



Development of Heat Transfer Learning Media Based on Android Application Inventor (AI) to Instill Student Self Directed Learning

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Abstract

This study aims to develop a learning media of heat transfer based on android Application Inventor (AI) to instill student self directed learning. This research is designed with research and development design, adapted from modified 3D model which stages includes define, design and development. The subject of this research is the students of PGSD (Primary School Teacher Education) Study Program of Universitas PGRI Semarang. The result of validation by expert on instructional learning media of heat transfer based on android Application Inventor (AI) get 3.76 values is categorized as very feasible, the presentation of the content obtained value 3.84 with very decent category. Students responded positively to the learning media of heat transfer based on android Application Inventor (AI) developed. Based on the result of data analysis, it can be concluded that learning media of heat transfer based on android Application Inventor (AI) is very feasible, effective, and got positive response with 88.56% percentage by students and can be used as one learning resource that can increase student self directed learning.

Abstrak

Penelitian ini bertujuan untuk mengembangkan media pembelajaran perambatan kalor berbasis android Application Inventor (AI) untuk menanamkan kemandirian belajar mahasiswa. Penelitian ini dirancang dengan desain *research and development*, yang diadaptasi dari model 3D termodifikasi yang meliputi tahapan *define, design, development*. Subjek penelitian ini yaitu mahasiswa Program Studi PGSD Universitas PGRI Semarang. Hasil validasi oleh ahli terhadap media pembelajaran perambatan kalor berbasis android Application Inventor (AI) memperoleh nilai 3,76 dikategorikan sangat layak, penyajian isi memperoleh nilai 3,84 dengan kategori sangat layak. Siswa memberikan respon positif terhadap media pembelajaran perambatan kalor berbasis android Application Inventor (AI) yang dikembangkan. Berdasarkan hasil analisis data dapat disimpulkan media pembelajaran perambatan kalor berbasis android Application Inventor (AI) dinyatakan sangat layak, efektif, dan mendapat respon positif dengan persentasi 88,56% oleh mahasiswa dan dapat digunakan sebagai salah satu sumber belajar yang mampu meningkatkan kemandirian belajar mahasiswa.

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INTRODUCTION

The development of science and technology increasingly encourage renewal efforts in the utilization of technology results in the learning process. The development of ICT (Information and Communication Technology) becomes a separate challenge on the implementation of effective and innovative learning. ICTs promise great potential in changing the way one learns, to obtain information, adjust information and so on (Bustomi, 2010). According to Eueung (2012), media based on information and computer technology (ICT) is one of the alternative selections of instructional media so that the process of teaching and learning in the classroom can be more interesting for students. Multimedia also opens opportunities for education to develop learning techniques (Nurhayati, 2013; Taufiq et al., 2017).

Utilization of software in ICT-based learning can be used as an effort to develop students' thinking ability (Taufiq et al., 2014). Through elements in the media can encourage students to be active in thinking activities characterized by finding and finding patterns, solving problems, understanding ideas, and communicating ideas into visualized forms, using connections between science topics for a problem-solving.

With the growing number of people owning and using mobile devices opens the possibility of using mobile technology devices in education. More than 80% of PGRI University students in Semarang, especially Primary School Teacher Education Study Program (PGSD) already have communication tools in the form of smart phone (smartphone) with OS (Operational System) Android. In the android OS has main advantages lies in the number of applications contained in the Google Play facility. Available applications that can be utilized to support lecture activities, such as video call facility, browsing, email, chat, games and taking pictures and video. Zheng et al. (2015), states that the development of smartphones is currently growing rapidly and rapidly, the technology is not only done by the user as a medium of

communication, but can also be used as a reliable and user friendly learning media.

Natural Science (IPA) is a collection of systematically organized knowledge that is not only characterized by the facts, but by the existence of scientific method and scientific attitude through inquiry process (Wiyanto, 2008). Therefore, science or science has characteristics consisting of scientific products, scientific processes, and scientific attitudes. Products, processes, and scientific attitudes are expected to be developed in science/ science lessons. To develop these three things, innovation in science learning is needed. One of the innovations in science learning is to develop learning media based on Android Application Inventor (AI) that can be installed on Smartphones. The application-based Android Application Inventor (AI) can be one of the interesting learning media, because students can study the science material in different ways, using the Smartphone as a learning resource. In addition to making learning more interesting, students can study the material without time limits, meaning that students can study outside of college hours, thus giving a positive impact on student self-reliance (Fatimah & Mufti, 2014).

The use of media in the learning process is one of the efforts to create a more meaningful and quality learning. According Kusumawati (2012), that the transformation of learning by using ICT advancements can facilitate teachers to convey material and increase interest in learning so that students can be active in learning independently at home and school.

The self-study process can give students a tremendous opportunity to sharpen their awareness of the issues surrounding and the environment. Self directed learning is very important because it allows students to make positive choices about how they are facing the real world or in everyday life. This pattern allows students to act on their own initiative to shape the environment (Tahar, 2006).

Self directed learning is an improvement in the knowledge, abilities, or development of individuals in which individuals choose and define their own goals in learning, and try to use

methods that support their activities (Gibbons, 2002; Loyens et al., 2008).

