The influence of mobile learning with oriented NOS to students learning performances

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Abstract. To evaluate the influence of Mobile Learning with Oriented NOS to science process skill, scientific attitude, and concept understanding of general chemistry students the purpose of this study. In form of quasi experimental, this was carried out by *post-test only control group design*. There were 142 students as subject separated on to 3 groups. Experiment 1 was treated by Mobile Learning with Oriented NOS, experiment 2 by Learning with Oriented NOS, and control group. Data collected by observation sheet of science processs kill and scientific attitude, and concept understanding test. Data was analyzed by inferential statistic method. Research result showed that average score of student science process skill and scientific attitude on experiment 1 respectively greater than experiment 2 and control. The significant value for the t test of student science process skill and scientific attitude, between experiments and control is alike that is 0.00. On the other hand, the significant value for the t test of student concept understanding between experiment 1 and experiment 2 is 0.249,while between experiments and control is 0.000. It may conclude that the learning with oriented NOS has better role on student learning performance improvement than mobile learning only.

1. Introduction

There are several reasons why people use information technology. Someone believes that using information systems technology can help him get more benefits and performance in work. Mobile technology helps one to access information quickly, wherever and whenever, and choose whatever device they want. One can easily join individually with technology or information systems and innovate. This has a strong effect on young students to use mobile devices for academic purposes[1].

The results of [2] research show that students really like interactivity, accessibility, and comfort of mobile learning. The mobile learning system can be applied easily and cheaply as a complement to the learning process. In applying mobile learning motivational factors need to be considered as interactive and interesting. However, the main purpose of the mobile learning environment must be for education not for entertainment [3].[4] have studied the integration of technology and pedagogy in the implementation of ICT projects in developing countries. The recommendation obtained from the study is presenting real word context is an important way to learn because humans naturally ask questions about the real world. There needs to be a transition from dictating information to learning that involves students in learning and solving problems. Mobile learning technology can empower students to learn independently and actively plan their own learning[5].

The development of mobile technology in learning must be in line the science learning curriculum development in the world. The trend in science education policies emphasizes the importance of scientific literacy as outcomes that can be transferred in science education [6]. Directing students to have knowledge to use scientific concepts meaningfully, thinking critically and making best decisions

on issues as focus on student scientific literacy building. However, science learning still ignores the social dimension of education and encourages the development of active participation in society [7].Science literacy is increasingly needed and considered as a key competency today so that we can live in the midst of modern society.The scientific literacy assessment framework covers aspects of context, knowledge, competence,and attitude [8]. Science literacy includes three competencies namely explaining the phenomena of science, evaluating and designing scientific inquiry, interpretation of data and evidence of science. Indonesian students average ability is recognize basic facts. Students experience difficulties in communicateand link fact with science topics, getting meaning and using science to solve various everyday lifeproblems[9].To achieve scientific literacy, students must have good performance in three aspects of science learning process, namely concept understanding, knowledge of methods, and scientific attitudes[8,10]. Knowledge of good scientific methods will lead to science process skills. Science process skills consist of basic skills, processing skills, and investigative skills[11]. Therefore, in the NOS-oriented mobile learning process that leads to the achievement of scientific literacy, these three aspects need to be focus output of learning.

The achievement of students' scientific literacy can be pursued by the teaching of science in a group that focuses on the ability of nature of science). Understanding Nature of Science is mean understanding of the characteristics of science as a form of human knowledge and inquiry. Subjects in science learning should be delivered correctly so that contribute one's scientific literacy achievement[12-14]. The main objective of integrating Nature of Science (NOS) in curriculum is to help educate students to become citizens who have scientific literacy so that they can solve complex scientific and technological problems in modern life and democratic culture[15-16]. Therefore, the development of mobile learning technology should be oriented to Nature of Science[17].

Nature of Science (NOS) refers to the epistimology of science as a way to find out the values and beliefs inherent in the development of science. NOS characteristic that exist in someone who has scientific literacy must be direct them to develop conceptsunderstanding, principles, theories, processes of science, and realize the relationship between science, technology, and society[13]. So, in principle NOS includes a conception of science knowledge, values and beliefs in acquiring science knowledge, as well as its influence on society, culture and science technology.How Mobile Learning with Oriented NOS influence student performance on science learning that is science process skill, scientific attitude, and concept understanding is still important issues to be studied.

2. Methods

The subjects in this study were participants in the general chemistry subject in academic year 2018/2019. There are 142 students divided into 3 Groups. Mobile Learning with Oriented NOS as independent variable, while science process skill, scientific attitude, and concept understanding as dependent variables. Some of the instruments used in this research are science process skills observation sheets and portfolio that adapted from[18,11], scientific attitude observation sheets consisting of character descriptors of scientific attitudes items developed with reference to [19]. Description of the attitude component distributed into 11 items with a scale of 2 that is implemented and not implemented. The third instrument is concept understanding tests. The type of research was quasi-experimental carried out by posttest control group design as presented in table 1.

