

# Android-based learning media for learning styles and student learning outcomes

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# Android-Based Learning Media for Learning Styles and Student Learning Outcomes

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**Abstract.** The purpose of this study was to determine the impact of static versus animation visualization on android-based multimedia education and on the ability of students to practice biology learning through android media in the visual versus verbal styles. The visualization process functions as an independent variable, and the students' learning styles are moderating. In addition, the learning approach follows the performance theory section of Merrill, and Mayer and Moreno's Seven Interactive Learning Concepts incorporate the multimedia presentation model. Training in class is done with interactive computing based on Android. The study subjects were West Kalimantan high school students who attended the Biology class. In the architectural experiment, MANOVA 2 x 2, with a total of 121 students at 4 schools, was used. Based on this result, image in interactive learning media may have a beneficial effect on enhancing individual student results and applying learning to Android media. Differences in student learning styles may also directly influence student learning performance both visually and verbally. The relationship between simulation and learning style has no impact.

## INTRODUCTION

The problem by the Ministry of National Education, Higher Education / Institutions and private Universities of Regulation No 109 of 2003 on the implementation of remote learning in higher education naturally would prepare all the infrastructure issues involved [1]. The first is electronic learning (e-learning) technology that is supposed to meet expectations of effective, secure and convincing education [2]; [3].

Digital media is an e-learning function which provides information / messages / instructions medium. Multimedia technology is continuing to evolve and increase in use technological advances, both in hardware and software, have allowed the implementation of good teaching techniques or practices through multimedia learning or multimedia-based computing in classroom instruction .

The introduction of Learning Multimedia is very significant in the creation of students and learning experiences or better understanding of issues and/or teacher attitudes. In order to be efficient, there are four core elements that have to be addressed [4]; [5], including the occurrence of learning outcomes (product knowledge), types of content, teaching methods and distribution platforms. However, in multimedia instructions, it is said to be successful when it manages to combine those four components. The results from previous research conducted in the field of immersive

digital learning with content in the category of concepts (in particular, mathematics) [6];[7] have concluded that mathematics research efficiency has improved. Similarly, shows that multimedia presentations improve awareness, encouragement, class participation and student satisfaction in mathematics learning in multimedia presentations. However, the usefulness of the method of visualization (static vs. animated) in interactive learning and learning styles in learning results were not affected by these two studies. The survey was performed in order to update [8];[9].

various types of content, including main information categories and a wider variety of learning results. This is intended to examine the impact of different viewing modes (static versus animated) on the presentation of interactive and learning styles dependent on Android (vision versus verbal) on learning outcomes. A thorough explanation of the study's aim is to obtain empirical findings concerning:

- RQ1: The form of visualization (animation vs static) multimedia learning has a major impact. The ability of Android-based students to apply learning models in biology research using android media.
- RQ2: Differences in learning styles (visual vs verbal) have no clear effect on Students' ability to apply android research.
- RQ3: The relationship between the forms of learning simulation is not really affected Multimedia-based learning styles of android and the ability of students to apply learning through android media.

In conjunction with the results of previous studies, it is anticipated that the findings of this study will provide guidance on the value of applying animation to interactive learning based on Android multimedia, especially dynamic learning materials (types of procedures and principles) to enhance student learning results. Nutrition is chosen for humans to absorb, since learning is very important. In addition, this information is classified as a core subject for high school students in the city of Pontianak.

## METHODOLOGY

### Variables of Research and Experimental Design

This Research is a quantitative analysis conducted almost experimentally. The aim is to examine the influence of the independent variable on the dependent variable. An independent variable is a form of visualization — in multimedia Android learning — with two treatments, including static or animated content, and student learning styles (visual and/or verbal). The dependent variable is the learning results of the student about implementation. In experimental architecture, a 2 x 2 factorial multivariate (MANOVA) was used.

### Research subject

High school students in the city of Pontianak are the subjects in this study. The number of students taking part in this study was 121 participants spread across four schools. Two classes have static-visualized interactive learning modules and the other class has dynamic learning modules with animated visualizations. Classes that have interactive static or animated simulation learning modules are selected at random. Table 1 summarizes the data on the number of students in the two groups who engaged in post-research treatment. The equality between the two classes (fixed group and animation group) was assessed on the basis of the final scores of the pre-requisite course (Data Base) students obtained from the Mann-Witney statistical analysis is non-parametric (Table 2) and results concluded that the two classes were similar (static and animation) (significant at  $5-007 = 0.05$ ).

