CREATIVE THINKING AND PROCESS SCIENCE SKILL: SELF-ORGANIZED LEARNING ENVIRONMENT ON WATERSHED CONSERVATION MATERIAL

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ABSTRACT

Learning geography plays a role in developing creative thinking and science process skills in students. Creative thinking and process science skills can be used in developing new methods and solutions to solve problems in geosphere phenomena using innovative perspectives. This study uses a quasi-experimental type with a Posttest Only Design. In this study, a purposive sample method was applied with two groups: the experimental group from science class 1 using SOLE and the control group from science class 3 using conventional methods. The instrument uses an essay test to measure the level of creative thinking ability and an observation sheet to measure the level of science process skills. The data analysis used was the Independent-Sample T Test and the Mann-Whitney U test with a significance level of 0.05. The SOLE model significantly affects watershed conservation materials' creative thinking and science process skills. The significance value of the Independent-Sample T-Test of creative thinking skills was $0.001 < 0.05$, and the significance value of the Mann-Whitney U Test of science process skills was $0.000 < 0.05$. The internet's investigative process provides information and mindset in scientific concepts in predicting damage/problems and watershed conservation efforts. In addition, the internet investigation process helps students obtain various literacy and information.

INTRODUCTION

A superior generation that is capable of adjusting to the age of disruption is formed in part by 21st-century learning. Students are expected to have various skills to succeed in future work life (Valtonen et al., 2021). Students must master creative, collaborative, critical thinking, problem-solving, and communication (Daulay et al., 2021). Mastery of these skills serves as a provision for future students to face the problems of everyday life and life in society (Care et al., 2019). This provision can shape students into superior generations who can adapt and compete with the times (Leasa et al., 2021). To improve 21st-century skills, learning activities, including Geography learning, must be applied optimally to require special attention.

Learning Geography has a role in fostering creative thinking skills in students. Creative thinking skills assemble cognitive activity efforts on particular objects, problems, and conditions using imagination, intelligence, insight, and various ideas with different perspectives and applications (Birgili, 2015). The results of innovative ideas construct an original product and contain new concepts, new methods, and new systems (Chen et al., 2019; Laar et al., 2020). Furthermore, these cognitive efforts help students be sensitive to geosphere phenomena in their environment and provide ideas and solutions to problems caused by human interaction with the surrounding environment (Suharto et al., 2021). Therefore, the development of creative thinking skills is crucial for

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supporting students in learning about geosphere phenomena and using them to solve difficulties in their daily lives by using original perspectives and ideas.

Creative thinking skills have a relationship with science process skills. It produces productivity achievements that contain components of science process skills (Yang et al., 2016). Mastery of creative thinking skills in students can stimulate science process skills such as observing, predicting, and hypothesizing, so creative thinking helps students in mastering better science process skills (Meador, 2015; Yildiz & Guler Yildiz, 2021). Additionally, learning situations that encourage creative action performance and novelty production might help students develop their creative thinking as a competence for the scientific method (Oliveira et al., 2021). These skills can be applied to creating fresh approaches and fixes for issues (Ozdemir & Dikici, 2016). Thus, science process skills and creative thinking foster reciprocal relationships so that they can influence each other.

Mastery of students' science process skills is essential to master in learning Geography. Science process skills help students improve knowledge based on the scientific method and gain new knowledge in the learning process (Antrakusuma et al., 2017; Serevina, 2018). The scientific method assists in developing concepts and theories based on student's prior knowledge as well as finding facts in science process abilities (Siregar et al., 2019). This method effectively supports competence in studying science and technology, provides problem solutions, and develops individual and social attitudes (Gomaa, 2016). Furthermore, competence in science process skills helps describe phenomena that occur in students' daily lives (Khamhaengpol et al., 2021). As a result, science process skills make students become scientific actors and people used to solving problems in everyday environments (Demir & Sahin, 2018). Thus cultivating essential science process skills to be developed in geography learning can accommodate students in finding facts, describing objects, building concepts, and overcoming problems of geosphere phenomena in students' daily lives.

