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The Effect of the Search, Solve, Create, and Share Model on Students' Science Process Skills in Measurement Material

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ABSTRACT

This research aims to determine the impact of using the Search, Solve, Create, and Share (SSCS) learning model on students' science process skills in measurement material. The research method used is a pre-experiment with one group pretest-posttest design. The sample in this study was obtained through simple random sampling technique. Science process skills data were obtained using performance assessments. The results of hypothesis testing using the paired sample t-test can be concluded that $t_h > t_t$, namely 5.874> 2.056. Based on the statistics, H_0 is denied and H_i is accepted, indicating a significant difference between students' average pretest and posttest scores. The rise in student learning outcomes is considered moderate with score 0.304. The effect size test findings received a price of 1.22 which are in the high range. It is possible to conclude that giving treatment using the SSCS learning model has a significant effect on student science process skills on measurement material in the high range.

Keywords : Independent Curriculum, SSCS; Science Process skills; Physics Learning.

I. INTRODUCTION

In an increasingly complicated world of education, a learning approach capable of fully activating students is required [1]. Search, Solve, Create, and Share (SSCS) is a potential learning model. This model encourages students to actively seek information, solve issues, create products, and share their findings with others [2]. This student-centered learning process is designed to help students develop critical thinking abilities, creativity, teamwork, and improve their learning results [3-7].

The SSCS learning concept is highly related to the Merdeka Curriculum, which focuses on student-centered learning and the building of the Pancasila Learner Profile [8]. This approach is also consistent with the theory of differentiated learning, which allows each student to learn based on their abilities and learning style [9]. By allowing students to actively seek knowledge, solve problems, and be creative, SSCS can help them build 21st century abilities and improve their learning results [10,11].

High learning outcomes indicate achievement in developing students' academic potential and skills, allowing them to become competent and competitive individuals [12]. Among the goals of national education outlined in Law No. 20 of 2003, improving learning outcomes is very important [13]. By improving the learning results of pupils, it can assist to build a generation of nations who are not only more knowledgeable and skilled, but also more noble, healthier, creative, and responsible people.

Learning outcomes are a form of student achievement. Student learning results are the abilities that learners have after acquiring learning experiences [14]. Learning result are also an indicator of the success of educators in teaching students [15]. Learning outcomes in the independent curriculum include concept knowledge, science process skills, and attitudes. Concept knowledge refers to students' understanding of facts, information, and basic principles in various disciplines. Process skills are the capacity of students to perform actions that assist the learning and application of concept knowledge. Meanwhile, attitudes include the spiritual and social attitudes of students in learning [16].

The SSCS model has a wide range of applications in scientific learning. Science, as a scientific subject, requires not just conceptual comprehension but also mastery of science process skills (KPS). KPS competencies include reading data, collecting data, interpreting data, communicating data analysis results, and making conclusions [17]. These abilities are useful not just for comprehending scientific facts, but also for resolving difficult problems in everyday life.

Based on observations and tests conducted on students in class X phase E MAS TI Batang Kabung, information was obtained that many students' physics learning outcomes were still low. Factors that cause low student learning outcomes come from students themselves, such as interest, talent, and health, and those that come from outside, such as the social environment, school facilities, and infrastructure [18]. Student learning results are also influenced by a lack of student engagement during the learning process. When students are actively involved in learning, they tend to be more focused and emotionally involved with the material being studied so as to increase their understanding of the material [2]. The lack of suitability of the learning model used is also a factor that affects learning outcomes.

Throughout the learning process, teachers have employed a variety of learning models, including discovery learning, problem-based learning, and traditional learning models. However, it would be better if the learning model used can encourage students' active participation and is in accordance with the material to be learned. Inappropriate learning models will cause students to become bored and not understand the material presented. For example, in measurement material, the teacher used a conventional learning model. The teacher explains something to the students, and the students record what the teacher says. The application of this approach bores pupils and reduces their ability to get involved in what they are learning, and knowledge only comes from the teacher. By applying the right learning model, teachers can improve student learning results and learning quality, ensuring that students not only memorize information but also understand and can apply their knowledge in different contexts.

