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The Effect of the Use of Android-Based Application in Learning Together to Improve Students' Academic Performance

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Abstract. Poor achievement of students' performance on Chemistry may result from unfavourable learning processes. Therefore, innovation on learning process must be created. Regarding fast development of mobile technology, learning process cannot ignore the crucial role of the technology. This research and development (R&D) studies was done to develop android based application and to study the effect of its integration in Learning together (LT) into the improvement of students' learning creativity and cognitive achievement. The development of the application was carried out by adapting Borg & Gall and Dick & Carey model. The developed-product was reviewed by chemist, learning media practitioners, peer reviewers, and educators. After the revision based on the reviews, the application was used in the LT model on the topic of Stoichiometry in a senior high school. The instruments were questionnaires to get comments and suggestion from the reviewers about the application, and the another questionnaire was to collect the data of learning creativity. Another instrument used was a set of test by which data of students' achievement was collected. The results showed that the use of the mobile based application on Learning Together can bring about significant improvement of students' performance including creativity and cognitive achievement.

Keywords: *Android Application, Learning Media, Creativity, Learning Outcome*.

INTRODUCTION

Mulyasa [3] stated that there are many factors affecting on learning interactions, both internal factors that come from within the individual and external factors that come from the environment. Teachers' main task is to condition the environment to support behavioral change for students. One way is by collaborating method with appropriate instructional media. To achieve learning outcomes in accordance with the objectives requires an instructional media easily understood with a complement of attractive material visualization.

Chemistry is one of the subject matters which difficulty to learn by students, because it has material in the form of elements / objects that are very microscopic and abstract, so that appropriate learning media needed to help facilitate students in understanding the material. One of the subjects of chemistry taught in high school is the basic law and chemical stoichiometry. Many opinions that say that the material stoichiometry more emphasis on solving math problems. This is indeed true, chemistry also examines a matter of chemistry [4]. But on this subject, students are not only required to complete the calculation of the chemical, but also must be able to understand the concept is then applied to chemical calculations [2] Understanding the concept of chemical calculations by the implementation on this is not an easy thing, especially for the 10^{th} grade students who just got a chemistry lesson.

The results obviously proved that the use of tools greatly help the process of teaching and learning in the classroom. Utilization of communication technologies for education, educational technology and media education is needed within the process of teaching and learning. Due to scientific, systematic and rational approach as required by the educational technology, the goal for effective education will be efficiently achieved [12]. This requires learning media that can be collaborated with classroom teaching methods so as to make the students feel interested and help students understand the material stoichiometry.

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One media that can be developed is an android-based instructional media. It can be integrated with varied teaching methods. One model of learning that can be combined with this android based learning media is cooperative learning. Cooperative learning model has long been developing with the goal that the result of increased student academic learning and students can receive a wide range of diversity of his friends, as well as the development of social skills [1]. Learning Together is a cooperative learning model that emphasizes learning model with a group discussion to find and apply the concepts in solving the problems [10]. With android-based instructional media which collaborate with cooperative learning model, expected to create a learning environment that is effective and efficient that will make students become interested in learning because the media is able to show an interesting animation. It is then able to develop the mindset of students become more creative. Then, through cooperative learning, students are encouraged to work together on a common task and they must coordinate their efforts to resolve the assignment of teachers for the purpose of cooperative learning model is the result of academic learning of students increased and student can receive a wide range of diversity of his friends, as well as the development of social skills [1]. Thus, the use of media that collaborated with learning together learning model is expected to increase creativity and learning outcomes of students so that learning objectives can be achieved effectively and efficiently.

RESEARCH METHOD

Development Procedures

This type of research was done by using research and development approach. The development model used as the basis in this development is the result of adaptation and modification from the development by Borg and Gall [9] and Dick & Carey [10] in order to obtain development procedures as follows.

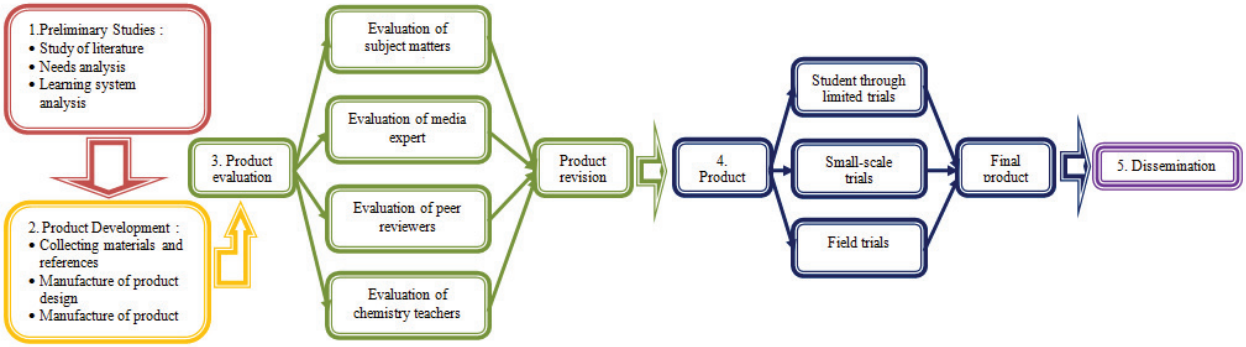

FIGURE 1. line of this research

The assessment instrument in this study was a questionnaire about the quality of the android-based instructional media for the 10th grade students of high school adapted from Prasetyo [16]. In addition to the media quality assessment instrument, this research also used creativity questionnaire to determine the development of students' creativity after using the android-based instructional media. Creativity questionnaire was developed based on the indicators of creativity expressed by Karina [6].