Based on the explanations that have been presented, it is possible that science learning using the heat transfer media application based on android Application Inventor (AI) to instill student self directed learning. The applications of heat transfer concepts are often found in everyday life so that in learning the material is expected to connect the concept of heat transfer with events in everyday life. The aim of this research is to develop a learning media of heat transfer based on android Application Inventor (AI) to instill student self directed learning.

METHODS

This research was conducted in Study Program of PGSD Faculti of Education Science PGRI University of Semarang even semester of academic year 2016/2017. Research and Development (R & D) method adapted from modified 3D model was applied, which includes define, design, development stage. In the define phase, there are needs analysis activities such as field studies (interviews), syllabus, and conceptual and sub-concept analysis in selected courses. At this stage also conducted a theoretical assessment to formulate the development of instructional heat transfer media based on android Application Inventor (AI) to instill student self directed learning.

At the design stage is done preparation of the design of heat transfer media based on android Application Inventor (AI) to instill student self directed learning. The result of this stage is the design of the of heat transfer media based on android Application Inventor (AI) to instill student self directed learning, and continued validation by experts.

In the development stage, a limited implementation implementation of heat transfer media based on android Application Inventor (AI) to instill student self directed learning. In large-scale trials conducted evaluation and revision so that ready to be applied applied in the retrieval of research data. The analysis conducted in this research is the impact of application heat transfer media based on android Application Inventor (AI) to instill student self directed

learning to the students through student response questionnaire.

To find out self directed learning skills of student learning to grow or not, then needed an assessment. According to Blaustein, et al. in Sudjana (2008), assessment is the process of collecting information and making informed decisions. Self assessment is a questionnaire as an alternative assessment or authentic assessment utilized in this research as a non-traditional approach to assessing student performance or learning outcomes in terms of self directed learning is one of Hight Order Thinking Skills (HOTS).

Through self assessment obtained by the data of student self directed learning which the indicator developed from the opinion of a number of authors, indicators of learning independence observed in this research as follows.

- a. Have the initiative and motivation to learn
- b. Have a habit of learning needs
- c. Setting learning goals / targets
- d. Utilize and search for relevant sources
- e. Establish and implement learning strategies
- f. Viewing adversity as a challenge
- g. Monitor, organize, and evaluate learning

Conclusions or considerations about student self-sufficiency after learning and using learning media based android calorie application Application Inventor (AI) material of heat propagation can be expressed in qualitative statement as follows.

1. BT: Not seen (if the learner has not shown the initial signs of behavior stated in the indicator).
2. MT: Begin visible (if learners have started to show any early signs of behavior expressed in indicators but not yet consistent).
3. MB: Begin developing (if learners have shown the various behavioral signs stated in the indicator and start consistent).
4. Constitutional Court: Culture (if learners continue to show the behavior stated in the indicator consistently).

RESULTS AND DISCUSSION

Validation of The Media

The first step (define) in the process of making a learning media based android

Application Inventor (AI) is needs analysis. Data collection of needs analysis was done with field study in PGSD Study Program PGRI University of Semarang, field study conducted to find out what things will be needed for the manufacture of instructional heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning. Needs analysis is done by conducting analysis of readiness, opportunities, challenges and obstacles in the making of heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning. The things that are also done is the analysis of the curriculum starting from the RPS (Semester Learning Plan) and media developed to support the learning process, student code during the learning process, the techniques used by lecturers in learning activities and constraints faced by lecturers. Furthermore, in analyzing the material of heat propagation, this analysis was conducted

to find out the essential materials used in the medium of instructional learning based on application and calorific application of Inventor (AI) and the material that need to be taught to the students.

Second step (design) is design and product feasibility test of heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning done by media and material content expert. Validation results in the form of suggestions and commentaries used as a reference to improve to continue the third stage of developing application of heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning. Subsequently, re-validation was performed and analyzed and calculated the percentage of scores obtained and divided by the maximum score. The percentage results are interpreted into the criteria set forth in Table 1.

Table 1. Percentage Criteria of Heat Transfer Learning Media Based on Android Application Inventor (AI)

Interval Percentage scor (%)	Criteria
81 - 100	Very Good
61 - 80	Good
41 - 60	Good Enough
21 - 40	Poor
<20	Fail

Validation of heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning in the research includes validation of design and product. Validation done by media experts and materials obtained the following results.

a. ValidationDesign

Based on the results of expert assessment, the percentage of design feasibility percentage is 95.13% including the criteria very well, so the design can be forwarded to be made with

improvement. In the aspect of the existing view, media expert generally states have been good but need a proper navigation button to facilitate the user in accessing the application. In addition, the color of writing also needs to be considered for the media display looks contrast, type and size of the letters, and arrangement of links on the application interface needs to be adjusted to be more harmonious and orderly. In the aspect of programming, media experts claim the learning media is very good.