The average score of student learning outcomes in class X phase E MAS TI Batang Kabung is 59, which is still below the school's minimal level of 80. The greatest score attained by pupils is 90, while the lowest score is 22. These numbers imply that student learning outcomes remain relatively low. Learning outcomes that have not reached the standard indicate that the material taught has not been mastered by most students. The large contrast between the best and lowest scores indicates a gap in students' knowledge of the material. This condition can affect students' academic development and learning motivation.

To address the issues raised above, a learning model capable of improving student learning outcomes must be implemented. One of the learning models that teachers might utilize is the Search, Solve, Create, and Share (SSCS) model. The SSCS learning approach allows students to acquire direct experience with the learning process [19]. The SSCS approach consists of four stages: Search, Solve, Create, and Share. Batul stated that during the search stage, students actively participate in the process of finding relevant information related to the material being studied. Students can find information from various learning sources based on their respective learning styles. The second stage is solving; students will work together in teams to discuss alternative solutions to problems based on the information that has been collected. The third stage is create; students will create a problem solving based on the solution found. In the share stage, students will present their work to the class [20].

The SSCS model has the potential to significantly improve students' scientific process skills. During the search phase, students are encouraged to gather relevant information and identify the problem to be solved. This stage teaches students to think analytically and critically. In addition, during the solve stage, students use the knowledge they have gathered to develop a solution or hypothesis. This stage improves logic and problem-solving skills [21]. The Create stage allows pupils to develop creative solutions or experiments. This level allows students to experiment with new ideas and apply scientific concepts in a variety of circumstances. Finally, during the share stage, students present their work to their peers or other audiences. This technique not only improves scientific communication skills, but it also boosts confidence and collaborative abilities [22].

The SSCS model is one of the learning models that can be applied to the independent curriculum. Each SSCS syntax requires the active participation of students and is carried out based on their respective abilities and learning styles. The SSCS learning approach can help enhance student learning result and make students more involved in the learning process [2], allowing them to not only accept teacher instructions but also explore and display their own abilities.

The SSCS learning model is a derivative of the problem-solving model with fewer steps [23]. This makes it easier to understand and implement in daily learning. The integration of these steps allows for a more focused and effective learning experience compared to more extensive and sometimes more complex stages [7]. The SSCS model also provides specific guidance through each stage that supports students' learning orientation to be better and directed. Measurement is one of the basic topics in physics that is very suitable to be applied with this learning model. The SSCS model allows students to see how the concepts in the measurement material are applied in real situations, so learning becomes more relevant and interesting. Students also learn to seek information, solve problems, work together, and present results in an interesting way [24].

The SSCS learning model has been shown to improve student science process skills while learning. Dewi contended that the application of the SSCS learning model was successful, and that there was an effect on science process skills on molecular shapes [25]. In line with this, Sari noted that the SSCS learning model based on the environmental approach has an impact on students' science process skills [26]. Rhozy discovered that the SSCS model increased student learning results for simple harmonic motion content, effort, and energy [3]. Sariasih's research discovered the same thing: an improvement in student learning outcomes after applying the SSCS model to virus content [4]. However, the majority of research on this paradigm focuses on specific learning materials. There has been no research particularly looking at how the SSCS model affects students' science process skills in measuring materials. Furthermore, earlier research focused primarily on pupils from regular secondary schools. As a result, the goal of this research is to fill a gap by investigating the effectiveness of the SSCS model in enhancing students' science process skills on measurement materials, particularly in private secondary schools.

The availability of learning resources and learning media is critical to the success of using the SSCS model in schools. Teachers must prepare learning resources and learning media before beginning the learning process. Textbooks, worksheets, and other scientific references are among the materials utilized as learning resources. Learning media in the form of movies, presentation slides, and photographs are used to supplement teaching and learning activities. Variations in media use are vital for keeping pupils interested and preventing boredom during the learning process.

