage Learning as a supporter of this teaching can be felt to increase sharing in teaching and learning activities.

The presence of ICT has made learning no longer centered on teachers but more focused on students learning (Anitah, 2009). Teachers are no longer a primary learning resource for students, but teachers as facilitators help students build their own knowledge. This is in accordance with the curriculum used by vocational high school 6 Surakarta at this time is 2013, in the curriculum, the teacher is not a center and students are required active in learning. In reality, however, teachers still use a conventional model that is centered on the teacher, and students have not been able to play an active role in learning. According to the teacher of the computer system at vocational high school 6, the total value of computer system of grade X students of Multimedia class who pass the minimum passing standard (KKM) is only 50% and the average score is still below KKM. In addition, teacher communication with students tends to be very less. When teachers explain, students tend to be indifferent and do not listen to the teachers. This is because the subject of the computer system in one syllabus has a material about the calculation of operation & digital arithmetic circuit, this material is less effective if only with lecture model so that learning seems boring and difficult to comprehend. Therefore, with the development of ICT, the use of Android-based learning media is considered very appropriate when used in the curriculum 2013 in computer system subjects.

Bruner said that learning will work actively, well and creatively if the teacher gives students the opportunity to discover a concept, theory, rule, or understanding through the examples he encounters in their life (Budiningsih, 2005: 41).

According to Bruner (Budiningsih, 2005), to support the learning process is required an environment that facilitates students' curiosity towards exploration, in order to make students become more active and understand the material well, then developed the Android application "Digital Arithmetic" through the application of the combined of Discovery-based learning model is expected to increase liveliness of students in learning and developing student learning by finding their own, and self-investigating. And after the researcher conducted a literature review obtained the result that there has been no research on computer-based arithmetic computer system learning based on Android, therefore held this research.

## Literature Review

Some research on relevant topics in this research such as Rahmalia Y (2014) entitled "The Effectiveness of Discovery Learning Model for Increasing Student Result at grade X in Basic Competence of Chart of Magnetism Analysis at Vocational High School 1 Pundong". The results of this research indicate that there are different results in the sphere cognitive between experiment class students and control class students using discovery-based learning. Siti Fatimah (2015) entitled "Experimentation of Learning Model of Discovery Learning and Problem Based Learning Based on Assessment For Learning on Student Learning Achievement Learning from Student Motivation Level" the result of this research shows that discovery learning model is better than problem-based learning model in improving mathematics learning achievement of students of class VIII junior high school Muhammadiyah, this result is proved by the acquisition of average score of discovery learning class discourse is 78,994 while, in problem-based learning class obtains a marginally average score of 70.235.

Other relevant research results by Yogo, Resty & Marr'atus (2015) in a national science e-journal seminar entitled "The Effect Of The Use Of Android Learning Media On The Improvement Of The Motivation Of Learning High School Students." that the application and use of Android-based learning media is very supportive of student-centered learning and encourage student interest to learn more deeply, with the experimental class research results get 0.326 gain higher than the control class that is 0.226. Yousef and Hamideh (2013) entitled "Mobile Learning for Education: Benefits and Challenges". This study shows that m-learning has benefits for education, one of which is m-learning which has the potential of a more satisfying

learning experience and increases the level of activity with letters and calculations among young people. Adrian and Setya (2017) in the IT-Edu journal entitled "Development of Learning Media of Android-Based Computer Networks to Improve Student Learning Outcomes in vocational high school Antartic Surabaya". This study shows that the learning result of students using Android-based learning media is better than the result of learning of students who do not use Android-based learning media, it is based on the analysis result obtained the average of control class is 76.4 and experimental class is 82.1. The average results from both classes indicate that the average of experiment class is higher than the control class by the difference of 5.7. The result of t-count is 2.36 with p-value = 0.021 smaller than the critical limit is 0.05 indicates a significant difference in the average of the two classes.

## Research Method

This study used a quasi-experimental approach (Campbell, D.T., & Stanley, J.C. (1963)) with the pretest and post-test types. Quasi-experiments are approaches that aim to reveal causal relationships by involving the control group in addition to the experimental group, but the separation of both groups is not by random technique.

This study used two classes as an experimental class and control class with a total sample of 29 students in each class. In the experimental class utilizing android-based learning media with discovery-based learning model in learning and in control class utilize conventional model in the learning process. Research topics about the comparison of learning model with the utilization of android application of Digital Arithmetic.

## Result and Discussion

**Table 1. The average of pretest and posttest**

Class	Pretest Average	Posttest Average
Experiment	45,86	84,14
Control	45,34	67,59

Based on Table 1. The experimental class learning achievement was using Android-based learning media and discovery-based learning model, giving the average result of pretest value of 45.86 and the value of post-test 84.14. In the control class which uses the conventional model got the average score of pretest 45.34 and post-test score is 67.59.

