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Remediation using SSCS model for reducing misconceptions about work and energy

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Abstract: Misconceptions are discrepancies between students' understanding of concepts and concepts defined by experts. Misconceptions are indicated as latent dangers in the learning process. One of the topics in science that has a high level of misconception among students is the concept of work and energy. The SSCS model is an approach put forward as an effective way to train students' conceptual understanding. This research aims to determine whether the misconceptions about the work and energy of grade 7 students will be reduced by applying the SSCS model (Search, Solve, Create, and Share) as a remediation approach. The experimental design was applied using a one-group pretest-posttest design. The research sample comprised 32 students (15 boys and 17 girls). Profiling of students' misconceptions before and after the action was measured using 14 two-level multiple-choice questions. There are four types of misconceptions based on initial measurements. The results show an average pretest score of 44.07 and an average posttest of 63.60. It can be concluded that the SSCS model significantly reduces student misconceptions. Further research on the types of errors present in mapping student profiles is recommended.

Keywords: SSCS, Misconceptions, Work, Energy, Junior high school.

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INTRODUCTION

Science learning is an academic and practical discipline of teaching, learning, and assessing science content, scientific processes, and scientific attitudes (Mbajiorgu, 2019). Concepts in learning Natural Sciences are the most critical aspects that must be verified before being conveyed to students. The concept can be interpreted as an abstract idea that describes the general characteristics of a group of objects, events, or other phenomena (Gunawan et al., 2017). Students' mistakes in understanding concepts are referred to as misconceptions. In other words, the misconception is a discrepancy between students' understanding of concepts with concepts defined by experts. Misconceptions can be identified as latent hazards in the learning process (Ritonga et al., 2017).

One of the topics in science at the junior high school level that is vulnerable to misconceptions is material on work and energy (Hasim & Ihsan, 2011; Kartal et al., 2011; Tayubi, 2005). Errors in constructing or understanding accepted concepts inside and outside the classroom will make students wrong in reconstructing a final concept of the topic being discussed. Mistakes in building concepts will make it difficult for students to continue learning because a lot of science material is arranged according to a tiered and related concept sequence. Conceptual change has become one of the main goals in science education, with many studies seeking to advance our understanding of conceptual change. Learning scientific concepts is not always the result of the knowledge that accumulates information. The following section will present the concepts and constraints associated with their use in the science classroom. Conceptual understanding is a fundamental goal in learning in general but is very relevant in science education because such understanding is needed to understand phenomena. (Mayuri & Aswirna, 2021)

Previous research has proven a gap between the students' expected understanding after starting a topic and the student's proper understanding in the example of a misconception case. According to Setyawan (2015), there is a misconception in students where students say that work is the product of force and distance, thus students state that if an object moves and then returns to its original point, the object is said to have work. According to (Nabila, 2021) another example of misconceptions experienced by students is when two objects move in a flat plane with different speeds, students have difficulty comparing the kinetic energy of the two objects correctly because there is an error in the concept of 'increase in speed = increase in kinetic energy.' Students assume that if the speed of an object is twice as fast as another object, the kinetic energy of the object will be twice as large. Therefore, it is necessary to diagnose misconceptions in participants before moving on to the following material.

One method that can be used to diagnose misconceptions is to use a two-tier diagnostic test (TTDT). The two-tier diagnostic test was chosen because it can provide an overview of the nature of students' understanding (Antari & Sumarni, 2020; Khiyarunnisa' & Retnawati, 2018; Sunarto, 2013; Tüysüz, 2009; Utami et al., 2017). According to toTüysüz (2009), the two-tier diagnostic test has two advantages over conventional multiple-choice tests: (a) reduces the risk of measurement error. In conventional multiple choice, there are five answer choices, so there is a 20% chance of students being able to answer correctly and it cannot be known whether the student answered with his ability or only guessed or guessed the answer. Therefore, the accuracy of the assessment is reduced; and (b) it enable teachers to access two aspects in one phenomenon. The form of questions that ask students to answer at the first level and explain at the second level allows teachers to know aspects of students' knowledge and understanding at once in one answer.

Another consideration for choosing the TTDT in addition to the three-tier test or other tests with more levels is the consideration of the urgency of students' beliefs in the remediation process in this study. In previous studies regarding the application of a three-tier diagnostic test, such as the research of(Mubarokah et al., 2018), it showed that the answers from students in both Indonesian and Thai schools showed a tendency to answer the third level of the test instrument with "very sure". InAndariana et al., (2020)showed a high level of student confidence in answering questions, but when analyzed, as many as 61.51% percent of respondents experienced misconceptions in the category of false positives, false negatives, or total misconceptions.

