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The Effects of Android-Assisted Creative Problem Solving Learning Model towards The Improvement of Students' Scientific Literacy

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Abstract. The objectives of this research was to describe the improvement of students's science literacy used learning based the creative problem solving by android. The method of the research was quasi-experiment using pretest-posttest control group design. Research was conducted at grade VII of junior high school in Kebumen. Sample was choosen with stratified cluster random sampling tecnique, yield three yunior high schools eachs in high, middle, and low category. Instrument of the data collection using multiple choice test which has been declared valid and reliabel. Data was analysed descriptively based on N-gain and inferentially using regression. Results of the research showed (1) android-assisted creative problem solving learning had a improvement on student's science literacy that showed by N-gain of scientific literacy in high category school was 0.728, middle category was 0.696, and low category was 0.708; (2) android-assisted creative problem-solving learning had a significant effect on students' scientific literacy of junior high schools in Kebumen.

INTRODUCTION

The evolution of this era requires a young generation who has qualified and able competing in various aspects of life, one of them is science and technology. The efforts to face global competition are through education. Enhance the quality of education is pivotal point to be done, in order to produce education quality and to enhance the student's ability to solve the problem. Based on the mapping conducted by The Global Index of Cognitive Skills and Educational Attainment 2014, Indonesia got the last place of 40 countries that had been researched. This condition indicates improving the quality of learning is indispensable.

The learning process inseparable from the selection of appropriate learning strategies, including learning methods, learning models, learning environment, learning media, and other factors which influence it. Choosing one of the appropriate learning strategies is not easy. Teachers should be discovering students problem on the learning process. Then, teachers will look for the best solution to solve students problem, starting from an analysis of the characteristic of students, the students learning needs, and other thing to appropriate the learning strategies. One example to the selection of the learning strategies is presenting a new innovations in the learning process. New innovation in the learning system is the current demands on education. Science and technology were evolved enormously day by day, this is giving a huge effect on people's lives, especially for education.

The implementation of 2013 curriculum demands innovation in learning activities. Implementation of the 2013 curriculum conducted by using a scientific approach for learning activities. The creative problem solving model is one of the recommended learning models in the implementation of the 2013 curriculum. Class which use problem-based science learning has higher standardized test scores than traditional classes [18]. Characteristics of problem solving learning which comes from problems, real phenomena or natural phenomena are expected to improve student's ability in solving contextual problems creatively. Creative problem solving is a variation on problem based learning through systematic techniques in organizing creative ideas to solve a problem. This model is designed to help problem solvers by using creativity in achieving goals, overcoming obstacles and increasing the likelihood of creative activities [11]. Treffinger describes the steps and stages of the CPS learning model as follows: (a) understanding the challenge; (b) generating ideas; (c) preparing for actions; (d) planning your approach [21].

Krulik & Rudnick said, problem solving is used by individuals using prior knowledge, abilities and understanding of unusual situations, students should be able to synthesize about which was studied and applied in a new and different conditions [6]. Harnard said, a creative person is a person who is related to a lot

of thinking ability in the analogy or by intuition [5]. A problem solving needed more than just personal thoughts, thoughts together in a group can reduce the error as an individual [17]. Troubleshooting requires creativity, whereas problem is sources to develop creativity [23]. Creative problem solving learning has been used successfully in the world of education from basic to higher education classes to train individuals in fulfilling his need [7].

On 21st century, the development of Information, Communication and Technology (ICT) greatly influence on the world of education, in implementation of this curriculum should encourage the learning activities in the classroom by making use of technology (ICT) [14]. Murphy said android devices are most widely used in cell phones (mobile phones) [15]. As the operating system for mobile devices, android mobile platform is referred to as the first complete platform, open source platforms, and is free [9]. States some of the advantages in the use of android as a medium of learning are: (a) the provision of access information without borders through the internet service and online database; (b) open the limitations of space and time in learning activities; (c) provide independent learning system, addressing the sensitivity in difference ways of learning, and provide monitoring of progress in the learning process on an ongoing basis; (d) Increase the productivity of knowledge; and (d) give the opportunity to the student's to control the learning process because student's learn actively and independently as well as in personal responsibility [2].

Science-Play is mobile learning which developed based on creative problem solving, this mobile learning makes it easy for student's to access the subject matter and tasks of the project on learning activities without being constrained, because of the time and place of the android is both practical and flexible. The use of mobile learning based on creative problem solving model is expected to improve the ability of student's in scientific literacy, this is demonstrated from the suitability of the syntax model creative problem solving.

