Implementation of Susan Loucks-Horsley Model in Android Media for Scientific Literacy in Different School Categories

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Abstract: This study aims to analyze: 1) the effect of model science learning based on Susan Loucks-Horsley model in Android on the scientific literacy of students in high, medium, and low school categories., 2) to find out which school category is most suitable to implement science learning based on Susan Loucks-Horsley model on Android. This research is a quasi-experimental study with a population of junior high school students in Yogyakarta City who have implemented the 2013 curriculum. The determination of students entering the experimental class and control in each school is done by cluster sampling technique. Data collection techniques related to the scientific literacy aspect are measured by tests. The results showed that: 1) model-based science learning Susan Loucks-Horsley had a significant influence on the scientific literacy of junior high school students in all schools, and 2) the school category that is best suited for implementing science-based learning model Susan Loucks-Horsley in Android is schools are all category.

Keywords: Susan Loucks-Horsley Model; Android; Media.

1. Introduction
Science learning activities include developing the ability to ask questions, find answers, understand answers, and perfect answers about "what", "why", and how about natural phenomena and the characteristics of the surrounding environment through systematic ways that will be applied in the environment and technology [1]

Learning Science is learning about nature and its surroundings that are systematically studied with concepts, facts, and principles that exist and can be applied and developed in everyday life with scientific attitudes and values such as the experimental process and its discovery and application to the environment and technology. The whole process of education in school and learning activities is the most basic activity. This means that the success or failure of the achievement of educational goals depends on how the learning process itself. The whole process of education in school and learning activities is the most basic activity.

Scientific Literacy is one of several types of literacy such as written literacy, numerical literacy, and digital literacy. In scientific literacy, students are invited to overcome fears in science learning. Students will be able to understand science experiments and reasoning [2]. Science literacy is the ability to follow scientific discourse and to connect the world of science to the context of everyday life - the ability to make science personally relevant [3]. The Programme for International Student Assessment (PISA) determines scientific literacy in three dimensions:
a. Scientific concept or scientific concept where the concept of science is needed to understand some phenomena from nature in this world and make changes to human activities.

b. Scientific processes or scientific processes that focus on the ability to obtain, interpret, and obtain facts.

c. Scientific situations or science situations are chosen from daily activities that practice science in class, laboratory, or in professional scientific work [4].

Three dimensions of scientific literacy can be obtained by students using the Susan Loucks-Horsley model learning stages in Android. The first dimension is the scientific concept that students can obtain in the propose explanations and solutions stage. The second dimension is the scientific processes that can be obtained by students in the stages of exploring, discovery, and creativity. The third dimension is the scientific situation that students can get at the taking action stage. The learning stage of Susan Loucks-Horsley (SLH), there are four stages [5]:

1) Invited Stage
   Students are invited to study. This stage serves to stimulate students' curiosity, student motivation, and start learning activities with the response of students. At this stage presented with demonstrations or photography that raises questions and feelings of students' wonder, through simple experiences or questions from the teacher. Curiosity will make them more sensitive and literate about science. At the end of this stage, students will focus more on one or more problems or questions, become enthusiastic, and feel the need for further investigation.

2) Explore, Discovery, and Creativity stages
   At this stage, challenge students to answer their own questions through observation, measurement, or experiment. Students compare and test their ideas and try to understand the data that has been obtained. Students do not work for the same experimental questions and tests. At this stage the teacher does not make any limitations or teacher's instructions. The teacher only makes suggestions for various activities carried out, so that important experiences can be provided by the teacher for students in the class.

3) Stage Propose Explanations and Solutions
   Students prepare explanations and solutions. When students have gained new experiences from the concepts they have learned through lessons, the students' initial concept of the same thing can be modified or replaced with something new. The teacher fosters students' verbal abilities through observation and experiment. Students are given the opportunity to trust their conceptions in line with the results of the students' observations so that students have definitions or concepts in their own language.

4) Stage of Action Making
   Taking action steps challenge students to apply and find out the usefulness of students' findings in everyday life.

   The function of the learning model is as a guide for teaching designers and teachers in carrying out learning. The choice of the learning model is strongly influenced by the nature of the material to be taught, the objectives to be achieved, and the ability of the students [6]. The SLH model reflects the relationship between science and technology, besides the SLH model is also in accordance with the new taxonomy of science education which is based on five domains, namely, knowledge domain, science process domain skills, creativity domain, attitudinal domain, and application and connection domain. At the stages of Invite, Explore, Discover, and Create students are required to adapt human problems in the environment and provide questions about science. At the propose explanations and solutions stage students are required to explain the phenomena of science in the world and find solutions to problems experienced by humans. At the take action stage, students are required to be able to behave and apply their thinking to social life.

