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# Development of Biology Learning Media Based on Android to Improve Students Understanding

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**Abstract:** This study aims to development of media mobile learning based on android for learning the biology of nervous system material and to determine the effectiveness of media mobile learning based on android in improving students' conceptual understanding. The type of research used was development (R&D), population, and sample, namely class XI IPA 2 as many as 30 students at one of the public high schools in Bogor Regency which was carried out from January to May 2020. This development research procedure used a model (4D) consisting of 4 stages, namely Define, Design, Develop, and Disseminate. The instruments used were tests (pre- test and post-test), response questionnaire sheets, and documentation. The implementation of deployment trials was carried out using a one group pre-test and post-test research design. The results showed that the media mobile learning got a very feasible category. This is based on the average percentage of the assessment from the expert validation team, namely 82.75%. Media mobile learning Android-based on learning the biology of the nervous system material can improve students' understanding of concepts and almost all students respond positively. This is proven by an increase in the results of the pre-test and post-test values after using the application so that the N-gain value obtained is 66.5.

**Keywords:** Mobile Learning; Based on Android; Students' Conceptual Understanding; Nervous System

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## Introduction

Currently, the development of science and technology (IPTEK) has developed rapidly in a comprehensive manner covering various aspects, namely in the fields of economy, politics, culture, art, and even in the world of education. Technology support in the field of education helps teachers to improve the quality of learning. Teachers who use technology can accelerate, simplify, and expedite the planning, implementation, and evaluation processes in learning.

21stcentury learning emphasizes that teachers can take advantage of existing technology and can use the tools provided in schools that are following the developments and demands of the times. 21st century learning also emphasize s students to be more active so that learning is no longer teacher centered but stu dent centered. The skills that must be possess ed in the 21st century include Collaboration, Critical Thinking and Problem Solving, Creativity and innovation, and Communication (Sadiqin et al., 2017; Saputri et al., 2019).

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Facing this 21st-century education, the government in Indonesia applies the 2013 curriculum which emphasizes the process scientific. The learning pattern in the 2013 curriculum is designed so that students can solve problems based on observations made either independently or in groups. Besides, the 2013 curriculum also promotes the use of multimedia, emphasizing active learning to seek and strengthen the development of each student's special potential (Farisi, 2016; Reinke, 2019). Current learning should apply more adequate models, methods, and teaching materials to provide more educational and interactive learning for students. Learning media is also very important to use to achieve learning objectives. The application of appropriate learning media can improve the learning process to be more interesting, not boring, not monotonous, and learning to be more interactive.

Educational learning media in Indonesia are still often found using conventional media (McLean et al., 2017; Suryanda et al., 2016). Examples of conventional media commonly used in class are blackboards, textbooks, student worksheets, and Ms. Powerpoint. This media is considered less effective and efficient. The currently recommended learning media to meet the demands of the 2013 curriculum along with the development of technology is digital learning media that can generate motivation and stimulation of learning activities, and bring psychological influences on students. The activities of students who take part in learning using digital learning media enter into very good criteria than the activities of students in classes with learning without digital (Wolff et al., 2015). Digital learning media can also present learning material in a contextual, audio, and visual way interestingly and interactively. One example of digital learning media that is being loved by the public is mobile learning based on Android.

The use of mobile learning is applied through Android smartphones –based which tend to be difficult to separate in people's lives of all ages. This is because smartphones have become a primary need in all circles of society. Indonesia is included in the top 10consumers smartphone. There are 355.5 million users of smartphones, whereas the total population of Indonesia reaches 268.2 million. This means that the circulation of smartphones is more than the total population throughout Indonesia. It can happen if one person has 2 or more smartphones. Then, there are 150 million active internet users, which means that 56% of the total population of Indonesia is already using the internet. Likewise, more than 50% of Indonesia's population actively uses social media (Websindo.com, 2019). The development of the digital world in Indonesia is very promising, from the point of view of internet users, social media users, even users smartphones so that students also tend to spend time with their smartphones Android and make Android increasingly popular. This is evident when giving a response questionnaire on the use of smartphones to students in class XI IPA 2, the result is that the use of smartphones, especially Android, is 98%, and iOS users are 2%.

Based on the results of observations of biology teachers and students at one of the public high schools in Bogor Regency regarding concept understanding and the use of instructional media in schools, it was found that understanding of concepts, especially the material on the nervous system, was still low. This is shown by the number of 34 students who have a score of 33% above the standard score while the score below the standard score is 67%, the standard score that has been determined is 73.