Watershed Conservation is the material contained in studying hydrology in geography learning. The study of watershed conservation in geography learning is expected to enable students to use watersheds best in community life (Irana et al., 2018). The environment in which students have positioned influences the learning process and may be used as a learning resource (Sugandi, 2016). The occurrence of watershed damage re-

quires conservation efforts to preserve river water and prevent the resulting impacts such as damage to river ecosystems, flooding, and decreasing water quality that can harm living things, including humans (Syaputri, 2017). Watershed conservation materials require creativity and scientific processes to raise students' awareness of problems and generate ideas or solutions to overcome them (Hendrawati et al., 2014). Thus, watershed conservation materials in geography learning require appropriate learning models to cultivate creative thinking and science process skills.

The application of the innovative learning model can help the achievement of students in mastering creative thinking skills and science process skills. Learning models that direct students' activities to think deeply can stimulate creative thinking skills and science process skills (Zain et al., 2022). Additionally, problem-based learning can help students build science process abilities and creative thinking (Nursalam et al., 2022). Science process skills and science process skills necessitate inquiry-based learning (Solé-Llussà et al., 2020). Furthermore, the learning approach is demonstrated through demonstrations, problem-based learning, or role-playing activities (Birgili, 2015). Therefore, learning geography must be designed using an effective learning model and able to develop skills in students, including creative thinking and science process skills.

The Self Organized Learning Environment (SOLE) model can develop students' creative thinking and science process skills. SOLE is a learning innovation that directs students to solve problems in groups using internet network technology from intelligent devices (Dolan et al., 2013). It can encourage students to work and learn to answer problems through questions, discovery, creativity, knowledge sharing, and spontaneity using technology and the internet (Lees & Noddings, 2016). Using the internet and smart devices in the learning process can search for a wider variety of digital literature as references and alternative answers and find various creative ideas as innovations for problem-solving (Johnson, 2015; Putra et al., 2021). The SOLE learning model focuses on supporting students in Science learning by providing well-packaged Big Questions, Investigations, and Reviews (Baylor, 2017). The process supports students as leaders of their learning experiences and transforms teachers into navigators, coaches, and co-architects, thereby providing educational equality (Weisblat & McClellan, 2017). Thus, learning activities have the potential to develop creative thinking skills and science process skills, so they are worth proving.

Previous research on the SOLE model conducted by Juarez (2022), discovered that SOLE could improve Soft Skills in Geographically Distributed and Multicultural Engineering Teams in engineering learning. Research by Pratama (2022) on SOLE combined with Augmented Reality media found that it can enhance critical thinking skills in learning physics. The study by Zakwani (2019) states that SOLE can effectively grow and train learning independence and student learning motivation in learning English. Previous research has yet to find the application of SOLE in geography learning and its effect on creative thinking and science process skills. However, there is a need for further research on SOLE in all knowledge, including geography learning and its impact on creative thinking and science process skills.

Researchers solved two research questions in this study: RQ1: Does the SOLE learning model affect creative thinking skills in Watershed Conservation materials?; RQ2: Does the SOLE learning model affect science process skills in Watershed Conservation materials?

The following are the hypotheses of this study: RQ1: H0: The SOLE learning model does not affect creative thinking skills in watershed conservation material; H1: The SOLE learning model affects creative thinking skills in watershed conservation materials. RQ2: H0: The SOLE learning model does not affect science process skills in watershed conservation material; H1: The SOLE learning model affects science process skills in watershed conservation materials.

METHODS

This research is a Quasy Experimental with Posttest Only Control Group Design. This study used a control group and an experimental group. The experimental group received the SOLE learning model treatment, while the control group received the conventional learning model treatment that teachers often use.