## Hypothesis Test Result

### Hypothesis Test 1 : There is a Difference in Student Learning Achievement on Computer System Subjects Between the Experiment Class and Control class

The first hypothesis aims to determine differences in student achievement between learning media based on android discovery-based learning model with the conventional model. The technique of taking data on this first hypothesis is using Mann Whitney test.

The results of the first hypothesis testing: the hypothesis is accepted when sig < 0.05 while the hypothesis is rejected if sig > 0.05.

Research Question 1: Is there a difference in learning achievement between students using Android-based learning media model of discovery-based learning with the conventional model?

Hypothesis 1: There is a difference between students using learning media based on Android discovery-based learning model with the conventional model.

**Table 2. Hypothesis test 1 result**

Group	N	P(sig)	Significance level	Information
Experiment	29	0,000	0,05	H <sub>1</sub> accepted
Control	29			H <sub>1</sub> accepted

Based on Table 2, the result of the analysis using Mann Whitney test on post-test value of both classes obtained sig value  $0,000 < 0,05$ . So the hypothesis is accepted. So it can be concluded that there are differences in learning achievement between experimental class using android-based learning media and discovery-based learning model with control class using the conventional model. This is reinforced by the average score of post-test results of both classes had a quite different learning achievement improvement that is the experimental class gets an average yield of 84.14 whereas, the control class gets an average result of 67.59.

### Hypothesis 2 Test: The Effectiveness of Android-Based Digital Arithmetic Learning Media with Discovery-based learning model Improving Student Learning Achievement in the Computer System Subject of Grade X of Multimedia Class of vocational high school 6 Surakarta

The second hypothesis aims to determine the effectiveness of the use of video tutorials and peers tutors. The technique of collecting the data in this second hypothesis use Wilcoxon sign rank test and gain test.

The result of second hypothesis tests: hypothesis is accepted when the test result of Wilcoxon sign rank test in both class gets result sig  $< 0.05$  while hypothesis is rejected if sig  $> 0.05$ . And for testing the hypothesis gain test is accepted when the experimental gain class gain  $>$  control class, while the hypothesis is rejected if the experimental class gain results  $<$  control class.

Research Question 2: How effective is the use of Android-based learning media with discovery-based learning model in improving students' learning achievement?

Hypothesis 2: The use of Android-based learning media with discovery-based learning model more effectively improves learning achievement than the conventional model.

**Table 3. Hypothesis test 2 result (Experiment Class)**

Data	N	P(sig)	Significance level	Information
Pretest	29	0,000	0,05	H <sub>1</sub> accepted
Post-test	29			H <sub>1</sub> accepted

**Table 4. Hypothesis test 2 result (Control Class)**

Data	N	P(sig)	Significance level	Information
Pretest	29	0,000	0,05	H <sub>1</sub> accepted
Post-test	29			H <sub>1</sub> accepted

From Table 3 and Table 4, the results of the hypothesis test using the Wilcoxon sign rank test. The result of the sig value obtained from the hypothesis test of pretest and post-test of the experimental class and control class is smaller than the significant level that is  $0,000 < 0.05$ . So it can be concluded that there are differences in mean values before and after being given treatment in the experimental class and conventional learning in the control class.

However, although the two classes had significant differences before and after the treatment, the experimental class gets higher of gain values than the control class.

**Table 5. Gain Index**

Class	Gain index	Criteria
Experiment	0,70	High
Control	0,40	Enough/medium

Based on Table 5, the experimental class is experience an increase in gain of 0.70, which means that the increase in experimental class learning achievement is included in the high category, while the control class has gained the gain test of 0.40 which means that the improvement in learning achievement of the control class included in the medium category. Mergendoller (Gumilar, 2009: 46) suggested that if the normalized average gain outcome of learning is higher than the normalized gain results from other learning, it is said that the learning is more effective in improving a competency than any other learning. Another opinion by Arikunto (1998) which stated interpretation of effectiveness percentage seen from n-gain for the percentage of 56% - 75% included in the category of learning media used effectively. This is also in accordance with the results of research by Yogo, Resty & Marr'atus (2015) in a national e-journal seminar on science education entitled "The Effect of The Use of Android Learning Media on the Improvement of the Learning Motivation of High School Students." that the application and use of Android-based learning media is very effective to support student-centered learning and encourage student interest to learn more deeply, with the results of experimental class research get 0.326 gain higher than control class that is 0.226. Thus it can be concluded that the use of Android-based learning media with discovery-based learning model is more effective than the conventional learning in improving learning achievement of computer systems in class X of vocational high school 6 Surakarta