II. METHOD

This is quantitative research with a pre-experimental design. This study used a one-group pretest-posttest design. The design can be represented as follows:

Table 1. one groub pretest-posttest design

Group	Pretest	Treatment	Posttest
Eksperiment	O_1	X	O_2

The sample for this study consisted of pupils from a private high school in Padang City, West Sumatra, selected using a simple random sampling procedure. Several preparations were made before conducting the research. Including determining the research site, arranging the essential letters, preparing and validating learning components, creating instrument grids, and then creating instruments based on the grids created.

The activity began with a pretest administered to the sample class to establish students' initial abilities. The pretest was administered after the questions were evaluated for validity, reliability, distinguishing power, and difficulty level. The assessment of students' skill aspects was carried out by demonstrating performance during practicum activities. After five meetings of teaching and learning, students in the sample class were given a posttest to measure their post-treatment scores.

This study collected data using skill assessment instruments namely a performance sheet. Instrument testing was performed to assess the quality of the tests employed in the study. The test instrument's testing methodologies include validity, reliability, distinguishing power, and question difficulty. The validity value is computed using the correlation coefficient using Product Moment. To determine the level of instrument reliability, the Sprearman-Brown formula is used. The Sprearman-Brown formula works by employing the correlation coefficient between the two hemispheres as the reliability coefficient of the component (half). For calculating the dependability coefficient of one device, Sprearman-Brown is used,

Distinguishing Power (DP) refers to a question's ability to differentiate between students with high and weak abilities. For objective type questions, the question's distinguishing power is calculated by reducing the number of upper-group students who answer right by the number of lower-group students who answer correctly; and then dividing the result by the number of upper-group students. The question distinguishing power is classified as extremely bad (DP ≤ 0.00), bad (0.00 < DP ≤ 0.20), moderate (0.20 < DP ≤ 0.40), good (0.40 < DP ≤ 0.7), and very good (0.70 < DP ≤ 1.00). The level of difficulty of the question (TK) for objective-type questions is calculated by adding the number of upper-group students who answer correctly to the number of lower-group students who answer correctly, then dividing by twice the number of upper-group students. The question's difficulty level is classified as either very difficult (TK = 0.00), difficult (0.00 < TK ≤ 0.30), moderate (0.30 < TK ≤ 0.70), easy (0.70 < TK < 1.00), and very easy (TK = 1.00).

Data analysis is performed once all data has been collected. Data analysis is the process of evaluating, grouping, systematizing, interpreting, and validating data to determine a phenomenon's social, academic, and scientific worth. To analyze the data, we used the normality test to determine whether the data was normally distributed, the paired sample t-test and Wilcoxon test to test the difference between two paired sample means, the N-Gain test to determine the magnitude of the increase in learning outcomes from pretest to posttest, and the effect size test to determine the size of the effect of using the SSCS model to improve learning outcomes. The data was analyzed using Microsoft Excel software. The normalcy test utilized is the Liliefors test. The following formula is used to perform a paired sample t-test on normally distributed data.

$$t_h = \frac{\overline{X_{d_i}}}{S_{d_i}/\sqrt{n}} \ or \ t_h = \frac{\overline{X_{d_i}}\sqrt{n}}{S_{d_i}} \quad (1)$$

For hypothesis testing of non-normally distributed data, such as student attitude scores, the Wilcoxon test is employed. The amount of data pairs in this study is more than 25 pairs, thus the distribution utilizes a normal distribution technique, so we may apply the formula for z transformation:

$$z_h = \frac{W_h - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}} \quad (2)$$

The N-Gain statistical test was used to measure how much the outcomes improved from the pretest to the posttest. The N-Gain value is calculated by subtracting the average posttest score from the average pretest score, which is then divided by the result obtained by subtracting the ideal score from the average pretest score. The N-Gain value is classified into three categories: high (> 0.70), medium (0.30 - 0.70), and low (< 0.30).

