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Improving Problem-Solving Student Ability: Integrating Google Earth with SETS Model Learning for Effective Solutions

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Abstract: Geography teachers must develop students' problem-solving skills through contextual learning. Integrating Science, Technology, and Society (SETS) learning with Google Earth enables teachers to leverage technology to help students learn about environmental issues. This study aims to investigate Google Earth's built-in SETS in learning and examine the impact of her SETS on her problem-solving skills. This study was included in a quasi-experiment involving 70 students from SMAN 1 Lawang (35 in the control group and 35 in the experiment group). The results show that her SETS learning integrated with Google Earth significantly impacts her problem-solving skills. SETS' four components integrated with Google Earth encourage students to develop their understanding to actively find solutions to environmental problems. Using student worksheets is essential for teaching students to use Google Earth to observe environmental issues. However, student worksheets must be developed with explanatory pictures attached to the instructions to make it easier for students to use Google Earth.

Introduction

Problem solving skills are very important for today's Geography learning. Geography as a study that examines a phenomenon through a geographical approach to solving human problems that have spatial dimensions (Hoalst-Pullen et al., 2021). So, this skill can help students in the process of finding solutions in a study through the stages of obtaining and processing information (Santrock, 2011; Xiaoxiao & Dongdai, 2020). Besides that, learning Geography needs to integrate these skills into the curriculum and need assessment (Care et al., 2018; Golightly & Raath, 2015). In addition to problem solving skills, the Geography learning process must also involve the practice of thinking in geography and research concepts in geography (Hadi, 2020).

Development of students' problem-solving skills can be through contextual learning activities. This learning refers to the latest issues that are happening around. This can help students to overcome some environmental problems (Prastiwi, et al., 2019). So, teachers need to facilitate students in building problem-solving skills in the learning process.

SETS (Science, Environment, Technology, and Society) is a Geography learning model which has recently been used to improve high-level skills, one of which is problem-solving. The SETS abbreviation sequence means that the four elements that

build the model are interrelated, therefore they must involve all elements at once (Astuti & Manurung, 2019). SETS learning model invites students to look at everything in an integrated manner, so that they can correlate the knowledge they have learned with the problems that occur in society (Maimunah, 2017). In addition, the SETS model must be applied in an integrated manner, making it possible to grow students' problem-solving skills (Martins, et al., 2021; Nurkhasanah, et al., 2019).

The SETS model provides opportunities for students to become the center of activities, collect evidence, and determine the actions taken to solve problems (Akcay & Yager, 2010). These opportunities can be applied to all stages of SETS, including (1) initiation, (2) concept formation, (3) concept application, (4) concept consolidation, and (5) evaluation. The SETS learning model also trains students to solve environmental problems in a creative way (Sugiarto & Djukri, 2015). This is also in accordance with the SETS orientation, namely using science and technology as a methodology to make the best decisions in solving problems (Yörük, et al., 2010).

Several previous studies regarding SETS learning did not involve technology as a tool to support student exploration in making decisions. The learning applied only integrates technology in the form of presentation media, case study videos, pictures, and independent exploration via the internet (Fatchan, et al., 2014; Imam, 2016; Muslimin, et al., 2019). In fact, the use of more complex technologies such as geospatial technology has a positive impact in constructing students' spatial thinking and problem-solving abilities (MaKinster, et al., 2014). In addition, according to Sumarmi (2012) SETS learning which is integrated with geospatial technology is able to facilitate student analysis in making and making decisions related to spatial aspects.

SETS learning model is very well integrated with the use of Google Earth as a form of geospatial technology. Google Earth is useful for understanding and making decisions regarding environmental issues (MaKinster et al., 2014). Google Earth can also potentially create more complex learning, support independent exploration, and allow students to represent different learning experiences (Oktavianto, 2020; Purwanto et al., 2021). One of the advantages of Google Earth is that it can visualize physical changes on the earth's surface at various scales that encourage understanding of the region (Lynn, 2012). More specifically, Google Earth can be a medium for learning geography because it can be used to explore changes in geography, such as land use (Xiang & Liu, 2017).

In this study, students used Google Earth as a media to explore information related to land conversion issues. Integrating Google Earth as a student exploration tool with SETS learning model can be an innovation in Geography learning activities. By integrating SETS with Google Earth, it can encourage students to understand the material theoretically, represent Geography objects, and be able to solve problems based on the four elements contained in SETS. Therefore, based on the previous description, the research aims to investigate SETS learning integrated with google earth and find out its effect on students' problem-solving abilities.