According to students, this nervous system material is very difficult to learn. The material of the nervous system also requires abstraction power so that it requires an appropriate way of conveying the material. The instructional media used by teachers has so far been limited, namely by using the application Microsoft Powerpoint, instructional videos, image media, and biology books. The use of learning media does not attract the attention of students, so there are still some students who are lazy and find it difficult to understand the learning material (Nugraini et al., 2013).

To improve conceptual understanding and the addition of learning media, media will be used mobile learning. Media Mobile learning is a learning model that utilizes information and communication technology using mobile Android based/phone connected to an internet network designed for student- centered learning, interactive in nature, and facilitates learning activities for everyone, which is not limited by place. , time, and distance, and can be used for individual or classical learning (Sparrow et al., 2020; Yousefi, 2014). Some of the advantages of mobile learning compared to other learning are that it can be used anywhere at any time, has a relatively cheaper price than the PC price, the device size is small and light, it is estimated that it can include more learners because mobile learning utilizes technology that is commonly used in everyday life (Seechaliao, 2017). Also, media mobile learning this Android-based has never been used by teachers before, especially on the nervous system material. Therefore, the use of this media is expected to improve students' conceptual understanding skills, especially in the material on the nervous system.

Based on this description, it is necessary to develop a media mobile learning Android-based. The development of this media is expected to provide an alternative for teachers and students in the teaching and learning process in improving students' conceptual understanding skills. This study aims to develop mobile

learning android-based learning biology about the nervous system material and to find out that media mobile learning android-based improve students' understanding of concepts in biology learning.

## Method

This research uses R&D (Research and Development) research by developing learning media mobile Android-based on the nervous system material. The software used in the development of media mobile learning is the MIT App Inventor combined with video, audio, discussion forums, and final exams. The spread (Disseminate) was held at one of the public high schools in Bogor Regency. The variable being measured is understanding the concept. The design used uses the 4D model (Thiagarajan et al., 1974) with the One Group Pretest Posttest design. The 4D (four-D) consists of the definition stage (Define), the design stage (Design), the development stage (Develop), the dissemination stage (Disseminate).

Definition (Define) stage, there are five stages; the first was to conduct interviews with the biology teacher regarding the difficulty of the material understood by the students and the media that the teacher had been using. Second, making observations to pay attention to the characteristics of students using cellphones, the level of understanding of student's concepts of the material by distributing response questionnaires to learning media and test questions at the level of understanding the concept of the nervous system material. The third is to study the applicable curriculum, namely the 2013 curriculum. The fourth is to analyze what learning media are often.

Planning (Design) stage, there are three stages, namely the first stage of collecting and identifying sources that support the preparation of learning media such as finding sources from books, modules, and other references. The second stage is selecting the format for designing or designing the content, illustrations, images, audio, layout, video, and animation that will be used. The third stage is to make an initial design by compiling learning materials in learning tools, namely lesson plans and syllabus. The material used in the development of this media is the nervous system material. After that, the researchers designed and created learning media using the application MIT APP Inventor to create mobile learning Android-based. The draft finished then consulted with the supervisor.

Development (Develop) stage, learning media that has been made is validated by expert experts, then revised and tested on a limited basis. Expert validation consisted of two validation material experts and two validation media experts. The results of the assessment and expert input before the product is applied in the field are used as guidelines for making product revisions. A limited trial was conducted by one biology teacher and five students to obtain information related to the weaknesses of the product being developed. This limited trial is to obtain direct input in the form of responses, reactions, student and teacher comments on learning media.

**Table 1.** Validator Rating Scale

| Category | Score |
|---|---|
| Verry Good | 5 |
| Good | 4 |
| Pretty Good | 3 |
| Not Good | 2 |
| Not Very Good | 1 |

Adapted from Akbar (2013).

Percentage that has been obtained then confirms the percentage of conformity with the following parameters

**Table 2.** Criteria for Media Feasibility

| Average Score (%) | Response Criteria |
|---|---|
| 81 - 100 | Very Worthy |
| 61 - 80 | Worth It |
| 41 - 40 | Decent Enough |
| 21 - 40 | Not Feasible |
| 0-20 | Very Unworthy |

Adapted from Akbar (2013).

Spread (Disseminate), This stage is the final stage, where the product can be tested extensively. This trial was conducted in class XI IPA 2 at SMA Negeri Bogor Regency

## Result and Discussion

Definition Stage (Define), from the results of the study, the material that is still difficult for students to understand is the material on the nervous system. This statement was strengthened by interviews with biology teachers and pre-research trials with students who obtained a score of 33% above the standard score while the score below the standard score was 67%. So that this nervous system material is still classified as low. According to students, this nervous system material is very difficult to learn because there is too much material and inefficient time so that it becomes the student's weakness point in the nervous system material. This is by Rahayu (2016) that the concept of the nervous system in high school biology subjects contains complex material and has much-related information in it, such as explaining the delivery of stimuli and sensory organs to

the central nervous system, then from nerves center leading to the muscle or gland.