The effect size (SE) test measures the impact of the SSCS learning model application. To calculate the effect size, divide the average difference between the pretest and posttest by its standard deviation. The effect size data can be classified into four categories: extremely weak effects (0.00 - 0.20), weak effects (0.21 - 0.50), moderate effects (0.51 - 1.00), and high effects (> 1.00).

III. RESULTS AND DISCUSSION

The result of this research is that the use of the SSCS learning model has a major influence on student physics learning results in the science process skills domain. There are five skill indicators tested during the learning process. The five indicators evaluated are: reading data (MC), collecting data (MP), analyzing data (MS), communicating the outcomes of data analysis (MK), and forming conclusions (MB) [27]. Student learning results in the skills aspect are obtained using a scoring rubric and are described in Figure 1 below.

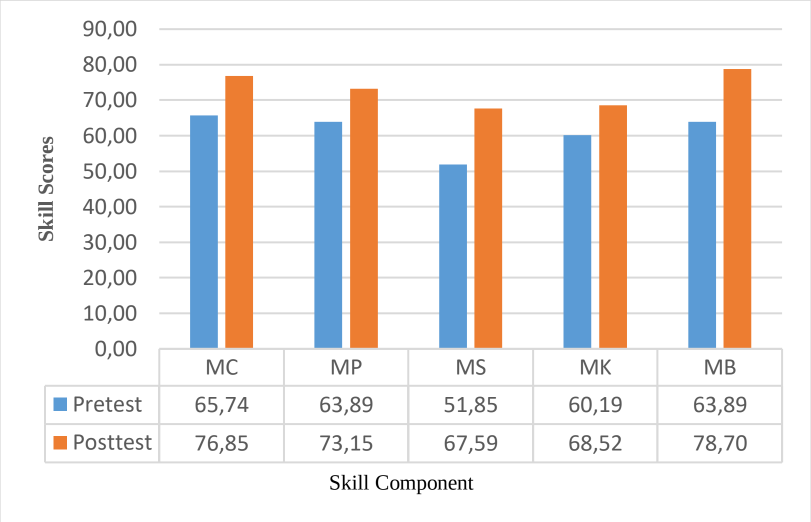

Fig. 1. Students' Skill Scores per-Indicator

Figure 1 depicts the mean value of student skill scores per indicator. The average value per indicator reveals that there is a variations in skill value between the prior test and posttest. The student skill rate at the posttest is higher than the pretest. This refers to the treatment administered to the sample class. The following table displays descriptive statistical data related to attitude aspects.

Table 2. Data analysis findings regarding skill aspects

Statistical Parameters	Pretest	Posttest
n	27	27
Mean	61,11	72,92
S	8,586	7,753
S^2	73,72	60,11

The descriptive statistical analysis results in Table 2 reveal that the learning results for students' skill differ between the initial test and the following test. The mean score of skill on the posttest exceeds the mean score of knowledge on the pretest, which is 11,85. To prove this, a hypothesis test was performed following a precursor test in the form of a normalcy test, as indicated in the table below.

Table 3. Normality test result regarding skill aspects

Statistical Parameters	Pretest	Posttest
α	0,05	0,05
L_0	0,1031	0,1673
L_t	0,1699	0,1699
Description	Normally distributed	Normally distributed

Table 3 shows the results of the normality test calculation on the skill aspect of the sample class. The data obtained is $L_0 \leq L_t$ so that both samples are normally distributed. Because the data is not normally distributed, the hypothesis test used is the paired sample t-test, as shown in the table below.

Table 4. Paired sample t-test regarding skill aspects

Statistical Parameters	Pretest	Posttest
α	0,05	
t_h	5,874	
t_t	2,056	
Description	There exists a significant difference.	

The statistical analysis yielded t_h = 5.874, while t_t for dk = n - 1 was 2.056. The t_h price falls inside the H_0 rejection range, hence H_i is approved at a significant level of 0.05. Statistical data analysis shows that there is a variation in mean pupil learning results before and after the use of the SSCS learning model in a private senior high school students Padang on measuring material, with the value after the implementation of the SSCS model being higher than before. The N-Gain examine and effect size examine show that the rise in student scores after treatment is moderate (0.304), and the SSCS model has a very high influence on this increase (SE = 1.22).