This research is the quasy experimental with non equivalent control-group design. Population in this study were all students in 10th grades of SMAN 1 Kasihan. 2 classes as the samples was determined by class random sampling technique because all classes have the same opportunity to be the research samples. The research design is showed in table 1.

TABLE 1. Non Equivalent Control-Group Design

No	Variable	Students Group	Pretest	Treatmen		Postetst
				Learning Together	Android-based instructional media	
1	Creativity	Experiment	Yes	Yes	Yes	Yes
		Control	Yes	Yes	No	Yes
2	Learning Outcome	Experiment	Yes	Yes	Yes	Yes
		Control	Yes	Yes	No	Yes

To determine the changes of students' learning outcomes in learning process after using the android-based chemistry instructional media as a source of independent learning, it took an instrument of learning outcome tests consisting of pretest and posttest in the form of reasonable multiple-choice questions . This instrument was developed based the Curriculum 2013. Scores of the cognitive outcome test was subsequently obtained by adding up all the scores for each item of the test. Determination of students' cognitive learning outcome (gain) used the same equation as when determining students' creativity gain. To calculate the gain's value, use the following equation [11].

$$g = \frac{S_f - S_i}{100 - S_i}$$

Sf = Final test
Si = Initial test
g = Gain

Furthermore, to prove the significance of differences in creativity and learning outcomes between the experimental class and the control class was done by testing statistically with MANOVA. The hypotheses proposed in this study are as follows.

H_0: There is no difference in the increase of creativity and cognitive learning outcome between the students treated with the android-based instructional media integrated to learning together with the students treated with learning together without the android-based instructional media.

H_a: There is a difference in the increase of creativity and cognitive learning outcome between the students treated with the android-based instructional media integrated to learning together with the students treated with learning together without the android-based instructional media.

RESULT AND DISCUSSION

A. Result

1. Preliminary Study

The study on the development of technology and communication from Stat Counter Global Stats 2015 obtained data that in the period of January-December 2015 android operating system was the operating system most widely used in Indonesia. The data showed a significant growth in each month and reached 74.28% in December. Based on the data, it is necessary to develop an android-based instructional media. To determine the needs and conditions of the students who used instructional media, it took a field survey which showed that 90% of high school students have an android-operating-system mobile phone, but only a few who use it to obtain information for learning, especially learning chemistry. Afterward, that was used to formulate what kind of instructional media to support learning process and can be used in mobile learning. In addition, a method suitable for use in learning process was also formulated so as to form a positive integration between method and instructional media used to support learning process in the classroom. In analyzing learning system, it took a study on the learning system used in learning at schools. SMAN 1 Kasihan has used the Curriculum 2013 in learning process so that the development of product based on that curriculum.

2. Product Development

At this stage, it took collection of teaching materials and references related to the subject matter of the Stoichiometry to be incorporated into the developed product. In addition to the learning materials, at this stage other materials were also collected such as graphics, images, fonts, animations, audio and color composition to be used in the developed product. Then, the activity consisted of making flowchart and storyboard. Making flowchart was intended that the developed product would have clear navigation flow so easily used in the operation process. Storyboard creation aimed to facilitate the manufacture of the frame of the developed product because it can give the illustration of the developed product. After the flowchart and storyboard have finished, the activity was to produce the developed product. The product development used Adobe Flash Professional CS 6 with Action Script 3. In addition to the Adobe Flash Professional CS 6, there were some supporting software used like Adobe Photoshop CS 6, Corel Draw Graphics Suite X5, and Adobe Air. Some of the main menus in the developed product are instructions, competence, material, profile, and game.

3. Product evaluation

a. Assessment of Learning Materials

Assessment of learning materials was carried by a subject matter expert (a lecturer of chemistry education), peer reviewers, and chemistry teachers. Results of the assessment of learning materials can be seen in Table 2.

TABLE 2. Results of the Assessment of Learning Materials

Aspect	*Material expert*	*Peer reviewer*					*Chemistry Teacher*					*Average Score*	*Maximum Score*	*Category*
		I	**II**	**III**	**IV**	**V**	**I**	**II**	**III**	**IV**	**V**			
Learning	24	23	22	23	24	22	21	22	22	21	23	22.45	25	Very Good
Material	34	39	41	40	40	40	38	40	37	38	40	38.81	45	Very Good

b. Assessment of Instructional Media

Assessment of instructional media was conducted by media expert, peer reviewers, and chemistry teachers. Results of the assessment of instructional media can be seen in Table 3.