A study of Grazziotin-Soares et al. showed that as many as 70% of the research respondents showed a positive relationship between students' confidence levels and common misconceptions as measured by students' correct answers(Grazziotin-Soares et al., 2021). It shows that the level of self-confidence may not be able to show the condition of misconceptions experienced by students, in line with research stating that belief in prior knowledge in students does not have a bad effect on learning that changes aspects of students' concepts. In contrast, the confidence level is more important in showing students' self-efficacy and interest in a topic. Thus, in this study, TTDT will be used without differentiating the level of students' confidence in answering questions. It is a consideration not to include the third level and above in this study because students need different handling between students who experience misconceptions, and the steps that must be taken after diagnosing students' misconceptions are remediation of students who are in the category of misconceptions.

In carrying out remediation efforts, one of the things educators can do is implement student-centered learning (Al-Balushi et al., 2020). Classical learning that places the teacher only as the center of all information will cause students not to have a solid conceptual basis (Mascolo, 2009). While for the remediation process, researchers consider using the search, solve, create, and share (SSCS) method as the proper method to treat the experimental class. Yusnaeni et al.,(2017) mention that SSCS is a learning model based on problem solving. The SSCS method has four stages, namely (1) Search (find topics), (2) Solve (design research),(3) Create (create products) and (4) Share (present presentations of products that have been made)(Lederman & Abell, 2014; Pizzini et al., 1988). The SSCS model is also in line with constructivism theory which states that the knowledge possessed by students does not come from outside the students themselves but is obtained in a personal and subjective way (Jones & Brader-Araje, 2002).

The active role of students in the implementation of learning is the main focus in constructivism-based learning. Teachers generally realize that at every meeting, students are not "blank papers" that can be used to record information easily, but students have brought experience, knowledge, and belief in something they have used to form an understanding of an object or phenomenon. According to (Taşdere

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& Ercan, 2011), this is what causes misconceptions to become resistant to change. According to Jones & Brader-Araje (2002) a constructivist approach that puts students into activities in order to build a correct concept of the problem identification process by the students themselves which refers to the problem solving process by students is able to be a way to eliminate misconceptions experienced by students. The SSCS model itself is considered capable of being a learning model that meets these requirements (Andiska, 2016; Johan, 2012; Saregar et al., 2018; Yusnaeni et al., 2017)

SSCS involves students' learning experiences, developing thinking skills, the ability to question things, and the ability to communicate the results of their thoughts to others. According to Assidiqi (2015), the SSCS model generally has four problem-solving steps: *Search* provides ongoing problems with a metacognitive and conceptual framework. The indicator of this stage is the ability to think critically and find simple explanations. A list of ideas in a question format is created for the investigation in problem identification. *Solve* problem solving planning. Start planning strategies to test the truth of hypotheses by developing problem-solving methods, searching for data, conducting experiments, analyzing data, and drawing conclusions. *Create*-makes works on a small scale to solve problems. The problem is reduced to a more superficial level, and simulation is carried out to prove the hypothesis—submission of problem-solving results effectively, such as using charts or tables. Furthermore, *Share*-students communicate their findings, solutions, and conclusions with teachers and peers in a discussion forum and presentation. Students can articulate their thoughts, receive evaluations and feedback, and finally refine solutions.