Table 2. Recapitulation of Experimental Data Validation to Heat Transfer Learning Media Based on Android Application Inventor (AI)

No	Validator	Average	Criteria
1	Media Expert	3,84	Valid
2	Material/ content Expert	3,92	Valid

Based on the material aspect, the expert advises that the image should be chosen according to the concept and given a description. In general, material experts claim that the design of learning media has been very good. Researchers make improvements by considering the advice of the experts, then conducted several times of discussion and evaluation to get a good and valid recommendation on the product design of heat transfer learning media based on android Application Inventor (AI) to instill student self

directed learning. On the aspect of learning is generally stated that the application / media is good.

a. Product Validation

The feasibility of the product is done by media experts and learning materials using a questionnaire developed by researchers. Expert validation results on the Learning and Propagation media apparatus product based on the Application Inventor (AI) of caloric propagation material in Table 3.

Table 3. Recapitulation of Expert Validation Result on Application Product of Heat Transfer Learning Media Based on Android Application Inventor (AI)

No	Validator	Average	Criteria
1	Media Expert	3.86	Valid
2	Material/ content Expert	3.90	Valid

Based on the results of expert assessment obtained the percentage value of product feasibility is 96.86% including the criteria very well, so the product can be tested by doing a little improvement. The advantages of application of learning apparatus multimedia applications based on android applications Inventor (AI) developed among others because the learning media is equipped with a complete component that consists of materials, pictures, videos and quizzes. In the developed Android program there are important learning support features such as: materials, pictures, videos and quizzes. The material presented packed more interesting and easy to understand because the information presented not only in the form of writing. All the features of the android-based learning apps with App Inventor (AI) technology allow it to be uploaded in the Google Store or Playstore app, so users can freely download and then install on user smartphones anytime and anywhere, so that students are given the widest possible learning opportunities independent. In addition can be used for self-learning, mobile learning can also be used as a learning medium that can be accessed

anytime and anywhere (Totiana et al., 2012; Arda & Darsikin, 2015). Research Taufiq et al. (2017) also shows the results that the android-based learning media can help students in particular and the scientific community in general to get the ease of learning the concept of science using a smartphone device without having to print using paper (paperless).

Student Self Directed Learning

Application of instructional media is intended to test the effectiveness of media use developed in order to instill student self directed learning. The application of heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning is done in two stages: small-scale test phase and field test.

Sample in this small-scale test involving five students. Trial of product usage is done experimentally that is pre-experimental design of one-shot case study model. Data on small-scale trial results of each indicator of self directed learning are presented in Table 4.

Table 4. The Result of Self Directed Learning in The Small-scale Test

Average	No Indicator of Self Directed Learning							Total	Percentage (%)
	1	2	3	4	5	6	7		
<i>Scor</i>	4	4	4	3	3	4	3	25	89,29

Description number of indicator:

1. Have the initiative and motivation to learn
2. Have a habit of learning needs
3. Setting goals / target learning
4. Utilize and search for relevant sources
5. Establish and implement learning strategies
6. Viewing difficulties as a challenge
7. Monitor, organize, and evaluate learning

The results in Table 4 indicate that the average total score of learning independence

indicator is 89.29% that has shown criteria of cultivating (MK) among students. The field test involved 42 students. Trial of product usage is done experimentally that is pre-experimental design of one-shot case study model. The data of field trial result of score of each indicator of student learning independence is presented in Table 5.

Table 5. The Result of Self Directed Learning in The field-scale Test

Average	No Indicator of Self Directed Learning							Total	Percentage (%)
	1	2	3	4	5	6	7		
<i>Scor</i>	4	4	4	4	4	4	3	27	96,43

Description number of indicator:

1. Have the initiative and motivation to learn
2. Have a habit of learning needs
3. Setting goals / target learning
4. Utilize and search for relevant sources
5. Establish and implement learning strategies
6. Viewing difficulties as a challenge
7. Monitor, organize, and evaluate learning

The results in Table 5 show that the average score of students' self directed learning indicator is 96.43% which has shown the criteria of cultivating (MK) among students. This shows that the use of instructional heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning as proposed by Suryaningsih (2014), that there is influence of interaction between learning media with the self directed learning to ability of science process skill, with a higher learning autonomy of students learning skill abilities that learn with real media is higher than students learning with virtual media, and in groups of students with low self directed learning, students' learning process skills in real-media learning skills are lower than those of students with virtual media.

The application of heat transfer learning media based on android Application Inventor (AI) to instill student self directed learning can present high level concepts and skills in science, which have a link between one element and other elements that are difficult to be taught and

studied through books alone (Wardani et al., 2013). The advantages of heat transfer learning media based on android Application Inventor (AI) is in explaining a concept can require students to explore and analyze try and explore the concepts and principles contained in a material faced, so as to build the structure of understanding. This can occur from the integration of components such as sound, text, animation, images/ graphics, and video that serves to optimize the role of the senses in receiving information into the memory system. The development of heat transfer learning media based on android Application Inventor (AI) can facilitate students to learn independently in developing their understanding ability.

CONCLUSION

Based on the result of data analysis, it can be concluded that heat transfer learning media based on android Application Inventor (AI) is very feasible, effective, and got positive response of student which can be used as one of learning resource that able to instill student self directed learning.

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