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DEVELOPMENT OF SSCS LEARNING MODEL TO IMPROVE CRITICAL THINKING AND PROBLEM SOLVING SKILL

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Abstract

Critical thinking and problem solving skills are one of the 21st century skills that students must possess to face technological and information developments and compete in a global society. This study aims to analyze the improvement of students' critical thinking skills and problem solving in the science learning process through the Search, Solve, Create and Share (SSCS) learning model. The research method used was pre-experiment with one group pretest-posttest design. The research sample was 52 students in grade 8 SMP Islam Al-Hadi Mojolaban. Data collection used Newton's Law Essay test instrument with an assessment rubric adapted from validated indicators P21. The test instrument used was valid and had a Cronbach's Alpha value of 0.782. The results of the N-gain on indicators consist of reason effectively, make judgments and decisions, use system thinking and solve problems 0.88, 0.56, 0.32, 0.33. The improvement of make judgments and decisions, use system thinking and solve problems is in the medium category and reason effectively falls into the high category. Therefore, the SSCS learning model can improve critical thinking skills and problem solving especially on indicators of reason effectively.

Keywords:*SSCS Learning Model, Critical Thinking Skill, Problem Solving, Science Learning*

Introduction

*US-Based Partnership for 21st Century Skills*or P21 has defined the skills needed in the 21st century, namely "The 4Cs". These skills accommodate 4 skills, namely critical thinking skills, creativity, communication and collaboration. 4Cs skills are in accordance with 21st century skills according to Trilling and Fadel in 21st Century skills: Learning for Life in Our Times, among others (1) Critical thinking and problem solving, (2) communication and collaboration, (3) creativity and innovation, (4) information literacy, (5) media literacy, (6) ICT Literacy, (7) Flexibility and adaptability, (8) Initiative and accountability, (9) Leadership and responsibility. 4Cs skills have been used as input in the field of education, especially 21st century learning in classroom practice (NEA, 2012).

The development of technology and information requires students to have 21st century skills or 4Cs skills, one of which is critical thinking and problem solving skills. The demand for a change in the mindset of students from low order thinking skills to high order thinking skills and simple action to comprehensive action is one of the basics needed for 21st century skills (Trilling and Fadel, 2009). These skills are also needed to compete in facing advances in science, technology and information in the era of globalization. The ability to think critically serves to analyze an argument and thesis the results (Rabari, 2011; Ennis in Costa, 1985) and make decisions (Mimbs, 2005; Koray & Koksal,

2009). Therefore, students need critical thinking and problem solving skills in facing challenges in the real world, especially the challenges of the 21st century.

In fact, students 'critical thinking and problem solving skills are still relatively low (Saputra et al., (2016; Nuryanti et al., 2018), so a solution is needed to enable students' critical thinking and problem solving skills to increase. Empowerment of 4Cs skills, especially critical thinking skills and problem solving can be trained through a learning model that is student center learning based on constructivism learning (Limbach and Waugh, 2010). Therefore, it is necessary to choose the right model. This is because the learning model can change the mindset and behavior of students during the transfer of knowledge (Joyce, 2000) In addition, the optimal learning process can be achieved if there is a match between the process and the learning model (Danial and Sepe, 2010). One of the learning models that can improve critical thinking and problem-solving skills is the Search, Solve, Create learning model. and Shar e (SSCS) (Saregar, 2018).

In teaching, student participation is very important (Hasib et al., 2021). The Search, Solve, Create, and Share (SSCS) learning model is a model that can be said to ensure student participation in the learning process by teaching a problem-solving process and developing problem-solving skills (Lartson, 2013). The SSCS model with a problem solving approach is designed to develop critical thinking skills and increase understanding of science concepts (Utami, 2011). The SSCS (Search, Solve, Create and Share) model was developed by Pizzini in 1985 and is a problem solving type (Irwan 2011). SSCS has undergone improvements through several researchers, namely Abbel and Pizzini 1992, Luft Bancroft and Burketa 1997 and Pizzini and Shepardson 1992b so that it can be used for mathematics and science subjects (Marten and Hansen, 2009). The SSCS learning model meets NCTM (National Council of Teachers of Mathematics) and NCISE (National Center for Improving Science Education) so that it can be used in mathematics and science learning. The SSCS model is designed in student center learning where the teacher listens to and observes more student activities rather than explaining material in class. This model trains students to discuss, question and explain so that the science learning process will be more interesting (Martin and Hansen 2009). The SSCS syntax is seacrh (investigation), solve (problem solving), create (construction problem solving) and share (communicate the results of problem solving) (Irwan, 2011). The syntax for the SSCS learning model is in table 1.