Table 1. Research Design

Group	Treatment	Posttest
Experiment	X	O
Control	-	O

Description:
X : SOLE Learning
- : Conventional Learning
O : Measurement of creative thinking skills and science process skills

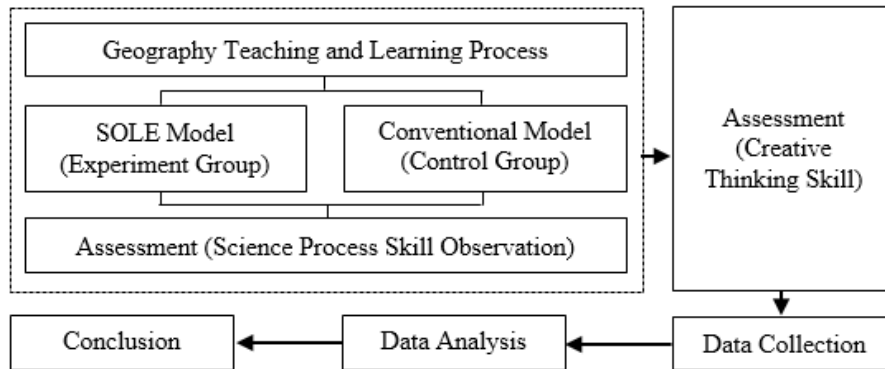The flowchart of research method can be seen in the figure 1.

Figure 1. Research Methods Flowcharts of SOLE on Creative Thinking and Science Process Skills

The subject of research was second-year students of SMAN Negeri 3 in the academic year 2022/2023. The geography course taught was Watershed Conservation material in the second semester of Indonesia's 2013 curriculum (revised edition). The experimental and control groups were chosen using a random sampling technique. The research subjects were second-year students from the Science class. The social science 1 students (n = 30) in the experiment group received SOLE learning, while the social science 3 students (n = 30) in the control group received conventional learning. The data collection technique used the pretest after being given the treatment of the learning model and observation while the learning was taking place. After receiving treatment, students took a test that consisted of eight essay questions referencing four different types of creative thinking skills (fluency, flexibility, originality, and elaboration) (Kim, 2017) and nontests in the form of observation sheets referencing altered science process skills indicators (observing, classifying, predicting, and concluding) to gauge students' science process abilities during

the two groups' learning activities (Oloruntegbe, 2010; Chabalengula et al., 2012).

An instrument can be said to be good if it meets the criteria of validity and reliability, so the tool must be tested first to be feasible to use. The validity and reliability tests were carried out in the third-grade science class at SMA Negeri 3 Batu with as many as 32 students. This particular class is not a study sample. The validity test using Pearson's Product Moment Correlation produces a value of 0.635-0.807 > r table of 0.361, which shows the test instrument is said to be valid. The reliability test using Cronbach Alpha yielded a value of 0.840 > 0.6, which indicated that the test instrument was said to be reliable.

Data analysis used the Independent Sample T-Test assisted by SPSS with a significance level of 0.05. Data analysis was carried out when the experimental and control groups were given complete treatment. The value used to test the hypothesis is the final score obtained from the accumulation of each indicator of creative thinking skills from the post test and the collection of each hand of science process skills from the student observation sheet. The Independent Sample T-Test was used to determine the effect of the SOLE model on creative thinking skills and science process skills. The prerequisite test must be met using the normality test and homogeneity test. The significance value of the Kolmogorov-Smirnov Normality Test for creative thinking skills is 0.200, which shows the data is normally distributed because it has a significance value > 0.05. In contrast, the science process skills yielded a significance value of 0.000, indicating that the data is not normally distributed because it has a significance value of <0.05. The homogeneity test of Levene's Test of Creative Thinking skills produces a significance value of 0.522, which indicates that the data is homogeneous because it has a significance value > 0.05. In contrast, creative thinking skills produce a significance value of 0.012, indicating that the data is not homogeneous because it has a significance value of <0.05. The Mann-Whitney U Test is used as a non-parametric test if the data are not homogeneous and normally distributed.