Science literacy known as the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity [16]. Science literacy enhances the ability of a person to observe events perceptively, reflect on them thoughtfully, an comprehend explanations offered for them" [1]. Science literacy has become a kind of icon in the world of science education [13]. The science education literature demonstrates that scientific literacy is generally valued and acknowledged among educators as a desirable student learning outcome. However, what scientific literacy really means in terms of classroom practice and student learning is debatable due to the inherent complexity of the term and varying expectations of what it means for learning outcomes [19]. In one of the earliest attempts to arrive at a definition of scientific literacy, deduced that scientific literacy was based on six characteristics. They stated that a scientifically literate person should have an understanding of basic concepts in science, nature of science, interrelationships of science and society, ethics that control the scientist in his work; difference between science and technology and interrelationships of science and the humanities [4].

Several regions in Indonesia have been very familiar with smartphone based android. However, some people assume that a child who use smartphone got a bad impact in learning. This research will explain about the positive effect of use smartphone in learning. Science-Play made in accordance with the times and adapted to the study of scientific.

METHODS

Types, Places and Research Subjects

The kind of this research was a quasi experimental research, and the research design used matching "pretest-posttest" control group design. This research was carried out in Kebumen Regency, Central Java Province, using 3 schools which have implemented the curriculum of 2013. Sampling of this research was based on school curriculum with stratification categories low, medium dan high. This designation was based on the score of national examination in junior high school of Kebumen Regency. The sample of this research are 192 students consists of 2 classes (control class and experiment class). The experiment classes were given a model of a creative problem solving learning by android, and the control classes was given conventional learning model.

Instruments and Data Collection Technique

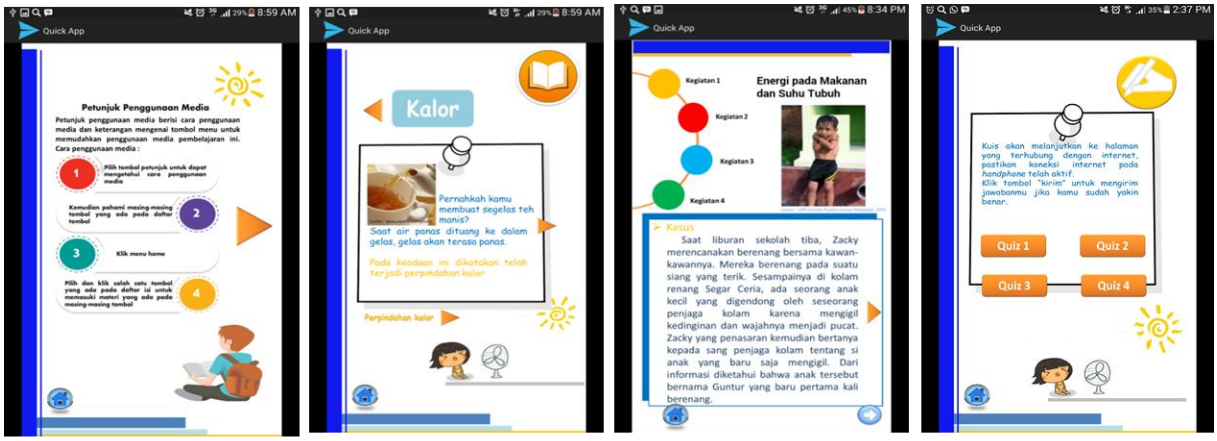
Science-Play as media learning based on android was adopted from research instrument by widyawati (2015) which has been declared valid and reliable, and adjusted by the use of android. Data collection

techniques in this research use multiple choice test to examine student's scientific literacy. Data analysis using Gain Score and inferentially using regression

Instructional media on this research was named Science-Play. Science-Play applications is instructional media of learning which can be used on android, this applications is included in the mobile learning. Science-Play can make students t be active in the class by using scientific methods. These condition are accordance with the opinion of Agustin concerning the advantage in the learning use mobile learning which is accessible, unlimitted of time and space, and providing independent learning system [2].

Science-Play application size is 23 MB. This application has a design offline, except on the students quiz. Science-Play application was created using Construct 2 then converted in to the format apk using Quick.app. Science-Play consists of 4 main menu, the following menu is instruction, materials, activities and quizzes. Activities menu was adopted from products research of [22].

Stages in learning which using Science-Play adapted to the creative problem solving stages. Instructional media has been declared valid by the media expert.



