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21st-Century Learning: Development of Respiradroid Media (Respiration Concept) For High School Students

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Abstract

This research is a research development that aims to develop biology learning media in the form of an android learning application. This study uses research and development (R&D) with a method developed by Thiagarajan, namely the 4D model with stages: define, design, develop and disseminate, the stages of this study are limited to the development stage. Products that have been developed are then validated by experts in their fields. The results showed that respiradroid learning media had an average of 3, 31 in aspects of learning media. The validation results obtained from media and material experts prove that respiradroid media developed are suitable for use in the learning process. Media respiradroid learning has the advantage that is, a learning media that is flexible means that it can be used anywhere, easy to install, easy to find material content with student stimulus for thinking. It is expected to improve students' higher-order thinking skills in the concept of respiration.

1. INTRODUCTION

The development of technology has an important role to support education in the modern era. Implementation of learning that involves technology needs to be considered, interactive media can explain complex and dynamic concepts more clearly, facilitate the recall of material content easily and increase understanding of content through student perspectives and make learning interesting (Ristanto, et al., 2020; Hwang, 2014). Learning media that can be used in the learning process is multimedia, because multimedia is a combination of text, video, graphics, audio and animation in devices such as computers (Miarsyah, Ristanto, Nurhayati, Siti, Suparini & Astuti, 2020). Learning by using technology will affect learning is maximally achieved (Rosamsi, Miarsyah, & Ristanto, 2018; Minocha, 2010).

Today, almost all middle school students use Android as a communication tool. The use of Android in learning can be a learning innovation (Grane, Olmedo, Crescenzi, & Suarez, 2011). Research conducted by (Hanafi, & Samsudin, 2012) also states that students are more interested in using Mobile-Learning on Android than e-learning. Another benefit of using Android as a learning material is that learning can occur anywhere (Haag & Alexsandria, 2011). With its potential and excellence, learning by using M-learning is an alternative learning that can improve efficiency and effectiveness (Teguh & Oky, 2014). Also mentioned by Lawrence (2015) that the use of smartphones can enhance learning in various ways and contexts.

Biology learning in the 21st century has undergone a change in learning from teacher-center to student-center, students are not only required to record everything that is explained by the teacher, but also actively seek various information (Camacho & Legare, 2015; Derevenskaia, 2014; Sukiniarti, 2016). In addition, changes in student learning approaches are also required to have higher abilities in terms of thinking. This ability is often called Higher Level Thinking Skills (HOTS). It was stated that the use of problem solving learning models is very suitable for use in improving HOTS (Barber, King & Buchanan, 2015; Gunduz, Alemdag, Yasar & Erdem 2016; Khoiriyah, & Husamah, 2018; Permana & Chamisijatin, 2019).

Through problem solving experience, students can learn both content and thinking strategies, Problem-Based Learning (PBL) also shows the existence of instructional approaches that offer the potential to help students develop flexible understanding and lifelong learning skills (Maulina et al., 2020; Cindy, 2004). Problem-based learning is a teaching model that uses problems as the main focus for developing problem solving skills, materials, and self-regulation (Kauchak & Eggen, 2012). Problem-based learning supports the online learning process and face-to-face classes that are systematically combined to produce blended learning scenarios, the learning outcomes show a significantly higher ranking (Woltering, Andreas, Klaus & Cord, 2009).

Android as a biology learning media contains learning material, pictures and practice exercises (Aprilia & Suryadarma, 2020). The process of learning activities must increase students 'mastery of the concepts of the material being taught and changes in students' thinking abilities. Media respiradroid (android respiration) is an android-based biology learning media, respiradroid tries to improve the mastery of concepts and higher-order thinking skills of students. In respiradroid there is also a part of the syntax of PBL learning models, namely the presentation of videos to initiate the learning process.

2. RESEARCH METHODS

This research is a research and development aimed at developing android-based learning media (respiradroid). This study uses a 4D mode (define, design, develop and disseminate) as can be seen in Figure 1.

