Development of Android-based mobile learning modules on the immune system for Madrasah Aliyah Negeri (MAN) 9 Jakarta

R D Wulaningsih*, R Rusdi and D Erawati

Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta (UNJ), Jl. Rawamangun Muka, Jakarta Timur, Indonesia.

*dewiwulaningsih.ratna@gmail.com

Abstract. The 21st century is marked by the use of technology in learning. One example is the use of smartphones as learning media in the form of Mobile Learning Modules, which are expected to make it easier for students to learn biology material. This study aims to develop biology learning media in the form of Android-based Mobile Learning Modules on the Immune System material. The research method used is Research and Development (R&D). Research procedures include concepts, design, material collection, product manufacture, product testing, and distribution. The study was conducted at MAN 9 Jakarta. The research involved media experts, material experts, students, and biology teachers. Data analysis using Kolmogorov Smirnov, statistical tests using Paired Sample t-Test. The results showed that the Android-based Mobile Learning Module for the Immune System material was rated by an average score of 91.4%. The average pretest and post-test scores were 57 and 78.8. The conclusion of this study shows that this Android-based Mobile Learning Module has fulfilled the requirements as a learning medium and can improve student learning outcomes on the Immune System material.

1. Introduction

The 21st century is marked by the high role of technology in education. Information and Communication Technology (ICT) can also be used as a learning medium. Learning media are aids in conveying subject matter to students. Cellular Learning is a learning process carried out by a person or group of people by utilizing mobile device technology such as smartphones. Learning through smartphones can be done anywhere, and at any time so that it can make students easier to learn [1].

One example of learning media is a module. This module is a complete unit and consists of a series of learning activities arranged to help students achieve certain learning goals. Modules are designed to be studied independently by students. The utilization of technology in learning can be done through the development of Mobile Learning Modules [2]. Research conducted by International Data Corporation (IDC) in 2017 shows that Android is a smartphone operating system that has the highest percentage of users. According to Ershad [3], there are many Android users, because Android has an open-source nature in providing free software, so Android developers can develop applications without the need to pay a license. Another advantage is that Android users easily install applications using smartphones they already have.

Based on the analysis of the needs of Madrasah Aliyah Negeri 9 (Jakarta) 9 students in Jakarta, it was found that 100% of respondents owned a smartphone, and 88.6% used the Android operating
system. This opportunity can be used in learning by utilizing technology in the form of an Android smartphone as a learning medium in the form of Cellular Learning Modules.

Biology is the study of living things, one of which is about the function and bioprocess in the human body. Based on the analysis of student needs at MAN 9 Jakarta, 42.8% of respondents stated that the explanation of the immune system was still lacking, and not very interesting in textbooks. According to Trisnaningsih [4], the body's immune system has a complex mechanism and often becomes a barrier for students to understand it. Based on these reasons, it is necessary to design the development of instructional media by utilizing smartphone technology. Cellular Based Learning Module The Android application is intended for the Android smartphone platform.

2. Methods
The method used in this study is a research and development method that refers to Luther's model [5]. Research procedures include concept, design, material collection, product manufacture, product testing, and distribution. This research and development was carried out at MAN 9 Jakarta. The targets of this study include material experts, media experts, students, and Biology Teachers.

Data collection was carried out with a needs analysis survey, using a questionnaire and interview guidelines [6]. After the Cellular Learning Module application is developed, the feasibility test is conducted on the Cellular Learning Module as a Biology learning medium about the Immune System material. The feasibility test conducted is a material feasibility test and the feasibility of the media. Feasibility test by media expert using a modified questionnaire [7], a feasibility test by material expert, a mobile learning experiment module test by students and a Biology Teacher using a modified questionnaire [6], and a learning achievement test using Pre Test questions and post test questions.

Data obtained from the needs analysis survey were analyzed qualitatively. While the data obtained from the feasibility test, testing, and testing of learning outcomes are analyzed quantitatively.

3. Results
The results of the feasibility test about android-based mobile learning modules on the immune system by material experts obtained a score of 94%, the results of the feasibility test by media experts obtained a score of 85.43%, the results of trials by students obtained a score of 86.9%, the results of trials by the Teachers Biology scored 99.3%. In total, all feasibility assessments and trials of the Android-based cellular learning module on the immune system obtained an average score of 91.4% with very good interpretation.