The facts found that teachers often use media Microsoft Powerpoint, instructional videos, picture media, and biology books. The method that the teacher uses when teaching tends to be the method of discussion and lecture. The only sources of books that students use when studying are biology worksheets and some books in the library. Therefore it is necessary to develop media mobile learning which includes indicators, concept maps, and nervous system material which includes video, audio, discussion forums, and final examinations to improve students' conceptual understanding, especially in the nervous system material.

Planning Stage (Design), this stage is done by first making the content of the material sourced from books, journals, or from the internet. Besides, images, videos, audio are collected to complement the content of the material. Questions and answers media were also made mobile learning. The material presented in this media mobile learning is the nervous system material.

The material that has been compiled is then made up of 50 multiple choice questions with answer options A to E. These 50 questions are validated first. In this study, two methods of validity testing were used, namely the content validity test and the test item validity test. The content validity test was carried out on 2 material expert lecturers to find out whether the question was feasible or not to be tested using the Aiken index formula. The results show that from the results of 50 items, it is found that the Aiken index for the question validation instrument is 0.76 with the medium validity category so that it can be continued with instrument testing with respondents who are following the purpose of developing the instrument. The instrument validity test was tested on class XII IPA.

The instrument was said to be valid if rcount> rtable. Valid questions will be used and invalid questions will be revised. To determine which items were used when testing the spread, the researchers considered the validity of the trial and the validity of the experts. This is because when the instrument test took place, the trial sample did not take the problem seriously, many were cheating on each other, the signal was unstable so that the filling of the questions was not optimal. The result is that from 50 questions, there are 40 valid questions and 10 invalid questions.

The questions that have been tested are continued with the reliability test. This test is performed to determine whether the instrument is reliable or reliable. The reliability test data was taken from the validity test data that had previously been carried out. The question instrument is said to be reliable if r11 ≥ 0.70. If r11 is equal to or greater than 0.70, it means that the learning outcome test that is being tested for reliability is declared to have high reliability (reliable) (Arikunto, 2012). The result of the rvalue11 obtained is 0.83. So, this value indicates that the test item instrument has a high level of reliability (reliable). So, the questions that will be tested in the distribution test and see the results of the scores pretest- and post-test are 40 multiple-choice questions.

In addition to question analysis, also made a storyboard, as well as a display for mobile learning, is using applications of MIT App Inventor and Pinterest. Making a storyboard includes designing the button layout, icon button, background, sound, and text size. The making of this mobile learning application uses the MIT App Inventor application so that it can be installed on smart-phone android.

Development Stage (Develop), the results of the Media Feasibility Analysis Test Media that have been developed are validated by material experts and media experts. The validation results can be seen in Table 3.

**Table 3.** Validation by Media Experts and Material Experts The

| Expert Validation | Average (%) | Category |
|---|---|---|
| Material/Topic | 83,0 | Very Worth It |
| Theory | 82,5 | Very Woth It |
| Amount | 82,7 | Very Worth it |

Average of the two experts is 82.75% which can be categorized as very feasible. According to Riduwan, (2015) the value with an interval of 81% - 100% can be categorized as very feasible, so that this media mobile learning can be categorized as very feasible, of course with several revisions as suggested by validation experts. Trial Step, this trial was conducted on 1 teacher and 5 students. The results of teacher and student responses to applications mobile learning android-based can be seen in Table 4.

**Table 4.** Teacher and Student Responses

| The Respons | NP (%) | Information |
|---|---|---|
| Teacher | 87 | Very Good |
| Students | 82 | Very Good |

In the range of values, 81% -100% can be categorized as very good so that, from the value obtained, it can be concluded that the application mobile learning Android-based received a good response from teachers and students. This good response from students shows that students are happy when learning to use media mobile learning. According to Gündüz et al., (2016) learning using technology can make students happy in learning because it has an attractive design appearance. Suggestions obtained from the teacher were to improve indicators, learning objectives that were following the 2013 curriculum, and add an absent menu,

while suggestions obtained from students were to improve image resolution that was still not HD. Based on the suggestions from the teacher and students, the media mobile learning will be revised again. The result for development media can be seen in Figure 1 and 2.