Method

Research Design

This study used a quasi-experiment design. This design was chosen because the authors needed complete control over the two groups studied because it was impossible to control all external variables (Sugiyono, 2015). Furthermore, testing the effectiveness involves the pre-test and post-test groups which can be seen in Table 1.

Table 1. Research Design

Group	Pre-test	Intervention	Post-Test
Experiment	O_1	X	O_2
Control	O_3	-	O_4

Source: (Sugiyono, 2015)

Information:

O_1 : Pre-Intervention Measurement (Experiment Group)
O_3 : Pre-Intervention Measurement (Control Group)
X : Intervention with Google Earth's integrated SETS model
O_2 : Post-Intervention Measurement (Experiment Group)
O_4 : Post-Intervention Measurement (Experiment Group)

This research shows the results that the model is effective in improving students' problem-solving skills. The effectiveness of this model is seen from the results of the pre-test and post-test tests for the experiment and control groups. The test was conducted to know the significance of increasing problem-solving skills in each category. Table 5 shows the difference between the pre-test and post-test scores for the control and experiment groups.

Reseacrh Subject

This study involved X IPS students of State Senior High School 1 Lawang as research subjects. Subject selection was determined by purposive sampling based on an equivalent group average. The sample used was X IPS 3 students as a control group and X IPS 4 students as an experiment group, with 35 students in each group. Both groups have a high score average of 90 in the odd semester.

Table 2. Research Subject

Groups	Gender		Total
	Female	Male	
Experiment	24	11	35
Control	25	10	*35*

Instruments and Data Collection

Data collection involves collecting quantitative data based on pre-test and post-test results to assess problem-solving skills. In addition, learning aids were used as research tools, including lesson plans, student worksheets, Google Earth usage guidelines, and six

essay-style test questions. Using student worksheets is based on using Google Earth as a learning medium to examine phenomena contextually, such as land conversion in the vicinity. In addition, the exam questions were problem-solving questions themed around land-use conversion issues aligned with the problem-solving ability indicators (Sujiono et al., 2017).

Table 3. Validity Result

Items	r count value	Classification
1	0.360	valid
2	0.508	valid
3	0.834	valid
4	0.584	valid
5	0.724	valid
6	0.497	valid

The validity of the problem-solving ability instrument was tested for validity using the product moment correlation technique. Items are declared valid if the results of r count value> r table with a value of r table that is 0.349. Based on the results, all items have an r-count value > from 0.349 so that all items are declared valid.

Table 4. Reliability Result

Reliability Statistics	
Cronbach's Alpha	N of items
.629	6

Furthermore, the implementation of the reliability test is conducted based on Cronbach's Alpha method. In this method, the instrument is reliable when the Cronbach's Alpha value is greater than 0.6. Based on table 4, the problem-solving ability test instrument has a reliability value of 0.629, therefore the instrument can be declared reliable.

Data Analysis

The hypothesis testing of this study is based on the independent sample t-test to determine the difference in significance between the control group and the experiment group. The normality test in this study used Kolmogorov Smirnov with a 95% confidence level (sig 5%), while the homogeneity test was based on Levene's test for equality of variances with a 5% level.

Result

The division of the findings in this study into two sub-sections: a) Google Earth integrated SETS learning activities and; b) the effect of Google Earth integrated SETS learning on the ability to solve problems.

Google Earth integrated SETS learning activities

SETS learning in this study utilizes Google Earth as a Geography learning media. Google Earth is a simple geospatial technology-based learning media that students can

easily understand. Referring to Poedjiadi (2010), this learning has five main stages, as shown in Table 5.

Table 5. Main Stages of Google Earth Integrated SETS Learning

No.	Stages	Activity
1	Initiation	The teacher allows students to formulate questions related to the image presented.
2	Concept Establishment	The teacher conducts questions, answers, and discussions with students to discuss questions/problems to explore material regarding land concepts, land resources, and land capability classes.
3	Concept Application	The teacher allows students to explore google earth and seek supporting information to answer questions.
4	Concept Consolidation	The teacher will enable students to look for other sources and analyze data based on what has been found.
5	Evaluation	The teacher provides opportunities for students to communicate and act within the knowledge of Geography.