(a) (b) (c) (d)

FIGURE 1. Preview (a) Instruction, (b) Materials, (c) Activities, (d) Quizzes

RESULT

Increasing Ability of Scientific Literacy

The improvement of scientific literacy is conducted by normalized gain score (N-Gain). Results from data analysis of N-Gain score indicates the achievement of improved students ability with regard by initial students ability. The result of calculating of N-Gain score indicate inequality in learning using creative problem solving learning model. Improvement criteria of N-Gain pesented in table 1.

TABLE 1. Improvement Criteria N-Gain [6]

Quantitatif Value	Qualitatif Value
(<g>) > 0,7	High
0,7 ≥ (<g>) ≥ 0,3	Medium
(<g>) < 0,3	Low

The improvement student's ability of scientific literacy obtained from pretest and posttest score on control classes and the experimental classes. Examination results were used to indicate N-Gain score which get from each school with high category, medium category and low category. The result of the aquisition N-Gain in school high category is presented in table 2.

TABLE 2. The aquisition of N-Gain score on high category of school

Criteria	Experimental Class		Control Class	
	Pretest	Postest	Pretest	Postest
Max	53	97	53	67

Min	30	80	27	47
SD	6,72	6,13	6,57	6,65
Average	42,26	84,39	40,77	53,68
N-Gain	0,728		0,27	

Based on table 2. The average of N-Gain on experiment class get 0,728 included in high category, and the average of N-Gain on control class get 0,27 included low category. The aquisition of N-Gain on middle school category presented in table 3.

TABLE 3. the aquisition of N-Gain score on medium category of school

Criteria	Experimental Class		Control Class	
	Pretest	Postest	Pretest	Postest
Max	47	97	47	67
Min	30	73	30	33
SD	6,27	8,14	5,41	6,87
Average	41,70	82,40	41,10	53,39
N-Gain	0,696		0,202	

Based on table 3. The average of N-Gain on experiment class get 0.696 included in medium category, and the average of N-Gain on control class get 0,202 included low category. The aquisition of N-Gain on low category school presented in table 4.

TABEL 4. The aquisition of N-Gain score on low category of school

Criteria	Experimental Class		Control Class	
	Pretest	Postest	Pretest	Postest
Max	48	93	48	93
Min	19	77	23	45
SD	7,73	7,46	6,07	9,46
Average	40,72	82,84	40,94	54,48
N-Gain	0,708		0,222	

Based on table 4. The average of N-Gain on experiment class get 0.708 included in high category school, and the average of N-Gain on control class get 0.222 included low category.

The Results of Analysis Scientific Literacy Capabilities

Prerequisite experimental hypotheses

Prerequisite experimental hypothesis is conducted on all categories of schools. Prerequisite experimental hypotesis is conducted in the form of a experimental homogeneity and experimental normality towards on score of experiment class and control class. The result of the normality test on experimental class and control class indicate the data come from a normal distributed population. The result of homogenity test presented value of significance is larger than 0.05. These results indicate data of experimental classes and control classes have the same variansi or homogeneous all category of school.

Hypotesis test

Hypothesis test was done after the prerequisite hypotheses test using a multivariate test between-subject effects. The analysis of the results of the test between-subjects effects all categories of school presented in table 5.

TABEL 5. The result test of linear regression with dummy variable

Dependent Variable	Category	R square	Sig.
Scientific Literacy	High	0,811	0,000
	Medium	0,765	0,000
	Low	0,726	0,000

Based on table 5, on the hypothesis test using the test of between-subjects effects that aided by 20 SPSS for Windows obtained a score of significance of 0.05, then < 0.000 H_0 is rejected, thereby the creative problem solving learning to use the Android indicate the enhancement of ability on students scientific literacy significantly. These results are in accordance with the results of previous studies conducted by Widiyawati Yeni and Triyono by using creative problem solving learning can improve the ability of students scientific literacy. The results of this study also in accordance with the stated opinion of schneider [18] that class which use problem-based science learning has higher standardized test scores than traditional classes. Problem solving learning is used by individuals using prior knowledge, abilities and an unusual situation understanding, students should be able to synthesise about what is learned and applied in new and different conditions as stated by Krulik [6] so that it can to improve science literacy skills. Significant influence is indicated with the acquisition of N-Gain score.

Science-Play applications is media of learning which can be used on android, so this application is included in the mobile learning. Science-Play can make students learn to be active wherever and whenever by using scientific methods. These conditions are in accordance with the opinion of Agustin [2] on advantage in learning to use mobile learning which is accessible, open the limitations of time and space, as well as providing independent learning system.

CONCLUSION

Based on the results of data analysis, it can be concluded the learning based on creative problem solving learning used android influential significantly to increase the ability of junior high school students of scientific literacy in Kebumen Regency.

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