TABLE 1. The number of student-based courses and support groups

Student-based courses and support groups	Classroom	N	%
Regular Class	A	24	
	B	28	
	Sub-Total	58	49,3
Animation Class	C	28	
	D	25	
	Sub-Total	63	50,7
Total		121	100

Note: N = Respondent

## Procedure Strategy

For this study, the procedure strategy consisted of establishing a procedure schedule and assessing the outcomes of the learning process. This technique is shown in detail in Table 3. The comparative function of the two Android-based multimedia procedures, namely static visualization and animation multimedia display learning, is described in Table 4. The animation used here is a type of animation that uses an Android framework that has the same results. Study how to gradually show animated content [3].

TABLE 2. Mann-Whitney Test Result for Two Standard and Animation Categories

Mann-Whitney U	22205.500
Wilcoxon W	4551.500
Z	-.743
Asymp.Sig.(2-tailed)	.457

TABLE 2. Procedure protocol

Lecture	Substance	Procedure
Lesson 1	Explaining Research Plan, Learning Model, Learning Outcome, Multimedia Learning Model, Theory 1	Definition of the learning program, study intent and operational learning modules; description of the Learning Styles Index (LSI); student ILS calculation. Module 1 guidance introduction, and drills.
Lesson 2	Interactive Learning Model, Theory 2	Using the introduction of module-2, and exercises. Module-3 learning presentation, and activities.
Lesson 3	Interactive Learning Model, Theory 3	Section 4 guidance introduction, and drills. Presentation of learning and tasks in Modul-5 (part of).
Lesson 4	Test Final	Implementation of final examination and analysis of study results.

## Measurement of Variable Analysis

There are two kinds of variables in this analysis whose data is collected by calculation, namely the dependent variable and the moderator variable:

A test (test final) was used to calculate the dependent variable-output, using an instrument created by the researchers. Researchers rendered a quiz application using the Flash application in this study and it can be built in the Smart Phone Application. Using smartphones is expected to offer students a high interest in working on questions as well as offering comfort as well. The moderator component-the Index of learning style (ILS)-was Calculated using system developed by the investigator. This instrument was developed to measure the styles of learning from one instrument

Under the Learning Felder-Soloman Index (ILS)[10]. The ILS is a questionnaire survey designed to measure the interest in 4 DLLs i.e. active / reflective, sensitive / intuitive, visual / verbal and sequential / global, with a total of 44 subjects covering issues in each dimension. This method was tested for validity and reliability for students of biological education. In this study both dimensions of the learning styles were evaluated but only one element of the learning styles, called visual / expressive language styles, were used.

## Methods for Collecting Data

Table 4 lists the summary of the average score on the ability to apply learning using the Android app. The data from the measurement results of all test variables were then analyzed using the multivariable variance analysis technique (MANOVA) 2 x 2 with the help of the SPSS statistics Software kit version 23. Nevertheless, several

quantitative statements to be made before implementing the MANOVA analysis technique include data normality and the homogeneity of the variance-covariance matrix [11]

**TABLE 3.** Average score capacity to apply ideas, processes, and values

Treatment	Learning Styles	Total of Student (N)	The ability to apply ideas		The capacity to implement procedures		The capacity to apply principles	
			Average Score	Standard Deviation	Average Score	Standard Deviation	Average Score	Standard Deviation
Regular Class	Visuality Verbal	45	49,1	12,20	38,5	10,26	35,2	10,50
Animation Class	Visuality Verbal	30	50,2	12,06	40,5	12,06	42,05	13,04
		25	40,6	13,07	41,3	13,05	40,02	13,05