   The E-learning stands for electronica learning, which means learning using computer devices or other electronic devices. The purpose of using e-learning is to facilitate the learning process which is packaged in digital form and its implementation requires computer and internet devices [7]. The advantages of using e-learning are as follows [8]:

a. Flexible, students can study anytime, anywhere, and with different types of learning.

b. Save time for the teaching and learning process.

c. Reduce travel costs

d. Save overall education costs (infrastructure, equipment, and books)
e. Reach a wider geographical area  
f. Train independent learners in gaining knowledge.

Android is an open-source operating system for smartphones, PDAs and other cellular phones. Android is easily made and flexible to adapt to different structures. Android based on Linux Kernel 2.6.xx, there are libraries for C / C++ used as numbers from Android system components. In the library there is a Framework which is a virtual machine that runs applications. In "Android Runtime" and the core library, there is a Framework that follows developers to create applications [9]. Android applications are used in the education system and many more Android systems are used. Based on pedagogical information or constructivism theory, students who create knowledge from seeing, hearing, and what they feel. Interactive learning applications have modules that are on devices suitable for learning in the environment such as mobile phones and tablets for classroom learning [10].

Guided by the opinions that have been raised, it can be concluded that the Android learning media are materials, tools, or methods or techniques used in teaching and learning activities, with the intention that the interaction process of educative communication between teachers and students can take place effectively, wherever and when just so that it can overcome the limitations of space and time, the application of which is in the Android operating system application using the internet network. Therefore, this paper presents the implementation of Susan Loucks-Horsley model in Android media for scientific literacy in different school categories.

The rest of this paper is organized as follow: Section 2 describes the proposed research method. Section 3 presents the obtained results and following by discussion. Finally Section 4 concludes this work.

2. Research method
This section describes the proposed research method.

2.1 Place and Time of Research
This research involved Grade VII of Junior High School students in Yogyakarta City, Indonesia where Curriculum 2013 has been implemented. The research was conducted in semester 2 (even) of the 2016/2017 academic year.

2.2 Research participant
The research participants consist of the panel expert including one expert in teaching content and one expert in media, 5 peer reviewers, and 2 science educators, 6 classes in junior high school students of grade VII were came from three different categories.

2.3 Research procedure
The study was conducted using pre and posttest control group design.

| Pretest and Posttest Design | Time |
|-----------------------------|------|
| Experiment class            | O₁   | X   | O₂   |
| Control class               | O₃   | Y   | O₄   |

Figure 1. Pretest and Posttest Design [11]

Where:
O₁ : Pretest experiment class  
O₂ : Posttest experiment class  
O₃ : Pretest control class  
O₄ : Posttest control class  
X : Treatment in the form of Science Learning model SLH on Android  
Y : Treatment in the form of Science Learning with the 2013 curriculum

2.4 Techniques and data collection instruments
The determination of students entering the experimental class and control in each school is done by cluster sampling technique. The sample selection technique uses cluster sampling technique based on
high, medium, and low school categories according to the results of the national exam for the previous three years. Data collection techniques in this study are interviews, observations, and tests. Interviews are used in preliminary studies. Observation techniques were carried out in preliminary studies during the study. The instrument is used to obtain student learning data before and after learning. (implementation of media using two software items Construct 2 and Quick App). The test used in the form of multiple choice questions to measure the realm of knowledge. Questions refer to learning objectives and indicators, scientific literacy aspects and learning material. The scientific literacy data were collected from the test of students’ learning outcomes before and after the learning process. The data obtained was determined by N-Gain value. The gain value was obtained using N-Gain. The normalized high and low gain (N-Gain) can be classified as follows: (1) if \( g \geq 0.7 \), the resulting N-Gain is in the high category; (2) if \( 0.7 > g \geq 0.3 \), then the resulting N-Gain is in the medium category, and (3) if \( g < 0.3 \) then the resulting N-Gain is in the low category [12].

3. Results and Discussion

Student scientific literacy data is taken from the test results for each research class. The results of this test are the results of the pretest and posttest of students (see Tables 1-3). Pretest was taken before treatment and posttest was taken after treatment. From the results of the posttest and pretest, the N-Gain value was calculated for analysis.