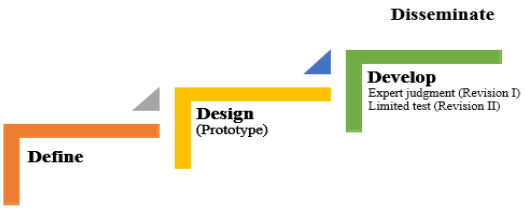

Figure 1. Research Design

The steps in this research model start from the defining stage, which is determining the requirements needed, by paying attention and adjusting the learning needs for students, at this stage there are several things that must be analyzed, starting from the analysis of students, analysis concepts, task analysis and formulation of learning objectives. everything that is done in the first stage is to define aims to provide an overview and determine the type of media to be created.

The second step is to design (design), starting from making storyboards, determining images, materials and videos that will be incorporated into respiradroid media and compiling a measuring tool to measure students' thinking skills (in the form of instruments about HOTS), this measurement tool is separate from the respiradroid media but is a unity in research. Media respiradroid is made using the android studio application 3.6.3.

Next is the development stage, which is developing respiradroid media, to produce development products at this stage, carried out through two steps, namely: (1) expert assessment in the field, followed by revisions, (2) developmental testing (developmental testing) the goal is to retrieve data for media validation from students. Product viability testing is carried out by two material experts and two media experts. Data analysis uses a mean score which is then converted to a standard value in the form of a percentage of eligibility.

The final stage is dissemination, the media that have been developed will then be used by other students and disseminated. However, this research is carried out until the development stage, because this is the initial research before going to the next stage. The assessment data obtained from the validator will be analyzed descriptively qualitatively and serve as a reference for revising the product, so as to produce a viable product. The developed product design is assessed by the validator using a validation sheet. The results of the assessment of all aspects are measured with a Likert scale. Likert scale is a number of positive or negative statements about an object of attitude (Sugiyono, 2017).

The sample of this study was students of class XI of SMAN 2 Telukjambe, Karawang with a total of 58 students. The instrument used in this study was a validation sheet from material and media experts, a validation sheet by teachers and students. Data collection techniques using questionnaires and tests, to determine the success of the use of respiradroid media, a mastery of concepts and high-level thinking skills was carried out. The percentage of validity scores is calculated using the following formula

$$JK(r) = \frac{\sum x^2 t}{K} - \frac{(\sum x)^2 t}{KxN}$$

Note:

$JK(r)$ = average validator assessment results
K = number of criteria
N = number of validators assessing
Xt = total validator score

The eligibility categories based on Likert Scale are as follows (Arikunto, 2009)

Table 1. Media eligibility criteria

Validation value	Eligibility category
1,00 -1,99	Not feasible
2.00 – 2.99	Pretty decent
3.00 – 3.49	Eligible
3.50 – 4.00	Very decent

3. RESULTS AND DISCUSSION

The product produced from this research development is respiradroid media. Development research is carried out with the Thiagarajan model which has been modified only to the development stage. The steps undertaken in this research development are: (1) define, (2) design and (3) development.

Define stages, at this stage a needs analysis is conducted. The analysis was conducted to observe the characteristics of students, abilities, learning motivation, background, experience and formulate learning goals. The analysis is carried out when creating a concept map of learning materials while determining achievement indicators. Initial analysis was carried out observation by interviewing biology teachers at school. Based on observations, the teacher states that students have difficulty in answering questions with high cognitive levels (higher order thinking skills) (Supriyadi, 2016).

Design stage, at this stage the preparation of media and materials used for learning activities is carried out. Making product design begins with making a storyboard then proceed with respiradroid media. The menu format at the beginning of the display contains an introductory section, concept maps, material lists, exercises and evaluations and assistance.

Develop stage, at this stage the development of respiradroid media is used by the teacher when teaching in class. Existing respiradroid media are validated by experts, if they have met all aspects of validation can be used by students as learning media. The following are the results of validation by media experts.