Using the detection model with two-tier diagnostic tests and the SSCS learning model is considered appropriate in seeking the detection and remediation of misconceptions in students on the topic of Work and Energy at the junior high school level. The use of the SSCS model, which demands collaboration between students, is also expected to be able to maintain social intertreatment between students despite carrying out online learning during the Covid-19 pandemic. The previous research on SSCS learning uses the SSCS approach independently. However, in this research, we combined diagnostic efforts with remediation using the TTDT method and the SSCS learning model and the adjustment of material for junior high school students who use integrated science, not only presenting Physics, Chemistry, and Biology as a single discipline (Andiska, 2016; Asih, 2015; Johan, 2012; Saddhono et al., 2019; Saregar et al., 2018; Yusnaeni et al., 2017). Andiska (2016) and Saregar (2018) showed usability temperature, heat, and Qalor as the main course. The scope of this topic is only limited to the physics aspect. The result of the Andiska study states that the SSCS model could decrease students' misconceptions about heat and heat topics. Johan (2012) stated that the influence of the SSCS model on increasing the problem-solving ability among college students is on the average level. This result was due to a lack of analysis toward the pairship between each competence indicator and the learning activity, a less suitable test instrument for measuring critical thinking ability, and the characteristic of the learning material and the college students. Johan stated that the learning group should be divided into several groups so the process of *Search* and *Solve* in the SSCS model can gain an optimal result, a pretest-postest model was used in this research. Asih (2015) and Yusnaeni et al (2017)stated that SSCS method could increase criticak thinking skill among high school student in math subject, Asih use Post-test only control design and use one tier instrument to measure student's critical thinking skill. Saddhono (2019), use the SSCS model in classroom with Schoology App and then measure the creativity and metacognotive awareness after the implementation of SSCS through test and interview, the results were there are increasement of student creativity and metacognitive awareness after the implementation of SSCS. This study also seeks to confirm previous similar studies to strengthen the existing theory from the previous research above.

The difference in the SSCS model used in this research compared to the model in previous studies is the combination with the Two Tier Diagnostic Test (TTDT) misconception diagnostic model. Remediation carried out by diagnosing with the TTDT model in addition to being able to provide a more accurate picture of the condition of students who are the subject of remediation, can also provide an overview of strategies in determining activities, worksheets, and content of assessment questions that will be given to students during the remediation process with SSCS. Saddhono, Hasanudin, & Fitrianingsih (2019) mention some of the advantages of implementing SSCS in learning as follows: (1) Using higher-order thinking skills in solving problems, (2) the opportunity to learn and strengthening scientific concepts more meaningfully (3) Opportunity to gain hands-on experience for the problem-solving process (4) Develop the scientific method by utilizing laboratory equipment or simple tools

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through experiments to develop an interest in the lesson, (5) Give experience on how scientific knowledge is acquired and developed. (6) Learn to cooperate with others, (7) Apply knowledge of Drawing, data processing, conveying ideas in suitable language, and other skills in a system to integration or holistic.

Thus, remediation with the SSCS model combined with TTDT has good prospects to be used as a remediation model that can be used to justify the misconceptions experienced by students. In particular, work and energy is the topic of this research.

METHOD

The research design was pre-experimental using a one-group pre-test-post-test design. One class as a sample was selected randomly from eight groups of Grade 7 classes at a Public Junior High School. The students of grade 7 had received energy material and energy changes. Then the sample class will be divided based on the category of misconceptions obtained from the misconception diagnosis test data. The experiment group used in this study was one class with a total of 32 students, with a proportion of 17 boys and 15 girls.

The first stage of this research is to map the problem of misconceptions in the matter of work and energy by using a two-tier diagnostic test that has been validated. From the results, remediation treatments were conducted using the SSCS model. The treatment of the SSCS Model was repeated twice. The results of the misconception diagnosis test on students in the form of test scores were analyzed and then grouped based on the criteria for the level of understanding possessed by the research subject. The categories used in the study using a two-tier diagnostic test are as in Table 1, adopting Coştu, Ayas, & Niaz (2012)

Table 1. Types of answers and categories of misconceptions

Answer Type	Category
Correct Answer-Right reason	Understanding (M)
Correct answer-Wrong reason	Type 1 (M1) misconception
Wrong Answer-Right reason	Type 2 (M2) misconception
Wrong answer-Wrong reason	Not Understanding Type 1 (TM1)
Wrong answer- No reason	Not Understanding Type 2 (TM2)
Correct answer- No reason	Partial Understanding (Ms)
No answer and No reason	Not Understanding type 3 (TM3)

The types of misconceptions were categorized by the type of students' answers and analyzed according to the concept types of the certain learning material that the students had misconceptions about previously. In this paper, the types of concepts are categorized into four types, namely:(1) Abstract, (2) Concrete, (3) definitive, and(4) complex, as mentioned in Table 2.