Table 1. SSCS Model Syntax

Phase	Activity
Search	1. Understand the phenomena or problems given to students 2. Observe the problem 3. Make inquiries 4. Conduct analysis to generate ideas
Solve	1. Plan a solution 2. Using critical and creative thinking skills in making hypotheses 3. Determine the method of solving the problem 4. Data collection and analysis
Create	1. Create products from the solve phase

	2. Testing hypotheses 3. Show creative results
Share	1. Communication with teachers, group friends and between groups 2. Express thoughts, feedback and evaluation

(Pizzini, Abel & Shepardson inIrwan, 2011)

The ability to think critically according to Rodinow and Barry (1994) in Tawil &Liliasari (2013: 8) is a process that emphasizes a series of standards and procedures for analyzing, testing and evaluating. Critical thinking skills according to Ennis (2002: 54) are logical and reflective thinking processes that focus on deciding what to believe or do. There are several indicators of critical thinking skills. including indicators according to Ennis and P21. Ennis (2002, 54-56) in the abilities aspect formulates critical thinking skills which consists of 5 indicators and is translated into 12 sub indicators, namely providing simple explanations, building basic skills, concluding which consists of deducing or inducing activities, providing further explanations and strategize. P21 formulates indicators of critical thinking and problem solving into 3 categories, namely reason effectively, make judgments and decisions, and solve problems which are described in table 2 (P21, 2009).

Table 2. Indicators of Critical Thinking Skills and Problem Solving Problems according to P21

Indicator	Description
Reason Effectively	Use various types of reasoning (inductive, deductive, etc.) as appropriate tothe situation
Use Systems Thinking	Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems
Make Judgments and Decisions	1. Effectively analyze and evaluate evidence, arguments, claims and beliefs 2. Analyze and evaluate major alternative points of view 3. Synthesize and make connections between information and arguments 4. Interpret information and draw conclusions based on the best analysis 5. Reflect critically on learning experiences and processes
Solve Problems `	1. Solve different kinds of non-familiar problems in both conventional and innovative ways 2. Identify and ask significant questions that clarify various points of view and lead to better solutions

(P21, 2009)

This study aims to analyze the improvement of students' critical thinking skills and problem solving in the material pressure and its application in everyday life using the SSCS learning model. The difference between this study and previous research is that the instrument indicators used in presenting the data use the P21 indicator or US-Based Partnership for 21st Century Skills. This research is expected to provide a contribution and novelty for teachers in the teaching and learning process, especially those that focus on applying the SSCS learning model to

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develop critical thinking skills and problem solving in relevant research.

Method

This study aims to analyze the improvement of critical thinking skills and problem solving in the stress learning process and its application in everyday life using the SSCS learning model. The research sample was 52 students in grade 8 SMP Islam Al-HadiMojolaban. Samples come from 2 classes out of 8 classes taken randomly by random sampling technique, so that all samples have the same opportunity (Sugiyono, 2018). The research method used was pre-experimental with a one group pretest-posttest only design (Fraenkel, 2012). Data on critical thinking skills and problem solving were obtained from students' essay test results on Newton's Law. The test instrument and scoring rubric are based on P2. The advantage of using an essay test instrument is that the answers to more explore students' ideas and creativity (Simsek C L and Kıyıcı F B, 2010). The data collection instrument was validated by an expert validator with a score of 3.48 which was categorized as very good. The test instrument has been validated and tested so that the items are valid and have a Cronbach's Alpha value of 0.782.

Student test results are classified into three categories: low, medium, and high, based on the classification, according to Shriki (2013) which can be found in table 3.

Table 3. Criteria for Category of Critical Thinking Skills and Problem Solving

Category	Percentage (P)
Low	< 55 %
Moderate	≤ 55% - ≤75%
High	> 75 %

The percentage can be calculated using the equation:

$$P = \frac{N_i}{N}$$

Where Ni is the score for each indicator and N is the maximum score for each indicator. Analysis of the improvement of students' critical thinking skills and problem solving using the SSCS model is the Gain score. The N-Gain Score indicates the difference between the pretest and posttest scores in one sample group. Meltzer, D.E. (2002). states that the Gain score can be obtained using the following formula:

$$N - gain = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

Where S_{post} is the average post-test score, S_{pre} is the pre-test average score and S_{max} is the maximum score. The interpretation of the N-Gain score is in table 4.

Table 4. N-Gain category

Category	N-gain Value
Low	(g) <0.3
Moderate	0,3 < (g) < 0,7
High	≥ 0.7

Result and Discussion

Table 5 shows the results of students' critical thinking skills and problem solving before and after using the SSCS learning model.

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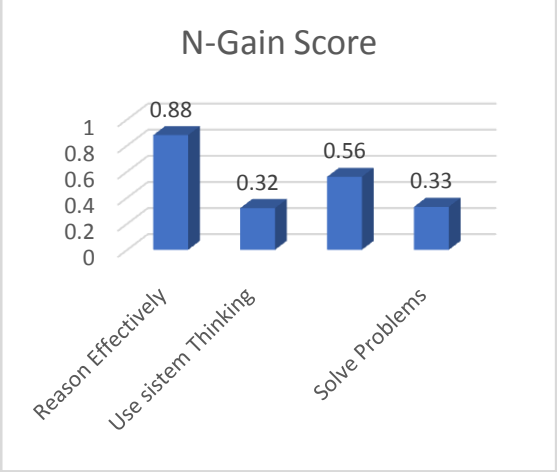
Table 5. A descriptive statistic of student creativity and innovation skills