Table 2. Respiradroid Media Assessment Instrument

No	Aspect	Indicator	Score	Note
1	Display Quality	Presentation of the initial appearance of Android-based learning media that facilitates the determination of further activities	3.35	Valid
		Icon / button that makes it easy for users to use learning media based on Android	3.50	Very Valid
2		Clarity of material menu hierarchy in android-based learning media	3.00	Valid
		Appropriate use of text colors and fonts on Android-based learning media	3.50	Very Valid
		Suitability of the proportion of images presented with the Android-based learning media display	3.40	Valid
		The process of loading on android-based learning media	3.25	Valid
	Softeware Engineering	Ease of finding content (syllabus, concept maps, materials and learning evaluation)	3.05	Valid
		Ease of finding content (syllabus, concept map, learning material and evaluation)	3.50	Valid
	Total		3.31	Valid

Validation is carried out by two validators, based on the results of the validation carried out by media experts the assessment is carried out on aspects of instructional media design where there are items about display quality and software engineering. Media respiradroid has the ease of finding material that students want. There are suggestions and comments from the validator namely:

- *Adding a navigation button to facilitate student learning. When opening an application on Android, it should be given a description of the application for levels and classes*. (**Advisor 1**)
- *Given the information in the opening section respiradroid for levels and classes, Verify the material at the high school level because there is some material for the level of students. In practice and evaluation, consideration is given to multiple choice practice questions*. (**Advisor 2**)

Based on suggestions and comments from respiradroid media validator revised using Android Studio 3.6.3 application. The average score obtained from the results of validation consisting of two indicators obtained 3.31 which means valid.

Table 3. Evaluation of the performance of respiradroid media display

Aspect	Indicator	Score	Note
Implementation	Presentation of Android-based learning media allows users to learn independently	3.00	Valid
	Android-based learning media can be used anytime and anywhere by users	3.50	Very Valid
	Display interface on Android-based learning media has a good layout	3.25	Very Valid
	The design of Android-based learning media display according to user level	4.00	Valid
Interface	The accuracy of color selection, color balance, font type, and font size on Android-based learning media	3.30	Valid
	The suitability of the format and image resolution presented with the display on the learning media based on Android	3.00	Valid
Total		3.34	Valid

The next evaluation criteria, namely the feasibility and interface aspects, which contain items on the presentation of respiradroid media performance, appearance, display design and image format and media resolution of respiradroid media. Based on the results of the validation of the experts stated that the aspects of implementation and interface is valid with the results of 3.34 which means that the media respiradroid is valid. The suitability of the format and resolution is displayed by considering the color selection and appearance that is not too striking so that it disturbs the vision and comfort of students while learning. Because the accuracy of the use of instructional media can encourage learning motivation and positive reactions from students, so that it can improve learning outcomes (Cheng, & Cheng. 2012; Zhai, 2018; Chang & Hwang, 2019; Silva, 2018).

Table 4. Assessment of respiratory media use

Aspect	Indicator	Score	Note
Reusable	Some or all learning programs on Android-based learning media can be utilized again to develop other teaching materials	3.00	Valid
	The Android-based learning media is easy to install or uninstall from a smart phone	3.50	Very Valid
Maintenable	Android-based learning media master files are easily transferred from one smartphone to another	4.00	Very Valid
Compatibility	Android-based learning media applications can run on the majority of Android versions currently in use	3.00	Valid
	Android-based learning media can run at all screen resolutions	3.00	Valid
Total		3.00	Valid

Based on the results of media validation with reusable, maintenable and compability assessment aspects an average value of 3.30 with valid criteria. One formulation of respiradroid media is that the media developed are in accordance with the results of expert assessments in their fields. In addition, the developed media has been applied with a problem based learning model to support students 'HOTS ability improvement, because the increase in HOTS abilities can be stimulated by students' activities in solving problems (Supriyatin, Sri Rahayu, Ristanto, Ichsan, 2019; Djamahar, Ristanto, Sartono, Darmawan & Muhlisin, 2019).

Figure 2. Display of respiradroid media

4. CONCLUSIONS AND RECOMMENDATIONS

Research and development that has been carried out produces learning media, namely respiradroid media. Based on the results of the vaidation from media experts and respiradroid media material, it was declared valid and suitable for use in learning activities. Media respiradroid also received ratings from several teachers with good grades. Thus this research and development is carried out as a step and initial research to conduct further research, to then be tested on students and can be disseminated.

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