The Effect of Google Earth Integrated SETS Learning on The Ability to Solve Problems

This research shows the results that the model is effective in improving students' problem-solving skills. The effectiveness of this model is seen from the results of the pre-test and post-test tests for the experiment and control groups. The test was conducted to know the significance of increasing problem-solving skills in each category. Table 6 shows the difference between the pre-test and post-test scores for the control and experiment groups.

Table 6. The results of the pre-test and post-test of the control and experiment groups

Group	Pre-test average	Post-test average	*Gain Score*
Experiment	62	84,1	58%
Control	61,3	76,3	37%

Based on table 5 the experiment group produced an average pre-test score of 62 and the post-test score of 84.1, therefore it can be said that it increased by 58%. Meanwhile, the control group produced an average pre-test score of 61.3 and post-test score of 76.3 so that there was an increase of 37%. Based on the opinion of (Hake, 1999) the gain score of 58% is included in the quite effective category and the gain score of 37% is in the ineffective category.

At the pre-test, the scores obtained between the two groups did not show a significant difference, so it can be said that both of the groups have relatively the same initial competence. After being given treatment, the experiment group showed a significant increase in problem-solving ability scores. These results indicate that the increase in problem-solving skills by students in the experiment group is higher than the control group.

Table 7. Normality Test

Group	*Kolmogorv Smirnov*		
	Statistic	Df	Sig.
Experiment group	.096	35	.200
Control group	.067	35	.200

Next, normality and homogenity tests were carried out. The gain score of normality test in both groups showed the same results, namely 0.200. Both showed a significance value > 0.05, meaning that the problem-solving ability values in both samples were normally distributed.

Table 8. Homogenity Test

Levene Statistic	df1	df2	Sig.
0,197	1	68	0,644

The homogeneity test was calculated using Levene's test with a significance level of 5%. As a result, the sig Levene Statistic value is 0.644, which means > 0.05, therefore it can be concluded that the problem-solving ability variable in the two samples has homogeneous variations.

The results of the prerequisite tests in Table 7 and Table 8 are then used as a reference to test the hypothesis of the effect of using the Google Earth integrated with SETS learning model on students' problem-solving abilities. The next test was carried out using the independent sample t-test on equal variances assumed (Table 9).

Table 9. Test of Independent Sample T-Test

Group	N	Mean	Std. Deviation	T	Df	Sig. (2-tailed)
Control	35	36,66	17,682	5,760	68	0,000
Experiment	35	57,74	12,505			

The results of hypothesis testing on the gain score value contained in table 8 obtained the value of Sig. (2-tailed) of 0.000. So, H_0 is rejected and H_1 is accepted, which means the Google Earth integrated SETS learning model affects students' problem-solving abilities.

Discussion

Based on the results, the SETS learning model built into Google Earth significantly impacts students' problem-solving skills. Integrating this model into Google Earth makes learning more interesting, fun, and meaningful than PowerPoint media and images. It is believed that learning using only PowerPoint and pictures ignores constructivist learning principles, resulting in passive students and a lack of meaningful learning. In contrast, in the Google Earth integrated SETS model, students can base their learning on real-world problems constructed constructively, including technology, environment and society.

Integrated with Google Earth, SETS Learning can build problem-solving skills by providing a technology-embedded learning experience. Google Earth can enhance students' spatial thinking skills, becoming a learning medium that helps students solve environmental problems. In this study, teachers were instructing students to use Google Earth to contextually identify and solve environmental issues, particularly land use and conservation materials.

Google Earth which is integrated in learning acts as a tool to support students' spatial exploration. Students need to understand solving complex environmental problems in order to be able to connect science concepts with problems that occur in society (Maimunah, 2017). In SETS learning model, students are directed to identify problems and actively looking for information as a reference for making conclusions or answers to problems (Fatchan et al., 2014; Nurkhasanah et al., 2019). On the other hand, SETS also invites students to think globally to solve environmental problems, especially in the context of society (Khasanah, 2013).

The teachers can develop students' problem-solving skills at each stage of SETS. According to Minarti, et al. (2012), SETS learning can construct the ability to reason and think better when faced with a problem. SETS learning activities provide authentic experiences to students in the community, especially in the context of science and technology. This follows the SETS learning concept, which integrates science, technology, society, and the environment, emphasizing the relationships and interactions between the four elements (Gathong & Chamrat, 2019).