| Table 1. Scientific literacy in schools classified as high |
| No. | Description | Experiment Pretest | Posttest | Control Pretest | Posttest |
|-----|-------------|-------------------|----------|----------------|---------|
| 1   | Average     | 22.65625          | 25.96875 | 25.24          | 23.18   |
| 2   | Standard Deviation | 3.51              | 1.56     | 1.37          | 4.04   |
| 3   | Maximum     | 26                | 28       | 28            | 27     |
| 4   | Minimum     | 12                | 26       | 23            | 20     |
| 5   | N-gain      | 0.3900954         |          |               | -0.55988 |

| Table 2. Scientific literacy in schools classified as medium |
| No. | Description | Experiment Pretest | Posttest | Control Pretest | Posttest |
|-----|-------------|-------------------|----------|----------------|---------|
| 1   | Average     | 21.85714          | 25.45714 | 23.147059      | 25.117647 |
| 2   | Standard Deviation | 3.32              | 2.34     | 2.80          | 2.28   |
| 3   | Maximum     | 27                | 29       | 27            | 28     |
| 4   | Minimum     | 10                | 18       | 17            | 18     |
| 5   | N-gain      | 0.44              |          |               | 0.0899671 |

| Table 3. Scientific literacy in schools classified as low |
| No. | Description | Experiment Pretest | Posttest | Control Pretest | Posttest |
|-----|-------------|-------------------|----------|----------------|---------|
| 1   | Average     | 21.647059         | 24.852941 | 19.9        | 20.666667 |
| 2   | Standard Deviation | 3.36              | 2.82     | 2.28         | 4.92   |
| 3   | Maximum     | 26                | 29       | 26            | 29     |
| 4   | Minimum     | 12                | 18       | 17            | 12     |
| 5   | N-gain      | 0.3826219         |          |               | 0.062249 |

From the Tables 1-3 above, it can be concluded that the experimental class N-gain is higher than the control class in all school categories, that means the scientific literacy in all experimental classes is better than the control class (see Table 4).

| Table 4. U Mann-Whitney data Scientific literacy |
| No. | Sekolah   | U Mann-Whitney | Sig. | Kesimpulan |
|-----|-----------|----------------|------|------------|
| 1   | High category | 103,500        | 0.000 | Ho ditolak |
| 2   | Medium category | 335,000        | 0.001 | Ho ditolak |
| 3   | Low category  | 423,500        | 0.026 | Ho ditolak |
In high category schools obtained asymp values sig <0.05, Ho is rejected, meaning that there is a significant effect of model science learning based on Susan Loucks-Horsley in android on the scientific literacy of high school students. In the moderate category, the asymp value is sig <0.05, Ho is rejected, meaning that there is a significant effect of model science learning based on Susan Loucks-Horsley in Android on the scientific literacy of school students in the moderate category. In low-class schools, the asymp value sig <0.05, Ho is rejected, meaning that there is a significant effect of the Susan Loucks-Horsley model-based science learning on the scientific literacy of students in low-class schools.

To find out whether there is a difference in the average scientific literacy score in the three categories of schools whose learning is using the SLH model in android, it is tested using ANOVA (see Tables 5 and 6).

### Table 5. Homogeneity of variance

| No. | Levene Statistic | df1 | df2 | Sig. | Meaning |
|-----|-----------------|-----|-----|------|---------|
| 1   | 0.793           | 2   | 100 | .793 | Ho accepted |

The similarity of variants for Anova is fulfilled.

### Table 6. ANOVA

|                        | Sum of Squares | df | Mean Square | F       | Sig. |
|------------------------|----------------|----|-------------|---------|------|
| Between Groups         | 0.048          | 2  | .024        | .444    | .643 |
| Within Groups          | 5.367          | 100| .054        |         |      |
| Total                  | 5.415          | 102|             |         |      |

### Table 7. Test different three groups

| No. | School            | Mean Difference (I-J) | Sig. | Meaning |
|-----|-------------------|-----------------------|------|---------|
| 1   | High category     | -0.04824              | 0.668| Ho accepted |
| 2   | Medium category   | -0.00536              | 0.995|         |
| 3   | Low category      | 0.04824               | 0.668| Ho accepted |
|     |                   | 0.04287               | 0.723|         |
|     |                   | 0.00536               | 0.995| Ho accepted |
|     |                   | -0.04287              | 0.723|         |

From Table 7 and according to SPSS calculations, significance of mean difference is more than 0.05 so Ho is accepted and there is no statistically significant difference in values between the three groups of research samples from high, medium, and low category schools. The sample selection technique uses cluster sampling technique based on high, medium, and low school categories according to the results of the national exam for the previous three years. The absence of significant differences between the three samples is due to the ability of students who are almost the same in the science learning abilities if facilitated with the right media and learning models. The distance between school categories can be reduced if using the same teaching materials and media.

### 4. Conclusion

This paper has presented the implementation of Susan Loucks-Horsley model in Android media for scientific literacy in different school categories. The N-gain of experimental class is higher than the control class in all school categories, that means the scientific literacy in all experimental classes is better than the control class. There is no difference in the average scientific literacy values that are statistically significant in the experimental class among the three groups of research samples, from high, medium, and low category schools. The school category that is suited for implementing science-based learning model Susan Loucks-Horsley in Android is schools are all category.

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