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The effectiveness of mobile-based interactive learning multimedia in science process skills

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Abstract. Science process skills can facilitate students to increase the curiosity and activity of students in learning by doing, experiencing, and associating the subject of science in real life. Scholars found different phenomenon to improve science process skill. Hence this research aimed to explore the effectiveness of mobile-based interactive learning multimedia to improve students' science process skill. This research was a quasi-experimental research with the entire subject 80 elementary students' in Salam Magelang. Data were collected through observation, interview, and test. The results showed that mobile-based interactive learning multimedia is more effective to improve science process skill between the students who learn using mobile-based interactive learning multimedia and classical model with students' book.

1. Introduction

The 21st century education emphasizes on some skills that has to be possessed by every student. Some skills such as critical thinking, communication, science process skill is also emphasized in this century's learning. To make science process skills be able to be mastered by students, active learning and meaningful learning process is required. Nowadays, many problems that are experienced by science learning in Indonesia, one of them is the low level of the students' science process skill in the elementary school. This is demonstrated by the TIMSS research in 2015, that the average of Indonesian students' science achievement is ranked 44 out of 47 countries [1]. Similarly, PISA research in 2015 showed that the results of Indonesian students' science achievement are ranked 69 out of 79 countries. The results showed that students' science skills in Indonesia are still very low [2].

The observation result that was done by the researcher in SDN Jumoyo 2 Salam Magelang, also showed that learning activities that use the students' book only show unsatisfactory science process skill result. One of the causes was the material learnt by the students often use abstract media, and the students are not used to do activities that can increase the students' science process skill. Learning using only the students' book will be very difficult to increase the students' science process skill because the materials presented in the students' books are still abstract and lack in variation. There are many ways that can be done by teachers to help the students to be able to master that science process skill, one of them is by using the development of ICT in educational field. Technologies give us the option to use in learning that is able to make learning for students more active and increase student's interest in learning [3].

The use of technology in scientific science learning cannot be neglected. The use of technology in science learning can support the exploration and experiment activities, accelerate working ability, help



to develop every student's knowledge, and is able to increase the students' motivation to become more enthusiast in learning [4]. One of the media that can be applied in that science learning is interactive learning multimedia. Interactive learning multimedia is media that consists of some medias in it, such as video, animation, text, picture and also voice. Learning with multimedia will be more interesting, more interactive and meaningful for the students [5,6,7]. Multimedia that is developed in form of mobile application can become a more interesting media, more practical and the efficiency level of application system in presenting data and respond data becoming better. The use of mobile phones in this application can also create a more interactive learning climate, can be used in individual learning and can be used wherever, not only by sitting in the classroom.

A research that was done by Osman [8] showed that the use of ICT in learning can increase the science process skill on students. Learning that is done with the help from ICT has better process skill result than conventional learning without the help from ICT. Chiang [9] also revealed that learning with the help of mobile device can increase the students activity in learning and also increase the students enthusiasm to learn.

The use of mobile phone technology in learning possesses many benefits especially in creating student-centered learning climate. Through mobile-based interactive learning multimedia, the students can access information more swiftly, access them any time and from anywhere and more varied to learn in their own context [10,11]. Mobile-based multimedia that is integrated with science process skill material can help the students to train and to increase the students' process skill. In this research the students must do activities that are emphasized on this research that are observing, asking, reasoning, concluding, and communicating. Process skill activity uses mobile-based interactive learning multimedia has to be tested on its effectiveness. This research was aimed at finding out the effectiveness of the use of mobile-based interactive learning multimedia to increase the students' process skill.

2. Method

The method that was used in this research was quantitative research, with the type of quasi experiment. The research design that was used is pretest-posttest control group design with two variable [12]. Mobile-based interactive learning multimedia was used as independent variable (X) and science process skill was used as dependent variable (Y). The subject of this research was 80 students of grade 4 at Jumoyo 2 Salam Magelang that are divided into three class groups that were chosen randomly. Two classes were experiment groups and one class was control group. Pretest-posttest control group research design can be seen on table 1.

Table 1. Pretest-posttest control group design.

Class	Group	<i>Pre-test</i>	Treatment	<i>Post-test</i>
Experiment	A ₁	O ₁	X ₁	O ₂
	A ₂	O ₃	X ₂	O ₄
Control	B	O ₅	X ₃	O ₆

Information of table 1:

- A₁ : Experiment Class Group 1
- A₂ : Experiment Class Group 2
- B : Control Class Group
- O₁, O₃, O₅ : Science Process Skill Pretest
- O₂, O₄, O₆ : Science Process Skill Posttest
- X₁ and X₂ : Experiment class treatment with mobile-based interactive learning multimedia
- X₃ : Control class treatment using the students' books.