RESULTS AND DISCUSSION

The SOLE model is a learning model designed to support Geography learning activities to be effective. SOLE Learning designs effective learning processes and helps students master 21st century knowledge and skills (Weisblat et al.,

2019). The SOLE model trains students to organize themselves in study groups to solve problems using computers and intelligent devices connected to the internet (Dolan et al., 2013). Using the internet and smart devices in the learning process can search for a wider variety of digital literature as reference learning sources for alternative answers, find various creative ideas as innovations for problem-solving and get a fact from a phenomenon (Putra et al., 2021). The sole learning model consists of three steps: Big Question, Investigation, and Review (Mitra, 2015).

Giving the teacher Big Questions is the first step in learning the SOLE approach. Giving students Big Queries via audio/visual materials serves as a stimulant when they respond to questions (Nugraheni & Wuryandani, 2018). In order to answer the question, "How should watershed conservation efforts in Batu City be carried out if viewed from the influence of land use, area height, and regional slope on watershed damage/problems," the teacher hands the student a map of land use, area height, and regional slopes in Batu City in 2020. Stimulus maps help the student's investigation process by students (Zhang et al., 2019).

The investigation process is the second stage. This process begins with forming six study groups, and educators provide student worksheets to support the investigation process carried out by students in answering the given Big Questions by identifying and classifying the data or information obtained (Hamid et al., 2020). The data or information obtained is then discussed with group members to analyze the damage to the Batu City watershed from the land use, elevation, and slope of the area given according to the literature searched through the internet. These results then become a reference in determining conservation efforts to preserve watersheds in Batu City. At the end of the investigation stage, students conclude the results and discuss them with their respective groups.

The third stage of the SOLE learning model is the Review process. In this process, each student makes a presentation by giving an opinion on the answers to the work on the investigation process (Wallengren Lynch, 2018). Furthermore, students conduct a question-and-answer discussion with other students in the audience. In the last stage, the teacher does reflection and evaluation to straighten the results of students' investigations and explorations. The study was conducted four times according to the predetermined lesson schedule.

Geography learning activities using the SOLE model affect students' creative thinking skills. The geography learning process using the SOLE model affects students' creative thinking skills. Independent Sample T-Test of creative thinking skills resulted in a value of 0.001 <0.05 (Table 2), meaning SOLE significantly affects creative thinking skills.

Tabel 2. Independent-Sample T-Test Creative Thinking Skills

Creative Thingking Skills	t-test for Equality of Means
	Sig. (2-tailed)
Equal variances assumed	0.001
Equal variances not assumed	0.001

Learning Geography using the SOLE model positively impacts growing creative thinking skills. The experimental group's average value of creative thinking skills is 85.50, higher than the control group's average value of 73.47 (Table 3). The experimental group that received the SOLE learning model had a higher average value of creative thinking skills than the control group that received the conventional learning model. Thus, geography learning recommends the SOLE model to foster creative thinking skills in students.

Table 3. Score of Creative Thinking Skills Based on Indicators

Indicator	Control		Experiment	
	Mean	Category	Mean	Category
Fluency	71.11	Moderate	87.22	Very High
Flexybility	74.44	High	86.11	Very High
Originality	74.44	High	84.44	Very High
Elaboration	73.33	High	83.89	Very High
Mean	73.33	High	85.42	Very High

The investigation process using the internet in the SOLE learning step affects the students' creative thinking skills. Using internet technology and intelligent devices in learning activities can develop 21st-century skills, including creative thinking skills in students (English & Kitsantas, 2013; Wannapiroon & Pimdee, 2022). The fluency indicator on creative thinking skills is most influenced by SOLE learning since it has a most significant 0.01 <0.05 (Table 4), for the Independent Sample T-Test. Students can learn a variety of literacy skills and facts about watershed protection through internet search. Relevant literacy and information obtained from the internet build students in providing various ideas for conservation efforts to preserve watersheds in Batu City. Zakwani & Walker-Gleaves (2019) explained that a learning environment by utilizing literacy resources from the internet in the learning process could motivate students to learn and find various exciting and new literacies on the internet. The more new information students get, the more creative students get in providing various ideas or ideas (Hagtvedt et al., 2019).