Table 2. Concept Categories

No	Concept Types	Characteristic	Example in Work and Energy Lesson
1.	Abstract	The object was something that was hardly able to be sensed by the sensory system and required a model to be able to explain it for real(Ismiyanti, 2020)	- Potential energy and kinetic energy
2.	Concrete	Objects can be perceived through sensation or perception by the senses(Brysbaert et al., 2014; Ismiyanti, 2020)	- Various sources of energy in nature
3.	Definitive	provide a definite and specific explanation to identify a particular thing or phenomenon(Hanzel, 2010; Harvey, 2012)	- Definition of energy - Definition of work
4.	Complex	contains many components in the form of other concepts that make up the concept(Laurence & Margolis, 1999)	- Energy change and transfer - Food as a source of energy - Respiration in humans - Photosynthesis in plants

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According to Majid, theoretically, the errors that exist in working on questions by students are such as; Careless Error is a type of Error due to the carelessness or lack of accuracy of students in solving problems given by the teacher. Careless type errors also occur because students do not understand the statement or instructions from the problem, so they do it wrong or cannot work on questions they understand—weakness in Process Skills, namely errors in process skills by students. Errors are caused when students already understand a rule or rule in working on the problem but make an error during the calculation or computation process, resulting in the student's answer being wrong. Reading Comprehension Difficulty, namely errors students make in understanding the problem. Students can understand the questions but have not been able to capture the information in the questions, so students cannot further process the solutions requested in the questions—Transform Error, which is an error in the transformation. Students cannot present the answers they have in mind in scientific sentences and are conceptually correct, so students' answers are wrong—encoding Error, which is an error in using notation. Students use the wrong notation in mathematical calculations so that students answers are wrong (Majid, 2017).

The data were compared based on results before and after treatment. The significance of reducing misconceptions from the pretest and posttest results was tested using the paired t-test. The aim is to find out whether there is a change in the profile of students' misconceptions after applying the SSCS model. Research procedure can be seen in Figure 1.

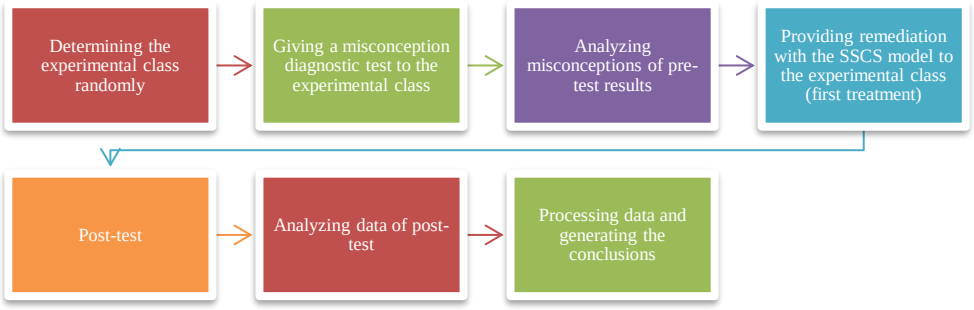

Figure 1. The research procedure

RESULTS AND DISCUSSION

Analysis of Student's Misconception Profile on Work and Energy Materials Before Treatment

In this section, the students' misconception cases will be explained based on the answers from the pretest questions. Based on the error categorization in Table 2, the profile of students' misconceptions of the work and energy material before giving the treatment in the form of the SSCS model is described in Table 3.

Table 3. Profile of Students' Misconceptions About Work and Energy before treatment

Topic	Misconception Type	Percentage of Students (%)	Standard Error (SE)	Concept Category	Number of Students Resposed to Question
Concept of Energy and Energy Sources	Understand (M)	47.82	2.093946449	Definitive, Concrete	Q1: 6 Q2: 16
	Misconception type 1 (M1)	8.69	2.116650949		Q1: 2 Q2: 1
	Misconception type 2 (M2)	10.87	2.171303204		Q1: 3 Q2: 2
	Not Understanding Type 1 (TM1)	34.78	2.235771039		Q1: 12 Q2: 4
Energy Transformation and Transfer	Understand (M)	8.69	2.319762369	Complex	Q3: 2
	Misconception type 1 (M1)	17.39	2.386227287		Q3: 4
	Misconception type 2 (M2)	8.69	2.487059608		Q3: 2