In the reading data indicator, pupils demonstrated considerable growth in their ability to comprehend and interpret the information presented. This skill entails not only reading the statistics or information presented but also comprehending the patterns and correlations contained within the data. This is critical in science learning since reading data is the first step toward understanding scientific phenomena. This outcome is consistent with Bell's research, which highlights that investigation-based learning, such as SSCS, can teach students to read and comprehend material more critically and profoundly [22]. In the context of the SSCS paradigm, the search stage allows students to investigate multiple sources of information and find relevant material. The process also includes an initial study of the data collected so that students do not simply accept it but also challenge its validity. As a result, students are better equipped to go on to the next stage of their study with a stronger knowledge.

In the data collection indicator, the use of the SSCS model allows students to collect data in a more systematic and structured manner. The solve step of this model allows students to create data collection tactics that are suited for the topic or question at hand. This approach necessitates thorough planning, including selecting the variables to be monitored, data gathering methods, and instruments required. This finding is confirmed by Johnson's research, which discovered that using a problem-solving method increases students' capacity to organize and manage knowledge efficiently [21]. In addition, this approach enables students to work in groups to share chores and ensure that the data obtained is thorough and accurate. This skill is important besides in science education, yet in a variety of settings beyond the classroom, such as scientific research and data-driven decision-making.

The indicator of data analysis has also increased significantly. This skill comprises examining acquired data, recognizing patterns or anomalies, and drawing preliminary judgments. During the create stage, students are given the opportunity to examine and analyze the obtained data. This process requires a number of higher-order thinking skills, such as grouping information, performing simple statistical calculations, and constructing graphs or tables to represent data. Yasin's research suggests that using the SSCS model in scientific learning can increase students' analytical skills by including them directly in the critical and reflective thinking process [7]. Students learn to distinguish between correlation and causality through data analysis, as well as to evaluate many aspects that may influence the results of their investigation. As a result, students not only improve their data analysis skills, but also their ability to critically evaluate the outcomes of their own analysis.

Students demonstrated a significantly improved capacity to communicate the results of data analysis, both vocally and in writing. The sharing stage in the SSCS model allows students to practice scientific communication skills such as report writing, presentation delivery, and group discussions. This method teaches students not just how to communicate information in a clear and ordered manner, but also how to use suitable scientific terminology. According to Trowbridge and Bybee, the ability to communicate results is an essential component of scientific process abilities that can be improved through collaboration-based learning [17]. Students also learn to receive comments from classmates or teachers, which allows them to constantly improve the way they present their work. This is especially important in the context of science education, since scientific communication is a vital ability for future scientific research and publication.

The indicator for drawing conclusions also improved significantly. This ability entails the process of reflecting on the data and analysis used to produce an answer to the research topic or problem at hand. The last part of the SSCS process allows students to reflect on the process they have completed, analyze the available information, and draw fact-based judgments. This approach is extremely significant in science education since it teaches pupils to think clearly and systematically. Previous study by Bell demonstrated that investigation-based learning encourages students to think critically and reach more accurate conclusions [22]. Furthermore, this step assists students in identifying flaws or shortcomings in their approach, allowing them to improve the quality of their learning in the future. Students who master these skills not only gain confidence in forming conclusions, but they are also better prepared to meet future academic or career obstacles.

According to the N-gain test, pupils' science process skills improved moderately. This suggests that, while the SSCS model typically has a beneficial influence on science process skills, the benefits are mild and do not exceed striking expectations. However, the effect size test data, which is in the high range, shows that the SSCS model has a considerable overall impact on the development of students' science process abilities. Students' active participation in each stage of the model—from search to solve, create, and share—is the primary factor that permits them to receive valuable educational experiences [22].