Tabel 1. Research Design

Groups	Treatment	Postest
E1	X1	O_1
E2	X2	O_2
C	Y	O_3

E1 : Experiment Group 1 E_2 : Experiment Group 2 C : Control group
X_1 : Mobile Learning with Oriented NOS O_1 : Observation of Experiment Group 1
X_2 : Learning with Oriented NOS O_2 : Observation of Experiment Group 2
Y : Learning without Oriented NOS O_3 : Observation ofControl group

3. Results and Discussion

3.1. The Effect of Mobile Learning with Oriented NOS on Science Process Skills

Descriptions and comparison of average performance of student science process skills in each aspect was presented in Figure 1.

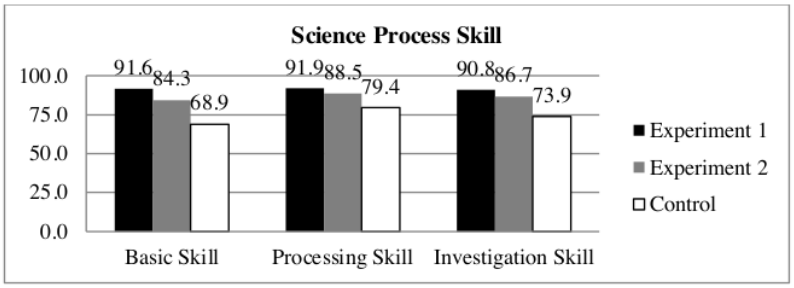

Figure 1. Comparison of Average Values on Aspects of Science Process Skills

There are differences in science process skills of students who are taught Mobile Learning with Oriented NOS compared to students who are taught learning without oriented NOS. Student who are treatedable to process data properly, investigate well and master the skills well too. Description and hypothesis test result of student science process skill on learning activities are presented in tables 2.

Table 2. Description and Results of The Student Science Process Skills Hypothesis Test on Activities

Variable		Average Score			Sig (p)			Analysis Tool
		E1	E2	C	E1 vs E2	E1 vs C	E2 vs C	
Science Process Skill	Activity 1	93.0	82.7	70.1	0.000	0.000	0.000	Z test ($\alpha = 0.05$)
	Activity 2	88.0	81.3	70.7	0.012	0.000	0.000	
	Activity 3	90.4	86.7	75.2	0.011	0.000	0.000	
	Activity 4	94.3	91.2	72.0	0.000	0.000	0.000	
	Total	91.4	85.5	72.0	0.000	0.000	0.000	T test ($\alpha = 0.05$)

The significance of the difference was tested by the t test and the free sample z test. The t test and z test are carried out through a prerequisite test consisting of a normality test using the Kolmogorov-Smirnov method and a homogeneity test with F test method. The significance value of t test and z test are smaller than the alpha value ($\alpha = 0.05$), so the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted. There is significant difference in student science process skills between experiment 1, experiment 2 and control group.

Students who are taught with Mobile Learning with Oriented NOS are able to learn better, visualize learning well, know what to do and know how learning activities should be carried out. Students are more prepared to carry out learning activities because students know and understand what should to do. Students can visualize learning activities that will be carried out and can solve problems well and face learning process. This media contain background reading and contextual problems which make it easier for students to answer and visualize the learning activities. That way student can choose the composition of materials, tools, goals, and what must be done in accordance with what activities will be carried out on learning. Students have awareness on obtaining data, processing data and complete investigation. Students can more easily determine what to do, what to observe, how to observe, what relationships apply, what equation need to be understood, and how a method is applied correctly during laboratory work. So that, the science process skills of students who are taught with Mobile learning with oriented NOS is better than students who are taught learning with without mobile learning application media. The use of ICT base interactive multimedia and simulation can increase student science process skills and achievement based on performance assessment[20-23].

3.2. The Effect of Mobile Learning with Oriented NOS on Scientific Attitudes

Description of the average value of students scientific attitudes in each aspect among experiment 1, experiment 2, and control groups presented in figure 2.