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Topic	Misconception Type	Percentage of Students (%)	Standard Error (SE)	Concept Category	Number of Students Resposed to Question
Kinetic Energy and Potential Energy	Not Understanding Type 1 (TM1)	65.21	2.561476471	Abstract	Q3: 15
	Understand (M)	33.33	2.443046799		Q4: 6 Q5: 5 Q6: 12 Q7: 9
	Misconception type 1 (M1)	5.79	2.562287076		Q4: 3 Q5: 0 Q6: 1 Q7: 0
	Misconception type 2 (M2)	11.59	2.635593871		Q4: 4 Q5: 1 Q6: 3 Q7: 0
	Not Understanding Type 1 (TM1)	49.27	2.750878635		Q4: 10 Q5: 17 Q6: 7 Q7: 14
Work	Understand (M)	8.69	2.801574016	Definitive	Q8: 2
	Misconception type 1 (M1)	21.73	2.921157536		Q8: 5
	Misconception type 2 (M2)	0	3.131788501		Q8: 0
	Not Understanding Type 1 (TM1)	69.56	3.145524725		Q8: 16
Food as a Source of Energy	Understand (M)	65.12	2.703293128	Complex	Q9: 15 Q10: 13
	Misconception type 1 (M1)	15.21	1.931824233		Q9: 2 Q10: 5
	Misconception type 2 (M2)	10.89	2.098878311		Q9: 3 Q10: 3
	Not Understanding Type 1 (TM1)	10.89	2.209307435		Q9: 3 Q10: 1
Respiration in Humans	Understand (M)	39.13	2.295699513	Complex	Q11: 9
	Misconception type 1 (M1)	4.35	2.301464035		Q11: 1
	Misconception type 2 (M2)	34.78	1.766460327		Q11: 8
	Not Understanding Type 1 (TM1)	21.73	1.798764693		Q11: 5
Photosynthesis	Understand (M)	27.53	2.272965838	Complex	Q12: 10 Q13: 5 Q14: 4
	Misconception type 1 (M1)	13.04	3.142957997		Q12: 4 Q13: 1 Q14: 4
	Misconception type 2 (M2)	28.98	0.4090374481		Q12: 2 Q13: 9 Q14: 9
	Not Understanding Type 1 (TM1)	30.43	0.2024809677		Q12: 7 Q13: 8 Q14: 6

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Several points were found where there were many misconceptions in students' understanding of the correct science concepts in the matter of work and energy. In question number 1, for example, 41.7% of students think that energy can be created but cannot be destroyed, and 54.2% of students stated that the reason is that energy storage devices such as lithium batteries used by cellphones are devices that produce energy. Only 33.3% of students understand the concept of energy conservation, and 37.5% of students express the correct reason.

Another point that shows students' misconceptions that are quite high is the concept of kinetic energy and potential energy. Questions about kinetic and potential energy are abstract questions where students are asked to visualize the concept of kinetic energy on the image of two objects moving with certain conditions and speeds. When asked which kinetic energy is more significant when two identical objects are moving at the same speed, only 20.8% of students were able to answer correctly. When asked why, 54.2% answered that objects positioned in front of other objects have a greater speed, while 16.7% of students answered that objects above other objects have a greater speed.

In the concept of energy transfer, students show difficulties in showing the energy transfer phenomenon. As many as 45.8% of students stated that iron that feels cold when held does not indicate a phenomenon of heat energy transfer, and as many as 25% of other students stated that a lamp that feels hot in the room when turned on does not show a phenomenon of energy transfer. Energy transfer material is a complex material in which students must understand the meaning of energy and forms of energy and then visualize how one form of energy in the form of heat energy can experience a transfer in a natural phenomenon.

In addition, it is also known that another material where students experience many misconceptions is the concept of works, where only 25% and students give valid reasons are 8.3%. On the other hand, the data shows that the concept with the minor level of misconception is food as an energy source, where as many as 65.12% of students can give the correct answers and reasons. Food as an energy source can be categorized as a complex concept because students must first understand chemical substances and how the human digestive organs process the chemicals in the food as an energy source. Students also showed a good understanding of respiratory material in humans, where 70.8% showed the right conditions regarding the levels of O2 and CO2 in the blood. However, only 41.7% of students can mention the correct reason.

Remediation of misconceptions using the SSCS model

In this section, we will review the provision of treatment and the implementation of the remediation process in research. The implementation of SSCS learning in the experimental class in terms of implementing each syntax in the SSCS model, namely: Search, Solve, Create, and Share, with online learning adjustments. The discussion of the implementation of the SSCS learning stage in this study is as follows:

Search phase

At the search phase, students are given a narration according to the topic of each group, then students look for and find the problems presented in the material and then arrange ways to solve these problems. An example of a problem in this research is that students analyze the sun as an energy source by solving problems regarding the use of solar energy in the water distillation process.