Tabel 4. Independent-Sample T Test Based on Indicators of Creative Thinking Skills

Indicators	Sig. 2 tailed
Fluency	0.01
Flexibility	0.04
Originality	0.37
Elaboration	0.31

Student learning activities in SOLE can build concepts by providing new ideas on the originality indicator. Information sources on the internet can foster knowledge that can build students by providing new ideas rarely applied in watershed conservation efforts. Internet facilities constructed in the SOLE learning process can build students' understanding of new concepts by connecting them with what students know (Mitra, 2015). Students who use the internet in the learning process positively impact the growth of new ideas and ideas obtained from various

sources of information on the internet (Chung et al., 2020). However, the study's results on the originality indicator were the weakest influenced among other indicators, with a significance value on the Independent-Sample t-Test of 0.37 >0.05 (Table. 4). Students imitate the information and sources they get on the internet, so they do not fully use their new ideas (Wegerif, 2002; Sun et al., 2022).

The learning group discussion process to answer questions in the SOLE learning step effectively builds creative thinking skills in terms of how students see various points of view on objects or problems. The group discussion process to learn from each other and exchange opinions to solve watershed problems and watershed conservation in Batu City provides students with various perspectives. Each student has a different point of view in seeing watershed objects or problems that can improve students' skills in thinking flexibly. Learning with group discussion activities can improve creative thinking skills (Ulger, 2018). Learning discussions allow students to think more flexibly to support creative thinking skills (Nabilah et al., 2021).

The findings in this study, namely the determination of the influence of the SOLE model on creative thinking skills, is that SOLE activity most results in the Fluency indicator of the investigative process using the internet to provide information that can help students acquire various literacy and information related to watershed conservation. Although students who use the internet in the learning process positively impact the growth of new ideas and ideas obtained from various sources of information on the internet (Chung et al., 2020). However, the SOLE model has little influence on the originality indicator because, in its activities, students only imitate information and sources they get on the internet, so they only partially use their new ideas. It is dif-

ferent from Chen's (2019) research, which shows an Originality value more significant than other indicators because, in the application of the learning model, it combines SCAMPER, which contains features that function as guides for students in developing new ideas and are different from the others.

Geography learning activities using the SOLE model affect students' science process skills. The significance value of the Mann-Whitney U Test yields 0.00 <0.05, which means that the SOLE model significantly affects science process skills. In addition, using the SOLE model in Geography learning positively impacts growing science process skills. According to Table 6, the experimental group, which received the SOLE learning model, has a higher average value of science process skills than the control group, which received the SOLE learning model along with conventional learning. The experimental group's average value of science process skills is 95.87, while the control group's average value is 85.40.

Table 5. Mann-Whitney U Test Science Process Skills

Science Process Skill	Value
Mann-Whitney U	197.000
Sig. (2-tailed)	0.000

The average value of science process skills in the experimental group is 95.87, and the control group with an average value is 85.40 (Table 6). These findings imply that the experimental group that received the SOLE learning model had a higher average value of science process skills than the control group who received the SOLE learning model get conventional learning models. Thus, geography learning recommends the SOLE model to foster science process skills in students.

Tabel 6. Score of Science Process Skills Based on Indicator

Indicator	Control		Experiment	
	Mean	Category	Mean	Category
Observing	86.67	Very High	94.44	Very High
Grouping	85.56	High	94.44	Very High
Predicting	83.89	High	95.56	Very High
Concluding	87.78	Very High	98.33	Very High
Mean	85.40	High	95.87	Very High

The learning group discussion process to answer questions in the SOLE learning step effectively builds creative thinking skills in terms of how students see various points of view on objects or problems. The group discussion process to learn from each other and exchange opinions to solve watershed problems and watershed conservation in Batu City provides students with various perspectives. Each student has a different point of view in seeing watershed objects or problems that can improve students' skills in thinking flexibly. Learning with group discussion activities can improve creative thinking skills (Ulger, 2018). Learning discussions allow students to think more flexibly to support creative thinking skills (Nabilah et al., 2021).