**TABLE 4.** Comparative aspects of the two-multimedia computer-based learning treatments

The Points	Multimedia Learning with Static Visualization	Presentation of multimedia learning with animated visualization	Description
Presentation of content	Segment content will be displayed simultaneously on a computer screen, followed by a narrative voice that explains the content parts.	Segment content will be shown on a computer screen simultaneously, accompanied by a narration voice associated with the presence of an animated pointer describing the content sections.	One part of the content is made up of multiple words / sentences or part / whole picture / diagram / table.
Learn to manage	STOP button and CONTINUE button which regulates the output of a narration (voice) are available.	Availability of the STOP and CONTINUE button that regulates the emergence of narration (voice) and animated pointers.	The button handler is a reflection of the nature of user interaction with multimedia learning next to another button.
Practice	Availability of content practice / workout with any form of question: multiple choice, short answer, blank fill, series. The material issue will be shown on the screen / computer screen without a narration.	Availability of content practice / workout with any form of question: multiple choice, short answer, blank fill, series. The material issue will be shown on the screen / computer screen without a narration.	Lecturers and students explore topics such as exercises / assignment.

The content of the book is modified: Learning Java Programming with NetBeans, An Introduction



## RESULT AND DISCUSSION

### Checking MANOVA Assumptions

Participant observation flexibility, group homogeneity and normality are the most important premises of MANOVA. In addition, the question of the value of the relationship between the dependent variable and the outliers was evaluated. All students who participated actively in the learning this time, which consisted of 4 groups, obtained experimental results. Two classes were treated with the learning module for animation type, and the other class was treated with the standard learning module type. Determination of which class gets preferential treatment was done randomly for one form of visualization (animated or regular).

From the findings of the test of normality with the Kolmogorov-Smirnov statistic test of three dependent variables (the ability to use the teaching tools, computational capacity and biological learning materials), one may infer that the normality assumption of collected data for the three factors is measured off (significant for  $\alpha = 0.05$ ).

While its analysis of the Box M homogeneity test indicates that a F test value of 1.247 can be filled in (significant at  $\alpha = 0.01$ ) for the covariances. The findings from the test for homogeneity of variance matrix with the Levene test are as follows: findings obtained from the calculation of the method implementing potentials at 0.423 (significant at  $\alpha = 0.05$ ); results obtained from the functional implementation at 0.890 (significant at  $\alpha = 0.05$ ); results achieved from the test for the significant value princely at the Levene test.

The Bartlett sphericity test for testing the relationship between the dependent variables reveals a relationship between the dependent variables (significant at  $\alpha = 0.01$ ). Moreover, the Boxplots diagram does not offer outliers of all data measurement outcomes.

Results of testing / evaluating the impact of the MANOVA 2 x 19 visualization feature and learning styles on students' ability to integrate the use of Android-based learning media. Based on the testing / analysis findings, it can be concluded that learning through visuals has an impact on the learning biology abilities of students using Android-based teaching media. The test results of variations in learning styles and cognitive abilities of the students have an impact and there is also no effect on the outcomes of student interaction assessments by using Android-based teaching media with two variables between visualization and learning styles.

Testing the ability to apply teaching media with the univariate test method has an impact on the form of visualization and there is no particular effect on learning types that do not both learn with android or web-based animation media. And the relationship between factor forms of visualization and learning styles, too. Students' ability to apply learning through Android-based media has a major impact, although student learning styles have no major effect on outcomes

## DISCUSSION

### Visualization Style Impact

Based on the summary of the testing / research study findings, it is concluded that there is a major impact on the form of presentation of visualization (static vs animation)-in multimedia learning-on the ability of students to use android-based biology learning models. Similar results are consistent with previous[12]. They said animated visualization interactive learning has been more effective than static visualization presentation because of its ability to improve student learning outcomes.

In this study, due to animation (pointer animation) in multimedia learning that follows / adapts the guiding principles of presenting knowledge in multimedia format, the advantages of animated visualization (with learner control) multimedia learning compared to static visualization occur. — Animation [13], especially on interactive principles, modalities, proximity, and segmentation. These principles are important throughout the learning process for learner control of the cognitive load. This applies to decreased job memory and remote memory in interactive cognitive theory.

### Learning Impact Styles

Based on the analysis of the test/research study findings, it is inferred that an important effect on students' ability to apply is the learning style factor (visual versus verbal) in immersive computer-based learning. This indicates that the capacity of student learning outcomes is a major difference in interactive computer-based learning between student

groups with visual and verbal styles of learning. It can be because of a lack of action in adjusting the show consistency between pictures, tables / diagrams / symbols and text / vocal interpretation in multimedia training.