This distinction can also be linked to a variety of pedagogical influences. One of these is the problem-based approach used during the solve stage. According to Johnson, this strategy enhances students' capacity to think logically and solve problems, but it takes more time and mentoring to observe the impact in the evaluation score [21]. Furthermore, the share stage allows pupils to practice scientific communication abilities that may not be adequately assessed in written test-based evaluations. However, the effects of this activity are frequently obvious in the long run.

The middle level on the N-Gain test indicates that the SSCS model can yet be modified to have a greater impact on students' final scores. Yasin additionally verified that adapting the SSCS model to meet the demands of pupils and local circumstances can be more helpful in enhancing science process skills [7]. Nonetheless, the large effect size gives strong evidence that the SSCS model is a viable and substantial technique for widespread use in scientific education. The large effect size indicates that, while the improvement in students' evaluation scores is moderate, the model's impact on students' cognitive and metacognitive skills cannot be overlooked. Trowbridge and Bybee's research emphasizes the necessity of building science process skills in order to raise a generation capable of critical thinking, making evidence-based decisions, and contributing to global problem solving [17].

This study's findings are consistent with prior research on the usefulness of investigation-based learning models in strengthening science process abilities [7], [21]. Investigative methods like SSCS are intended to engage students in an active, exploratory, problem-solving-based learning process. Yasin discovered that the investigative approach encourages students to investigate material independently, completely comprehend concepts, and implement what they've learned in real-life situations [7]. Thus, the SSCS approach not only helps pupils improve their science process skills, but it additionally presents them with valuable and practical learning experiences.

The Search, Solve, Create, and Share (SSCS) learning model, which is one of the investigation-based learning, provides benefits to improve students' critical and analytical thinking skills [21]. This happens because students are directly involved in activities that teach them how to observe, collect data, analyze, and draw conclusions based on evidence. The search stage of the SSCS model encourages students' critical thinking skills, by challenging students to successfully find and analyze information. Furthermore, the solve stage teaches students to think logically and creatively when developing a solution to the problem at hand. These abilities are in accordance with the indicators of science process skills assessed in this study, which include reading data, collecting data, and processing data.

The findings of this study additionally represent new improvements by demonstrating the unique impact of applying the SSCS model to distinct indicators of scientific process abilities. The reading data indicator increased significantly, indicating that pupils could not only grasp the data but also interpret it in a broader perspective. This study also proved that the create stage of the SSCS model is highly effective in encouraging students to think creatively and design experiments or new solutions. This stage allows pupils to explore and apply their information in new ways, thereby enriching their learning experience.

Another result of this study is the emphasis on the sharing phase, which is often overlooked in other studies. This stage allows students to convey the outcomes of their work, verbally and in writing. This technique not only improves scientific communication skills, but it also boosts confidence among students. According to Bell, the capacity to convey scientific results is a vital skill for both the workplace and academics [22]. Students who practice this skill not only gain confidence, but also better prepare for future obstacles.

This study also demonstrated that SSCS may be effectively used in science learning at all levels of school. The model provides a structured yet flexible framework that enables teachers to tailor its application to the needs of their students and the learning setting, making it compatible with differentiated learning in the independent curriculum. This study confirms the usefulness of using SSCS as a mainstream learning technique in science classrooms, as the results reveal a beneficial influence on many markers of science process skills. This is especially vital as we face the difficulties of the twenty-first century, when critical thinking, analytical, and communicating abilities will be increasingly important for the younger generation to acquire.

IV. CONCLUSION

In conclusion, the implementation of the Search, Solve, Create, and Share (SSCS) learning model significantly enhanced student science process skills at a significant level of 0.05. The N-Gain scores for student learning results indicate a moderate-range improvement in student scores, with values of 0.305. The effect size (SE) test results revealed that SE = 1.218 was in the high range. This study makes an important contribution by providing an appealing alternative for educators seeking to increase the quality of learning. The SSCS model could be one of the answers for overcoming learning problems. Future study should involve a variety of samples, testing on different materials, and comprehensive analysis of the aspects that influence successful implementation.

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