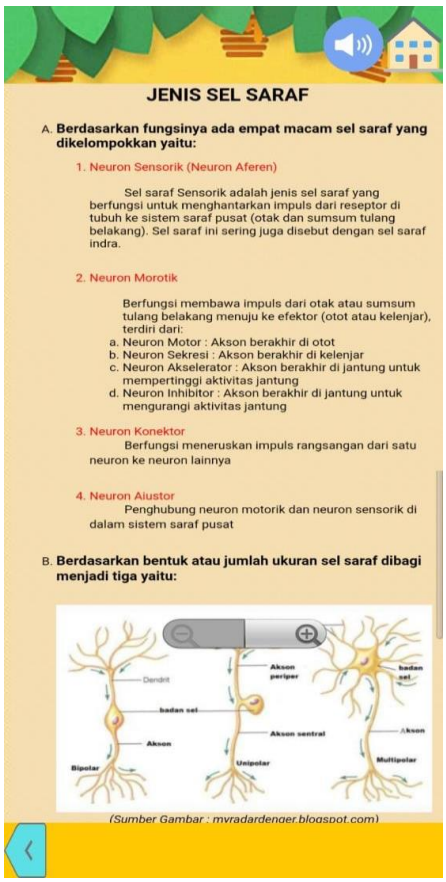


**Figure 1.** Type of nervous menu

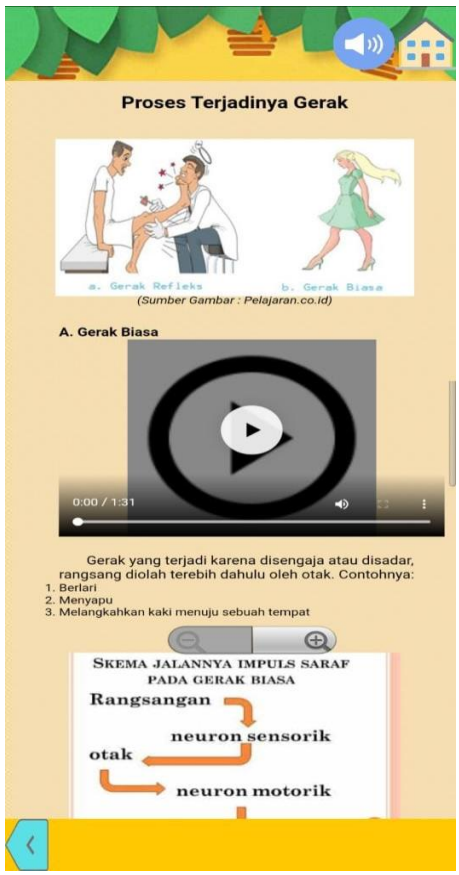


**Figure 2**. Nervous mechanism menu

Deployment Phase (Disseminate), media that has been categorized as feasible and has been revised following suggestions validation team of experts then conducted trials. This trial focused on one class, namely class XI IPA 2 which was tested proven to help study the nervous system material. The mean results of the scores for the pre-test and post-test class were 40.7 and 79.9 respectively, so it can be seen that the mean value has increased so that the highest value obtained is 90. This means that the use of media mobile learning can improve understanding of the concept. The N-gain value obtained is 66.5, so it is included in the medium category. This is because learning with media mobile learning very influential on students' conceptual understanding. According Rodríguez et al., (2020) it shows that the use of mobile learning Android-based improves students' understanding of biology, mathematics, and electronics subjects. Besides, the practical characteristics of mobile learning that can be carried anywhere become an attraction for users to facilitate learning anywhere and anytime so that students can learn even without being accompanied by a teacher. mobile learning Android-based can also be used as an independent learning medium. Apart from being portable, mobile learning Android-based also has the advantage that it can be used repeatedly (Lai et al., 2015).

The advantages that students feel when using this application are that the application mobile learning is better understood and looks more attractive compared to textbooks. Then students are happy because there is a sound or back sound on the media so that students don't get bored. Advantages of mobile learning compared to other learning are that it can be used anywhere at any time, has a relatively cheaper price than the PC price, the device size is small and light, is expected to include more learners because mobile learning utilizes technology commonly used in everyday life (Gu & Belland, 2015; Qian et al., 2018; Reyna et al., 2018). The existence of mobile learning can reduce paper usage because this application can be installed on a smartphone and used without having to print it so that the learning process becomes one of the implementations of conservation in learning (Al-araibi et al., 2019).

## Conclusion

The development of media mobile learning Android-based on learning the biology of nervous system material gets a very feasible category as a learning medium with a value of 82.75% which is validated by media experts and material experts and can improve students' conceptual understanding, this is evidenced by an increase in the results of the pre-test and post-test after using the application. The mean pre-test and post- test scores obtained were 40.7 and 79.9 so that the N-gain value obtained was 66.5, which was included in the medium category and almost all students responded positively because it contained text, videos, and forums discussion so that the learning process is flexible and not bound by time.

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