Knowledge pre-test results using the android-based mobile learning module on the immune system to 33 respondents received the lowest score of 43 and the highest score of 80 with an average score of 57 while the post-test obtained the lowest score of 67 and the highest score of 93 with an average score of 78.8. Comparison of the average score of pre-test and post-test can be seen in Figure 1 below:

![Figure 1. Pretest and post-test scores.](image-url)
N-gain obtained is 0.508, the value is included in the medium criteria [8] and can be interpreted that learning Biology of the Immune System using the Android-based Cellular Learning Module can improve student learning outcomes in the material of the Immune System. Learning outcomes data in the form of Pretest and Post-test scores were statistically analyzed by SPSS through Paired Sample t-Test, this test was conducted to find out whether there were differences in average learning outcomes before and after using the developed module. Before conducting the t-test, the normality test was carried out with Kolmogorov Smirnov, and the homogeneity test was a prerequisite test with the Levene test.

The normality test used Kolmogorov Smirnov with a significance level of 0.05, the significance value obtained for the pretest score was 0.142 and the significance value for the post-test score was 0.195. Because the two significance values are 0.142 and 0.195> 0.05, accept H0, which is a normally distributed research data. The homogeneity test using the Levene test with a significance level of 0.05 obtained a significance value of 0.453> 0.05, then accepts H0, which is a variant of homogeneous data.

A paired sample t-test aims to determine whether there are differences in average learning outcomes in groups that are tested before and after using the application module on a mobile phone. This test uses a significance level of 0.05. with a significance value of 0.000. Therefore, the significance value is 0.000 <0.05, so reject H0, which means that there is an influence on student learning outcomes with the use of Android-based Cellular Learning Modules on the material of the human immune system.

4. Discussion
The learning process is still limited to the delivery of insufficient information to help students study Biology [9]. The solution that can be done to overcome this obstacle is to use learning media. Learning media can help students in understanding difficult material, according to Arsyad [10] that learning media can explain something complex to be simple.

One type of learning media is modules. Modules are created and designed to facilitate students in learning. Modules are not only in printed form but also in the form of software, such as applications that can be accessed by students through their smartphones. According to Sannikov [2] modules in the form of software that includes audiovisual material are considered better and more interesting in the learning process.

In this study, the development of the Cellular Learning Module was carried out on the Immune System material. The results of the analysis of student needs and teacher interviews revealed that several respondents stated that they had difficulty learning biology. Material that is considered difficult is the Immune System. This is supported by Hadiyanti [11] that the Immune System is the most difficult material in Class XI High School. Difficulties are caused by abstract and complex learning material that is difficult for the sense organs to observe.

In due diligence, the material obtained a score of 94% with a very good interpretation. Media development in the form of mobile learning modules is able to meet the objectives and criteria of learning content, conformity to student characteristics, the efficiency of learning time, and easy to use by students [12]. Learning material experts also gave a number of suggestions for improvement including correcting the wrong words in typing, correcting the layout of the text that was previously left-aligned, left and right-aligned, making changes to some videos that were originally in English into Indonesian, adding terms important to glossary and to replace some terms that are less precise.

In due diligence, expert media obtained a score of 85.43% with a very good interpretation. Media experts also provided several suggestions for improvement including changing the design of the menu display to make it look more attractive, improving the layout of the video that should be placed after the explanation of the concept.

After the feasibility and improvement tests were carried out, 36 students were tested. Students respond that the Android-based mobile learning module material from the immune system is interesting and easy to use, the explanation of the material facilitates understanding, questions are given in accordance with the material described in the module, but it is hoped that the Cellular Learning Module Application can be downloaded via Play Store and not only can be installed on smartphones with the...
Android operating system but also on other operating systems like iOS and Windows. According to Darmawan [13], installing applications can support Mobile Learning both offline and online.

Trials were also conducted by Biology teachers and ranked with very precise interpretations. The Biology teacher states that the Mobile Learning Module is very adequate and can overcome the constraints of time constraints in learning the material of the Immune System.

After passing the feasibility test and trial then a test of learning outcomes is carried out, the aim is to determine the effect of the use of this development module on learning outcomes. Trials of learning outcomes are carried out with pre-tests and post-tests on students before and after using this Cellular Learning Module. The results of the learning trials resulted in an average pre-test score of 57 and an average post-test score of 78.8. After that, the Strengthening score is calculated and gets a value of 0.508 which is included in the medium criteria [8]. Media assessment gets a score with a very good interpretation but the Gain score is only in the medium criteria, this proves that there is an increase in student learning outcomes not only because of the learning media factor [14].