The series of activities in SOLE learning affects science process skills. The stimulus used in the step of giving the Big Question in the form of a map of land use, elevation, and slope of the area can grow indicators of observing science process skills. Indicators of observing science process skills can be grown through observations using pictures or objects given to students during the learning process (Nugraheni & Wuryandani, 2018). Observations using maps as a stimulus Big Questions can facilitate finding information because maps provide information that students can identify (Egiebor & Foster, 2019). However, the study's results on the observed indicator were the weakest influenced among other indicators, with a significance value of 0.75 >0.05 in the Mann-Whitney U Test (Table 7). The experimental and control groups used the same media: land use maps, slope maps, and elevation maps of the Batu City area. Observations using the same learning media give students the same results and experiences (Puspitarini & Hanif, 2019).

Tabel 7. Mann-Whitney U Test Based on Indicators of Science Process Skills

Indicator	Sig. 2 tailed
Observing	0.75
Grouping	0.28
Predicting	0.00
Concluding	0.02

Observation of land use maps, elevations, and slopes of the area can grow students' science process skills. Observing the map encourages students to categorize the objects featured in the map based on similarities and differences in the attributes of the objects. Students can distinguish the information obtained on the two maps provided. The similarities and differences in object characteristics obtained from the map identification results can hone students' grouping skills (Sahnaz et al., 2018). Grouping several objects based on the characteristics of similar groups can describe the similarities and differences of an object or phenomenon in an area (Cai et al., 2019).

The investigation process using the internet at the SOLE learning step can affect predictive indicators. SOLE learning influences predictive indicators most the most, with the most significant value of 0.00 <0.05 Mann-Whitney U Test (Table 7). The internet investigation process can provide information and a mindset in scientific concepts in predicting damage/problems and watershed conservation efforts. The similarity of patterns and information obtained through the internet can connect the same information with the problem, or Big Question students will answer. The use of internet technology can see information from the outside world in the same context (Weisblat & McClellan, 2017). Students access websites on the internet that provide websites, information, and articles that students want to predict and research to answer questions or problems (Zakwani & Walker-Gleaves, 2019).

Drawing conclusions after conducting investigations and group discussions trains students to develop conclusion skills. The process of concluding the results of student investigations in SOLE learning is part of the science process skills that students must master (Turiman et al., 2012). Investigating land use and the slope of the area in Batu City provides information related to watershed problems that will arise. After students know the watershed problems in Batu City, students choose the proper conservation method to overcome these problems (Cook, 2019). When students can sum up the author's perspective on the watershed and the conservation challenges around it that are covered in learning activities, they can develop conclusion-making skills (Handoko et al., 2019; Rumalolas et al., 2021).

The findings of the influence of the SOLE model on science process skills, namely SOLE activities, most affect the indicators of predicting investigative processes using the internet, providing information and mindset in scientific concepts in predicting damage/problems and watershed conservation efforts. However, the SOLE model has little influence on observing indicators because the experimental and control groups use the same media, namely land use maps, slope maps, and elevation maps for the Batu City area. Observations using the same learning media provide students with the same results and experiences.

CONCLUSION

Learning activities in the SOLE model can influence creative thinking and science process skills in watershed conservation materials. SOLE learning activities significantly affect fluency indicators on creative thinking skills and predictive skills on science process skills. The internet's investigative process provides information and mindset in scientific concepts in predicting damage/problems and watershed conservation efforts. In addition, the internet investigation process helps students obtain various literacy and information. The researcher recommends the Self Organized Learning Environment (SOLE) model in geography learning to cultivate creative thinking skills and science process skills. Thus, SOLE learning needs to be applied consistently to get maximum results. The SOLE model needs to be implemented by considering proper time management and requires training in its implementation. It aims to create active and effective SOLE learning. Furthermore, when students undertake research from internet sources throughout the learning process, the teacher must provide intensive guidance so that students can focus more on their learning tasks.

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