At the initiation stage, as the first syntax, students are presented with problems as a stimulus to explore and find answers independently. This stage encourages students to ask questions and answer questions related to environmental issues so that it can lead to further interaction. The teacher directs students to observe environmental issues around them and formulates several questions. Students' ability to acquire problems through geography questions can indirectly encourage sensitivity and concern for points in the surrounding environment.

In the second stage, concepts are formed through lectures, discussions, and Q&A. This method encourages students to ask questions and discuss based on the material presented actively. In addition, students may need to master concepts related to land use documentation and conservation activities before entering the concept application phase. Concept formation is crucial as essential knowledge for solving problems. This is consistent with the view Dia, et al. (2021); Poedjiadi (2005) that students also need a broad conceptual understanding to discuss environmental issues in their learning activities.

The third stage in learning activities is the application of concepts. Students in groups investigate the problems discussed using Google Earth media. At this stage, Google Earth is a student exploration tool to see the location of the case study area and land use and identify land-use changes. Using student worksheets is essential at this stage to facilitate students in carrying out their tasks. Each working group is given the problem of land conversion in a different location to expand students' exploration to solve several problems based on the Geography approach. According to Dewi, et al. (2017), one method to improve students' problem-solving skills is by providing learning experiences with different strategies from one problem to another.

The third stage is the core of the SETS syntax, because the concepts learned can be

applied to the problems discussed (Fatchan et al., 2014). Activities in the third stage aim to clarify students' understanding in understanding the problems discussed in a more structured manner. Utilization of Google Earth can also help students to interpret objects on the available geographic information. However, in practice, students still have difficulty exploring the features of Google Earth, because they have never used it before. These conditions indicate that students still need the introduction of technological literacy in the learning process so that they are accustomed to using spatial representation tools in the problem solving process.

In the fourth stage, namely the consolidation of the concept, students are given the opportunity to convey the results of their group analysis. In this activity, students can deepen their understanding because they are faced with other problems with different spatial conditions. This stage can strengthen problem-solving skills because students are faced with various problems that integrate the knowledge they already have (Partayasa et al., 2020).

The last stage, namely evaluation, the teacher plays a role in straightening things that are not right so that the understanding that students have does not deviate from the concepts that should be. The evaluation activity was carried out in a formative manner because it provided feedback to students during learning activities. Evaluation or reflection activities also aim to deepen and explore information to determine the best decisions in problem solving efforts (Miller & Maellaro, 2016).

SETS learning model also has advantages because it focuses on problems in the surrounding environment within the scope of science and technology. This is in accordance with the statement Fatchan et al., (2014) that the SETS learning model focuses on real problems, in which it emphasizes various concepts and processes, which students then investigate, analyze, apply these concepts and processes to situations encountered in the surrounding environment. Therefore, integrating Google Earth with SETS in Geography really helps students to conduct independent investigations which can then make decisions to provide solutions to a problem. This strategy also provides opportunities for deeper thinking about the interrelationships between science, technology, the environment, and society (Sumarmi, 2012).

In addition to the models and media used, understanding the geography material also affects students' problem-solving abilities, especially on land use and conservation materials. This material needs to be mastered by students to find out the potential for land use and knowledge of solving problems of natural damage caused by humans (Yoga & Christina, 2017). The effect of mastery of the material, students have the potential to improve problem solving skills.

This model is effective in improving students' problem-solving skills. In addition, in practice, it can also influence activeness, critical thinking, and environmental care attitudes to find solutions to environmental problems (Yörük et al., 2010). This learning

also fosters sympathy and empathy for environmental problems by providing solutions based on science and technology (Fatchan et al., 2014; Nurkhasanah et al., 2019).

However, this study needs to improve in preparing the student worksheet. Students still need clarification about the use of Google Earth in analyzing a phenomenon, so the teacher needs to dictate it in detail. So, preparing a detailed student worksheet with steps accompanied by explanatory pictures is necessary.

Conclusion

The research results show that the Google Earth integrated SETS learning model significantly affects students' problem-solving abilities. This learning encourages students to view a problem in an integrated manner within the scope of science, environment, technology, and society. In practice, students use Google Earth to study environmental issues in a spatial context through student worksheets. Thus, students can connect knowledge of scientific concepts with problems in the surrounding environment. Integrating SETS learning with Google Earth can allow students to collect evidence independently and determine the best decisions to solve environmental problems. However, SETS learning integrated with Google Earth still needs the development of student worksheets so that instructions are easier to understand.

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