Statistical analysis was performed by conducting a Paired t-Test. This test was chosen to compare the average difference between the two sample pairs before and after treatment. The treatment referred to in this study is the use of learning media in the form of Android-based Cellular Learning Modules for the material of the Immune System. The result is that there are differences in the pre-test and post-test mean values.

The use of the Mobile Learning Module can underlie the formation of curiosity and increase the creativity of students through the presentation of the material and supported by questions practice [15]. Mobile Learning applications can clarify the delivery of material messages so as not too verbal.

A student's knowledge test is used as an indicator to see whether learning objectives have been achieved. The results showed the average post-test score of student learning outcomes was higher than the pre-test score, meaning students had better knowledge than before. This is in line with research conducted by Kocakoyun [16], showing that the use of the mobile learning module application can increase student motivation and improve academic achievement. As for the increase in learning outcomes illustrates that students are become better to understand and master the concepts of Biology material being studied [17].

The feasibility assessment of the mobile learning module android-based for human immune system material is done by calculating the average score of the feasibility test and trial. The results of the calculation of the feasibility test and trial get an average score of 91.4% with a very decent interpretation [18]. Most of the indicators used for the assessment of the mobile learning module have been met. This shows that the Android-based mobile learning module immune system material is appropriate to be used as a Biology learning media.

5. Conclusion
Based on the results of the study concluded that the module for learning the human immune system based on Android phones has been successfully developed, and obtained an assessment with the interpretation that it is very feasible to be used as a learning medium. The use of android-based cellular learning modules can also improve student learning outcomes.

References
[1] Yahaya N and Salam S 2014 Mobile learning Application for Children: Studying With Dino Proc. Soc. Behav. Sci. 155398–404
[2] Sannikov S and Zhdanov F 2015 Interactive Educational Content Based on Augmented Reality and 3D Visualization Proc. Comput. Sci. 66(1)720–729
[3] Irsyad H 2015 Android Application in 5 Minutes (Jakarta: PT Elex Media Komputindo)
[4] Trisnaning S, Suyanto S and Rahayu T 2016 Development of Quipper School Learning Management System in Learning Material of the Body's Defense System to Increase Motivation and Learning Outcomes of Class XI Students in SMA Negeri 3 Yogyakarta J. Biol. Educ. 5(6)28-36
[5] Luther A C 1994 Authoring Interactive Multimedia (Boston: AP Professional)
[6] Badan Standar Nasional Pendidikan (BSNP) 2014 Textbook Assessment Instrument (Jakarta: BSNP)
[7] Crozat S, Oliver and Trigano P 1999 A Method for Evaluating Multimedia Learning Software (Florence: France)
[8] Mardaphi D 2012 Measurement, Assessment, and Evaluation (Yogyakarta: Nuha Medika)
[9] Dahar R W 2011 Learning Theories (Jakarta: Erlangga)
[10] Arsyad A 2011 Learning Media (Jakarta: PT Raja Grafindo Persada)
[11] Hadiyanti L N 2016 Development of Teaching Material for Human Immune System Material Based on High School Students Early Knowledge Journal of Biology Learning 2(1) 39-50
[12] Ibrahim N and Ishartiwi 2017 Development of Mobile-Based Learning Media for Android-Based Science Subjects For Middle School Students Edukatika Reflection Journal 8(1) 80-88
[13] Darmawan D 2012 Educational Innovation (Bandung: Rosda)
[14] Rusman 2012 Computer-based Learning (Bandung: Alfabeta)
[15] Sugiarto D and Wibawa S 2017 Development of Schoology-Based E-Learning to Improve Student Learning Outcomes in Basic Network Subjects Class X Tkj IT-EDU Journal 02(1) 136-140
[16] Kocakoyun S and Bicen H 2017 Development and Evaluation of Educational Android Application Cypriot Journal of Educational Science 12(2) 58-68
[17] Ernawati R, Toharudin U and Ibrahim Y 2017 Implementation of Lsa Type Active-Cooperative Learning Model Against High School Student Learning Outcomes in the Human Immune System Subconcept Biosfer: Journal of Biological Education 10(2) 12-29
[18] Riduwan 2016 Introduction to Statistics for Educational, Social, Communication, Economics and Business Research (Bandung: Alfabeta)