The instruments that were used were observation, interview and science process skill test. Observation and interview were used to find the initial state before the research is done. Science process skill was given to the experiment and control class in the beginning before treatment as pretest and at the end of treatment as posttest.

Data analysis technique that was used was descriptive analysis and independent t-test. Descriptive analysis was used to describe before and after state after treatment was done. Independent t-test was done to test the effectiveness of mobile-based interactive learning multimedia in increasing the students' science process skill. Before independent t-test was done, prerequisite test was previously done such as normality test and homogeneity test. The data analysis in this research used the help from SPSS software version 16.

3. Result and Discussion

3.1. Result

The activity that was done by giving science process skill pretest firstly both in experiment and control classes. The activity with mobile-based interactive learning multimedia was done in experiment class. After pretest was given, students worked in group of 4-5 students, every group had to do assignment and were given instruction that were in the mobile-based interactive learning multimedia. The example of the students' activity using mobile-based interactive learning multimedia can be seen in figure 1.



Figure 1. Example of the students' activity using mobile-based interactive learning multimedia.

Figure 1 shows that the students obtained information based on the materials and problems presented in the multimedia. In group, the students worked on every instruction that were based on the steps of the process skills that have been presented in the multimedia. After all of the treatments were done, after that every class group was given posttest to measure the students' process skill attainment. The data analysis result of pretest and posttest between the control and experiment group can be seen on table 2.

Table 2. Pretest dan posttest data result of science process skill.

Data	Group	N	Mean	Max Value	Min Value	Std. Deviation
Pretest	Control	26	48.85	75	30	12.59
	Experiment 1	27	50.19	75	35	10.69
	Experiment 2	27	52.78	75	30	10.03
Posttest	Control	26	64.42	80	50	7.66
	Experiment 1	27	78.52	95	65	6.77
	Experiment 2	27	80.19	95	60	8.82

Table 2 presented the result of pretest and posttest of science process skill of the experiment and control classes. The pretest result between the experiment and control classes were not far different, whereas the experiment class posttest result showed that the students' science process skill has increased better

compared to control class. The result of science process skills posttest in each indicator can be seen on figure 2.

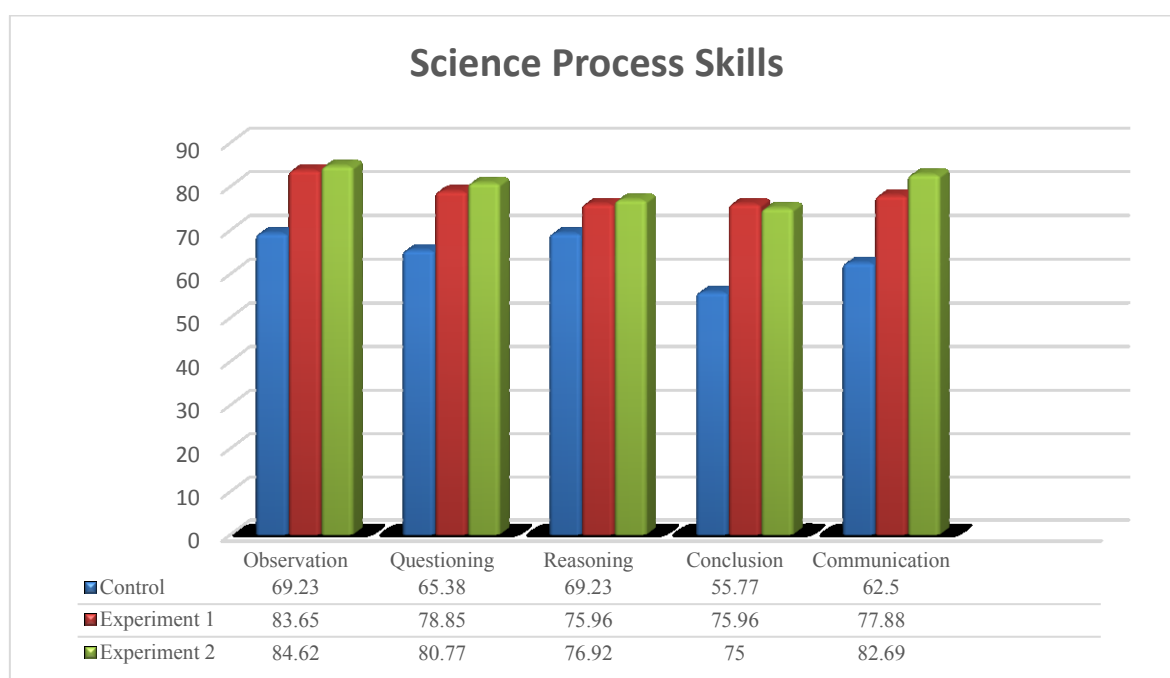


Figure 2. Data summary of science process skills test result.