### The Effect of Interaction Between Visualization Forms and Learning Model

Focused on interpretations of the results of the test / analysis, it is concluded that the relationship between the visualization type factors and the learning style does not have a major impact on the ability of students to apply learning through Android-based teaching media. Accordingly, the conclusions drawn from the study of these two variables related to [1] and [2]) may be clearly specified. These findings are consistent with the [14] and [8] results of previous studies.

### CONCLUSION

Interactive learning method has a significant effect on improving student learning outcomes, in particular learning based on android animation. In immersive online learning, the visually and verbally differing types of student learning patterns may have various effects on students. There is no effect of involvement in achieving student learning outcomes between the simulation process factors and learning styles. The importance of using animation in interactive multimedia learning, particularly for the main content form.

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### REFERENCES

1. U. S. P. Nasional, "UNDANG-UNDANG REPUBLIK INDONESIA NOMOR 20 TAHUN 2003 TENTANG SISTEM PENDIDIKAN NASIONAL," *Acta Pædiatrica*, vol. 20, pp. 6–6, 2003, doi: 10.1111/j.1651-2227.1982.tb08455.x.
2. M. D. Merrill, "Finding e3 (effective, efficient, and engaging) Instruction," *Educ. Technol.*, pp. 15–26, 2009.
3. M. Rusli and I. K. R. Y. Negara, "COMPUTER-BASED LEARNING AND LEARNING STYLE Department Information System Department of Computer System," no. 109, pp. 177–191, 2017.
4. R. C. Clark, *Developing technical training: A structured approach for developing classroom and computer-based instructional materials*. John Wiley & Sons, 2011.
5. S. C. Williams, M. Militello, and D. Majewski, "Sorting important elements for successful college transition and completion for students with learning differences," *Prev. Sch. Fail. Altern. Educ. Child. Youth*, vol. 64, no. 12, pp. 326–338, Aug. 2020, doi: 10.1080/1045988X.2020.1776671.
6. A. R. Madar and Y. Buntat, "The effect of using visual graphics via interactive multimedia on learning of mathematics (straight line) at secondary school," *J. Tech. Vocat. Eng. Educ.*, vol. 3, pp. 94–103, 2011.
7. S. Trenholm, L. Alcock, and C. L. Robinson, "Mathematics lecturing in the digital age," *Int. J. Math. Educ. Sci. Technol.*, vol. 43, no. 6, pp. 703–716, 2012, doi: 10.1080/0020739X.2011.646325.
8. M. Rusli, I. W. Ardhana, I. N. Sudhana, and W. Kamdi, "The Effect of the Type Visualizing—on the Presentation Strategy of the Computer-Based Multimedia Learning—and the Learning Style towards the Student's Capability in Applying Concept and Procedure of Object-Oriented Modelling," in *Proceeding of International Seminar on Electrical, Informatics, and Its Education*, (B35-B40). Malang State University-Indonesia, 2013.
9. G. Tur, V. I. Marín, J. Moreno, A. Gallardo, and S. Urbina, "From diagrams to self-regulated learning: student teachers' reflections on the construction of their PLE," *EMI. Educ. Media Int.*, vol. 53, no. 2, 2016, doi: 10.1080/09523987.2016.1211335.
10. T. A. Litzinger, S. H. Lee, J. C. Wise, and R. M. Felder, "A psychometric study of the index of learning styles©," *Eng. Educ.*, vol. 96, no. 4, pp. 309–319, 2007.
11. D. P. Mandic, N. ur Rehman, Z. Wu, and N. E. Huang, "Empirical mode decomposition-based time-frequency analysis of multivariate signals: The power of adaptive data analysis," *IEEE Signal Process. Mag.*, vol. 30, no. 6, pp. 74–86, 2013.



12. <sup>8</sup> H. Lin and F. M. Dwyer, "The effect of static and animated visualization: a perspective of instructional <sup>4</sup> effectiveness and efficiency," *Educ. Technol. Res. Dev.*, vol. 58, no. 2, pp. 155–174, 2010.
13. <sup>9</sup> C. Clark and R. E. Mayer, "E-learning and the science of instruction: Proven guidelines for," 2008.
14. B. M. Mccann, "The relationship between learning styles, learning environments, and student success," in *Journal of agricultural education*, 2006.

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