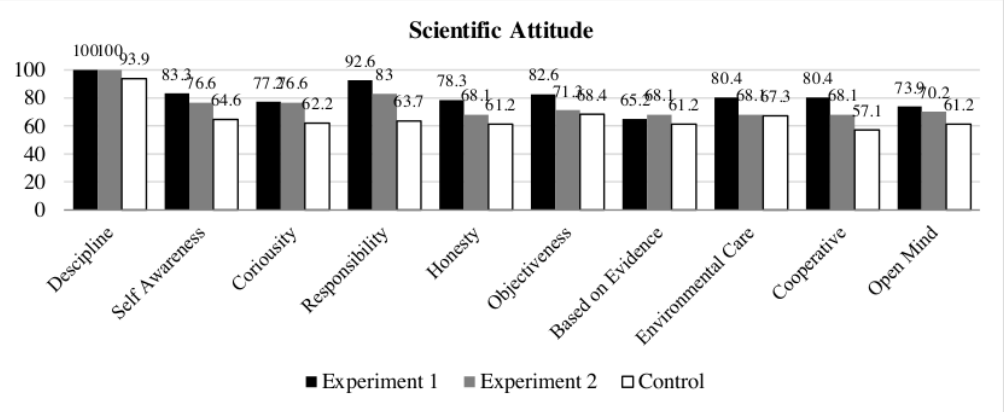

Figure 2. Student Performance on Each Indicator of Scientific Attitude

There is no difference in curiosity between experiment 1 and experiment 2. This is because before learning activities are carried out, background reading was given to the experiment 1 and experiment 2 students. That way in the minds of students there will be awareness of what should be done, and what should be observed. Contextual questions on case study discussion are made in accordance with the learning that will be carried out. Students in both experimental groups had the same curiosity and were higher than the control group. This is one of the factors that allegedly caused no difference in scientific attitudes between experiment 1 and experiment 2 students. Hypothesis test results of students scientific attitude between the groups is presented in table 3.

Table 3. Hypothesis Test Results of Student Scientific Attitude

Variable	Sig (p)			Analysis Tool
	E1 vs E2	E1 vs C	E2 vs C	
Scientific Attitude	0.000	0.000	0.000	T test ($\alpha = 0.05$)

The experiment 1 group is on the best position. In the indicators based on evidence show that the average score for experiment 2 group is slightly higher than the experiment 1 group, however the difference is not too significant, students in both groups are able to conclude learning activities are better than the control group. Students in experiment 1 and experiment 2 groups know what should do and know what must be observed. Students in both groups are able to draw conclusions easier. The significance value of t test between group 1 and group 2 is smaller than α (0.05) so the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted. There are no significant differences of student scientific attitudes between groups. Learning that present inquiry experience and information communication technology (like android) base multimedia can improve student learning outcome, critical thinking, and scientific attitude [24][22][25].

3.3. The Effect of Mobile Learning with Oriented NOS on Concept Understanding

The summary level of concept understanding for each group student is presented in Figure 3. The majority of students in experiment 1 group and experiment 2 were at the level of understanding the concept with a good category. While most of students in the control group, are at the level of low category of concept understanding. Results of student concept understanding hypothesis tests are present on table 4.Significance value of t test for student concept understanding of experiment 1 and

experiment 2 is greater than the alpha value (α = 0.05). Therefore, there is no significant difference in students' concept understanding between experiment 1 and experiment 2. There is no effect android-based learning media towards student concept understanding.

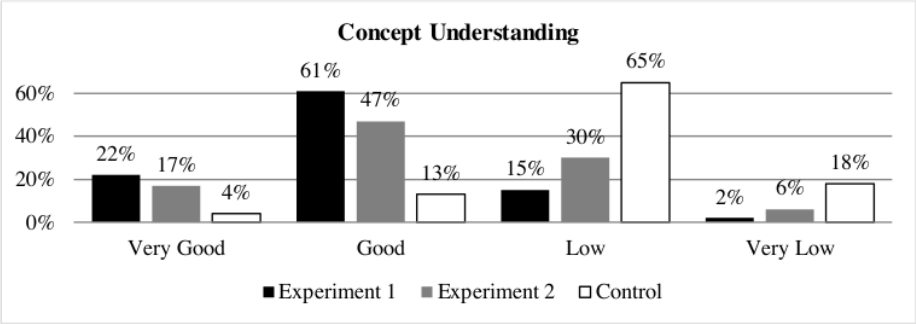

Figure 3. Percentage of Student Concept Understanding on Categories

Table 4. Results of Student Concept Understanding Hypothesis Tests

Variable	Sig (p)			Analysis Tool
	E1 vs E2	E1 vs C	E2 vs C	
Concept Understanding	0.249	0.000	0.000	T test (α = 0.05)

There are significant differences in students' concept understanding between experiments groups and control group. There is the effect of applying learning with oriented NOS towards student understanding concepts. Application of learning with oriented NOS is play better role to improve student learning performance than mobile learning only. This is show that learning strategy and model have more important role in improving student learning performance than media of learning.

4. Conclusion

Bas on the results of the research and discussion, the following matters can be concluded that the use of mobile learning with oriented NOS influence students science process skills. This evidenced by the significant value of the t test results which is 0.00 smaller than α (0.05). There is the influence of Mobile Learning with Oriented NOS to student scientif attitude. This is evidenced by the significant value of the t test results which is 0.00 smaller than α (0.05). The significant value for the t test of student concept understanding between experiments and control is 0.000. However, the t test of student concept understanding between experiment 1 and experiment 2 is 0.249 greater than α (0.05). It is mean that the application of mobile learning only wasn't influence student concept understanding on learning with oriented NOS treatment. So that the application of learning with oriented NOS play better role to improve student learning performance than mobile learning only.

Acknowledgments

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