TABLE 3. Results of the Assessment of Instructional media

Aspect	*Media Expert*	*Peer reviewer*					*Chemistry Teacher*					*Average Score*	*Maximum Score*	*Category*
		I	**II**	**III**	**IV**	**V**	**I**	**II**	**III**	**IV**	**V**			
Audio Visual	51	50	49	51	49	50	48	49	47	47	50	40	55	Very Good
Software Engineering	22	22	23	22	24	23	20	21	19	22	24	22	25	Very Good

c. Trial Assessment

Trial assessment was carried out through two-stage assessments, the assessment of limited trial and small-scale trial. Results of the analysis showed in Table 4.

TABLE 4. Results of Trial Assessment

Aspect	*Average Score of Trial*		*Maximum Score*	*Category*
	Limited	**Small Scale**		
Learning and Material	23.5	23	25	Very Good
Appearance and Media Operation	45	44	50	Very Good

d. Field trial

The trial was conducted aimed to determine the effectiveness of the developed instructional media in terms of the improvement of students' cognitive learning outcomes and creativity. Field trial used 1 experimental class and 1 control class. The average can be seen in Table 5.

TABLE 5. Students' Pretest and Posttest Scores

Class	**Number of Student**	**Pretest**		**Posttest**		**<g>**	**Category**
		Average Score	**Completeness (%)**	**Average Score**	**Completeness (%)**		
Experimental	28	26.71	0	79.82	71	0.72	High
Control	25	26.52	0	76.60	48	0.68	Fair

Field trial was also conducted to determine the increase of students' creativity. Students' creativity was measured using creativity questionnaire given before and after the treatment. The increase can be seen from the gain resulted from the creativity questionnaire. Data of students' creativity can be seen in Table 6.

TABLE 6. Data of Students' Creativity

Class	**Number of Student**	**Before Treatment**		**After Treatment**		**<g>**	**Category**
		Average Score	**Score**	**Average Score**	**Score**		
Experimental	28	101.64	67.76	117.00	78.00	0.32	Fair
Control	25	104.24	69.49	113.68	75.79	0.21	Low

e. Hypothesis Testing

This hypothesis testing aimed to determine whether there is any difference in the increase of creativity and cognitive learning outcomes between the students who were treated with the android-based instructional media integrated to learning together and the students treated with learning together without the android-based instructional media. Before the hypothesis testing, there were several prerequisite tests that must be carried out, namely normality and homogeneity test. In this research, the normality and homogenity test had given the result that the data are homogen and normal distrubuted. So, it can use manova test to analysis the hypothesis.

Hypothesis testing was done using N-gain data obtained from data of the increase of students' creativity and cognitive learning outcomes with SPSS. The analysis results of Manova test are presented in Table 7.

TABEL 7. Manova Analysis Results

Effect	**Significance**	**Explanation**	**Conclusion**
Hotelling's Trace	0.039	Ho is rejected	There is a difference in the increase of creativity and cognitive learning outcomes

B. Discussion

Generally, the results showed that the developed android-based instrucsional media has very good category in terms of material and media. Then, the results of hypothesis testing showed there are differences of the increase in creativity and learning outcomes between the students treated with the android-based instructional media integrated to learning together (LT) and the students treated with learning together (LT) without the android-based instructional media. Achievement of these results consistent with the results of research conducted by Ita Puspita [5].

From the results of the product validation and trials were done, there are some characteristics of android-based instructional media as described below.

1. The relevant learning materials. The material presented by android-based instructional media in accordance with the curriculum, students characteristic, and needs of high school students. The relevance of these media is essential in making instructional media [8].
2. Visualize a clear and attractive. Pictures, animations, and layout in the media made clearly and make the attraction of students in using it. This is in accordance with the submitted [9] that mobile learning media should have a clear picture and good to help students understand the material and make the appeal in the use of media.
3. Flexible. The android-based instructional media can be used anywhere and anytime. This is consistent with the results of research [13], that the digital learning media can facilitate students to learn anytime and anywhere and can increase creativity and memory learners because it can be used repeatedly. Squire [7] also states that mobile learning media can be used by students without being tied to time and place.

However, in development research found some limitations, including the following.

1. Not all students have a smartphone or tablet supporting this media.
2. Display graphics of android-based instructional media is affected by the resolution and density of the screen on a smartphone or tablet is used.

CONCLUSION AND SUGGESTION

1. Conclusion

Based on the results of the research and development of Android-based instructional media, it can be concluded that:

a. The characteristics of this media are flexible, attractive and interactive.
b. This media has been developed has very-good-quality criteria based on the assessments by expert judgement, peer reviewers, chemistry teachers and students.
c. there are differences in the increase of students' creativity and cognitive learning outcomes between using the android-based chemistry instructional media integrated to learning together and learning together without the android-based instructional media.

2. Suggestion

According to the results of this research and development that has been done, the following points can be suggested.

a. This media has been assessed for its feasibility. So, it is suggested that teachers and students use it as an alternative media for independent learning.
b. This media needs to be developed in other operating systems.
c. This media can be used further on classroom action research or experimental research on different research subjects.

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