## Discussion

The effectiveness of learning is characterized by the activity of students in learning, especially in organizing and information discovery. Therefore, the more active the students are in the learning process, the more effective the learning is done (Eggen and Kauchak (1998)). By utilizing Android-based learning media with discovery-based learning model, the learning process can be focused on the students so that the students can develop students' way of learning by finding their own, and investigate themselves. The students can build their knowledge widely through various sources, with the use of Android, students can play an active role in learning, this is referred to the independence of students in finding information to complete the task given by the teacher. The use of android digital arithmetic applications has a positive impact on students such us; students get simulations and the learning of arithmetic operation calculations are displayed interactively in the form of educational games, thus facilitating students in understanding the material and increase student interest in learning. With the use of Android-based learning media, the average score of the experimental class is higher than the control class which utilizing the conventional model (see figure 1) which shows the difference in student achievement.

## Conclusion, Implication, and Suggestion

### Conclusion

There is a difference in learning achievement of computer multimedia classroom subjects in terms of cognitive learning outcomes, between experimental classes are classes that get android-based learning media with discovery based learning model and control class with conventional model. The experimental class received a posttest of 84.14 and a control grade of 67.59. It is also shown from the result of hypothesis test 1 using mann whitney test with result of sig  $< 0,05$  which can be drawn the conclusion that there is difference of posttest value between experiment class and control class.

The effectiveness of learning media based on android digital arithmetic in discovery based learning model can be seen from hypothesis 2 test using Wilcoxon sign rank test and gain index analysis. Based on the

result of hypothesis 2 test, the sig value obtained by the experimental class and the control class are both getting smaller results than the 0.05 significance level. So it can be concluded that there are differences in mean values before and after being given treatment in the experimental class and conventional learning in the control class.

However, although both classes experienced significant differences before and after treatment, the experimental class gave an increase in the gain value of 0.70 higher than the control class giving an increase in gain value of 0.40. Mergendoller (Gumilar, 2009) suggests that if the normalized average gain outcome of a learning is higher than the normalized gain results from other learning, then it can be said that the learning is more effective in improving the competence of other learning. So that can be drawn the conclusion of learning media based on android digital arithmetic with the model of discovery based learning effective in improving learning achievement compared to conventional learning

## Implication

### 1. Theoretical

The use of Android-based digital arithmetic learning media with discovery-based learning model is effective in improving students' learning achievement compared with the conventional model. It is because, in the discovery-based learning model, the students are required to be active in observing, reading, discovering, finding the sources, explaining, concluding and etc. to find out the wanted concept.

### 2. Practical

This research has proved that the use of Android-based learning media blended with discovery-based learning model can improve students' learning achievement. It is because when the learning process, students become more active, interactive, and creative, also the students can build their knowledge extensively. The results' of this study provide for teachers and schools to be an alternative use of models and media learning in teaching and learning activities.

## Suggestion

The suggestion from this research is expected teachers can be motivated to use the varied model of learning and produce better and interactive learning media simulation so as to facilitate students in understanding the material and increase the students interest in studying.

## Bibliography

- Adrian, & Setya. (2017). Pengembangan Media Pembelajaran Jaringan Komputer Berbasis Android Untuk Meningkatkan Hasil Belajar Siswa di SMK Antartika Surabaya. *Jurnal IT - Edu*, 1(2), 49–53.
- Arikunto, S. (2006). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.
- Budiningsih. (2005). *Belajar dan Pembelajaran*. Jakarta: Rineka Cipta.
- Gumilar, I. (2009). *Penggunaan Media Simulasi Virtual Pada Pembelajaran Konseptual Interaktif Untuk Meningkatkan Pemahaman Konsep dan Meminimalkan Miskonsepsi Siswa Kelas X*. Universitas Pendidikan Indonesia Bandung.
- Matsuo, K., & Sakat. (2008). New Functions For Stimulating Learners' Motivation in a web-Based e-learning System. *Journal of Distance Education Technologies*, 6(4), 34–49.
- Rahmalia, Y. (2014). *Efektivitas Model Discovery Learning Untuk Peningkatan Hasil Belajar Siswa Kelas X Pada Kompetensi Dasar Analisis Rangkaian Kemagnetan Di SMK 1 Pundong*. Universitas Negeri Yogyakarta.
- Siti, F. (2015). *Eksperimentasi Model Pembelajaran Discovery dan Proble Learning Berbasis Assesment*

*For Learning Terhadap Prestasi Belajar Matematika Ditinjau Dari Tingkat Motivasi Siswa.*  
Universitas Muhammadiyah Surakarta.

Yogo, Resty, & Marr'atus. (2015). Pengaruh Penggunaan Media Pembelajaran Android Terhadap Peningkatan Motivasi Belajar Siswa SMA.

Yousef, M., & Hamideh. (2013). Mobile Learning for Education Benefits and Challenges. *International Journal of Computational Engineering*, 3(6).