Figure 2 shows the result of science process skills posttest in each indicator. The highest score in the experimental class is 84.62 on the observation indicator and the lowest score is 75 on the inferred indicator. The highest score in the control class is 69.23 on the Observasi and reasoning indicator and the lowest score is 55.77 on the inferred indicator. Before the hypothesis test on the science process skill was done, the normality and homogeneity test were also done as one of the conditions that has to be fulfilled. The normality test was done with One Sample Kolmogorov-Smirnov using SPSS software version 16. The result of normality test of process skill can be seen on table 3.

Table 3. Data summary of normality test result.

Data	Group	Kolmogorov-Smirnov Z	Sig. (2-tailed)	Condition	Conclusion
Pretest	Control	0,807	0,533	P > 0,05	Normal
	Experiment 1	0,902	0,390		
	Experiment 2	0,855	0,457		
Posttest	control	0,720	0,677	P > 0,05	Normal
	Experiment 1	1,186	0,120		
	Experiment 2	0,630	0,822		

Table 3 shows that the value of sig (p) normality test is higher than 0,05. It can be concluded that the data variance of the control and the experiment class are distributed normally. After the normality test was done and the data distribution was considered as normal, the homogeneity test would also be done by using One Way Anova test. The result of homogeneity test can be seen on table 4.

Table 4. Data summary of homogeneity test result.

Data	df1	df2	Sig. (p)	Condition	Conclusion
Pretest	2	77	0,188	P > 0,05	Homogenous
Posttest	2	77	0,387		

Table 4 shows that the value of sig (p) of the pretest data was 0,188 and sig (p) of the posttest data of science process skill was 0,387. The result of sig (p) One Way Anova test was higher than 0,05, so that it can be concluded that the data variance between the experiment and the control classes are homogenous. Therefore, the prerequisite test of normality and homogeneity of this research was fulfilled. The data that were gathered were then analyzed using independent t-test. Independent t-test was done to find out the significance of difference of process skill between the experiment and the control classes. The result of independent t-test can be seen on table 5.

Table 5. Data summary of independent t-test analysis.

Data	Group	df	Sig. (p)	Condition	Conclusion
Posttest	Control & Experiment	51	0,000	$P < 0,05$	H_0 is rejected

Table 5 shows that the value of sig (p) independent t-test is 0,000 less than 0,05. It can be concluded that H_0 is rejected, it means that there was significant difference of the students' science process skill between the experiment and control classes. It means that the mobile-based interactive learning multimedia was more effective to be used compared to learning by using only the students' book to increase the students' science process skill.

3.2. Discussion

The result of hypotheses test showed that mobile-based interactive learning multimedia gave different influence. In general, the application of mobile-based interactive learning multimedia was more effective to be used in increasing science process skills. Science process skill is very important to be mastered by every student. Science process skill is a skill that can help the students to increase their skill for communication, collaboration, analyzing problems, and make a conclusion [13]. Due to the importance of the science process skill, many efforts are done to increase that skill. One of the efforts that was done by the teachers to increase the science process skill was with combining mobile-based interactive multimedia with science learning. Interactive multimedia in learning possesses many benefits for the students and the teachers, The students will feel more interested and challenged to operate that multimedia. The students will become more active to follow every learning process and increase students achievement because the students fell happy, interested to learn [6,14,15].

The research result showed that the use of interactive multimedia gave significant effect on the students' science process skill [16]. Students who learned using mobile-based interactive multimedia were more active and creative in doing the activities. Along with the research result showed that the use of science and technologies in learning can increase the students learning result in terms of science process skills, science concepts, and science content knowledge [17,18,19]. The use of technology in science curriculum were generally successful in improving science process skills [20]. The use of this mobile-based interactive learning multimedia in learning provides scientific content. Every learning covers activities that can train science process skill such as observing, asking, analyzing problems, reasoning, concluding and communicating. In the learning the students are systematically trained to increase science process skill scientifically, thinking logically and arranging information based on the problems and data that were presented in the media.

4. Conclusion

The research result and hypotheses test in this research proved that mobile-based interactive learning multimedia was more effective in increasing the students' science process skill compared to using only the students' book in integrative thematic learning. However, this research can be finished in limited time, and was only limited in science process skill variable measurement. Therefore, in future researches can be applied in the more sufficient time and can be applied in other variables. In the increase of science process skill, the use of mobile-based interactive learning multimedia was more effective to use, so that

mobile-based interactive learning multimedia can be use as a good alternative to use in the learning activities especially in increasing the students' process skill.

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