Statistics Descriptive	Post Test Indicators				Pre Test Indicators			
	A	B	C	D	A	B	C	D
Total Score	194	104	328	212	83	55	152	109
Maximum Score	208	208	416	416	208	208	416	416
Percentage	93,26923	50	78,84615	50,96154	39,90385	26,44231	36,53846	26,20192
Category	High	Low	High	Low	Low	Low	Low	Low

Note: A: reason effectively, B: use system thinking, C: make judgments and decisions, D: solve problems

Table 5 shows the scores of critical thinking skills and problem solving before and after using the SSCS learning model. Before using the SSCS learning model, students' critical thinking and problem solving skills were in the low category on each indicator. After the learning process using the SSCS learning model, there was a significant increase in the indicators of reason effectively and make judgments and decisions that were in the high category. In the indicators of use system thinking and solve problems, there was an increase in pre test scores and pre test scores, but the two indicators were still in the low category. In general, there was an increase in the pre test score and post test score on each indicator of critical thinking skills and problem solving as indicated by the N-gain score in Graph 1.



Graph 1. N-gain of students' critical thinking and problem solving

Based on graph 1, there is an increase in critical thinking skills and problem solving on each indicator. The improvement of make judgments and decisions, use system thinking and solve problems is in the medium category and reason effectively falls into the high category.

Based on these results, the SSCS learning model is seen as a learning model that can improve students' cognitive abilities and 4Cs, especially critical thinking and problem solving skills. Pizzini and Shepardson (1991) revealed that the SSCS learning model tends to make students discover science concepts in an interesting way because students can be directly involved in the problem solving process. The advantages of the SSCS learning model according to Chin (1997) include

(1) Stimulating students to use simple statistics, (2) Effective and easy to practice, (3) Making context studies, developing higher thinking skills, and transferring thinking skills from one scope to another. another scope. Based on its advantages, the SSCS model is able to accommodate wider student interests, make students more active in the learning process, train higher-order thinking skills and increase understanding of science, technology and its application in everyday life. Based on its superiority, the Scientific approach with the SSCS model is seen as a learning tool that can improve critical thinking skills and problem solving in the learning process.

Critical thinking skills according to Ennis (2002: 54) are logical and reflective thinking processes that focus on deciding what to believe or do. Based on this understanding, the ability to think critically is a skill that is needed to analyze to conclude to solve a problem. Critical thinking skills can be developed through the learning process with the SSCS model in the problem solving process in the search, solve and create phases. In the search phase, students are trained in student skills in using various kinds of reasoning according to how to think and analyze a complex system to investigate a problem. This phase is in accordance with the research of Febriyanti et al., (2014) in which students are active in investigating a problem which can be seen from the activeness of students in asking questions to solve problems. In the solve phase, students are trained to solve various types of unusual problems in conventional and innovative ways and identify and ask significant questions that explain different points of view and clues for better solutions. This phase places students as problem solvers who will get their own satisfaction when they are able to solve the problems at hand (Kirkley in Johan, (2014). In the Create stage, students are trained to analyze and evaluate evidence, arguments, claims, and beliefs, analyze and evaluate angles. view the main alternative, synthesize and make connections between information and arguments, interpret information and draw conclusions based on the best analysis and reflect critically on learning experiences and processes. In this phase, students are required to discuss and be active in the learning process so that critical thinking skills can be improved (Walker, 2003). This phase also guides the ability to process information possessed by students which is one of the characteristics of critical thinking skills (Fatimah &Widiyatmoko, 2014)

Several research results support the results of research that has been conducted in which the SSCS learning model has a positive effect on critical thinking skills and problem solving. Research by Falah et al (2018) and Saregar et al (2018) where the SSCS learning model can improve critical thinking skills. The results of Falah et al's research showed an increase in students' high critical thinking skills (2018). The research results of Saregar et al also show that the SSCS model has an effect on students' critical thinking skills and has a positive impact on student activeness in the learning process (2018). The research results of Suciati (2013), Lukitasari (2016) show that SSCS is effective in improving students' critical thinking skills. Herlina et al. (2014) research also supports the results of research where the improvement of students' critical thinking skills based on the N-gain test in learning using the SSCS model is higher and significantly different than the PBI and conventional models.

This study has shortcomings which do not consider the aspects of students' individual cognitive differences which are considered a factor that affects differences in student learning outcomes (Hasib et al., 2021).

Therefore, research is needed that focuses on the same area by taking into account students' cognitive differences.

Conclusion

Based on the results of data analysis, the N-gain score on indicators consisting of reason effectively, make judgments and decisions, use system thinking and solve problems is 0.88, 0.56, 0.32, 0.33. The improvement of make judgments and decisions, use system thinking and solve problems is in the medium category and reason effectively falls into the high category. Therefore, the SSCS learning model can improve critical thinking skills and problem solving

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