Solve phase

In the solve phase, students design their experiments to find solutions to the problems previously stated. Students are free to determine the references used in designing experiments from the internet but are given an example of a reference as an initial picture for students about the reference in question.

Create phase

In the creation phase, students carry out a planned experiment. The creation phase is implemented online with students working individually or in groups if their homes are close. Because the research was conducted during a pandemic, the implementation of the experiment was also given waivers by using a virtual lab if the original items were unavailable. The researcher helped students find a virtual lab suitable for the student's experiment, or students found themselves via the internet with the researcher's approval before experimenting.

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Share phase

During the sharing phase, students share their work through WhatsApp groups which are then uploaded by researchers on Google Classroom to be observed and responded to by students from other groups. In the implementation of this study, the intertreatment from other groups was lacking so that the researcher sparked it by asking questions to students from the presentation results.

The share phase is followed by students giving conclusions. Researchers help direct students to draw conclusions and verify student conclusions.The following is a transcript of the conversation between the researcher and the students in class when the students tried to conclude:

Student 1: *"The process of making food by the plants themselves that require sunlight, water and carbon dioxide."*

Researcher:*"Well, it is almost true but not complete ... let us put it together again 'Photosynthesis is the process of making food substances by plants in the form of (...) with basic ingredients (...) and (...)"*

Student 2:*"Photosynthesis is the process of making food substances by plants in the form of starch with the basic ingredients of sunlight, water, and carbon dioxide."*

Analysis of Student's Misconception Profile on Work and Energy Materials After Treatment

The profile of students' misconceptions of the work and energy material after giving the treatment in the form of the SSCS model is described in Table 4.

Table 4. Profile of Students' Misconceptions About Work and Energy After Treatment

Topic	Misconception Type	Percentage of Students (%)	Standard Error (SE)	Concept Category	Number of Students Resposed to Question (Q1, Q2, Q3, ...Q15)
Concept of Energy and Energy Sources	Understanding (M)	63.33	4.889368429	Definitive, Concrete	Q1: 6 Q2: 16
	Type 1 (M1) misconception	0	4.855366834		Q1: 2 Q2: 1
	Type 2 (M2) misconception	6.68	4.957028567		Q1: 3 Q2: 2
	Not Understanding type 1 (TM1)	30	5.105888591		Q1: 12 Q2: 4
Energy Change and Transfer	Understanding (M)	60	5.319172831	Complex	Q3: 2
	Type 1 (M1) misconception	13.33	5.323500546		Q3: 4
	Type 2 (M2) misconception	3.33	5.550277887		Q3: 2
	Not Understanding type 1 (TM1)	23.33	5.729447976		Q3: 15
Kinetic Energy and Potential Energy	Understanding (M)	46.68	6.022873124	Abstract	Q4: 6 Q5: 5 Q6: 12 Q7: 9
	Type 1 (M1) misconception	3.33	6.233705847		Q4: 3 Q5: 0 Q6: 1 Q7: 0
	Type 2 (M2) misconception	8.33	6.478947551		Q4: 4 Q5: 1 Q 6: 3 Q7: 0
	Not Understanding type 1 (TM1)	41.67	6.79278771		Q4: 10 Q5: 17 Q6: 7 Q7: 14
Work	Understanding (M)	20	7.155741044	Definitive	Q8: 2

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Topic	Misconception Type	Percentage of Students (%)	Standard Error (SE)	Concept Category	Number of Students Resposed to Question (Q1, Q2, Q3, ...Q15)
Food as a Source of Energy	Type 1 (M1) misconception	6.67	7.641500468	Complex	Q8: 5
	Type 2 (M2) misconception	6.67	8.082397722		Q8: 0
	Not Understanding type 1 (TM1)	66.67	8.570410077		Q8: 16
	Understanding (M)	100	8.640875592		Q 9: 15 Q 10: 13
	Type 1 (M1) misconception	0	5.814962845		Q 9: 2 Q 10: 5
	Type 2 (M2) misconception	0	6.106321397		Q 9: 3 Q 10: 3
	Not Understanding type 1 (TM1)	0	6.358890976		Q 9: 3 Q 10: 1
Respiration in Humans	Understanding (M)	33.33	6.485897459	Complex	Q 11: 9
	Type 1 (M1) misconception	0	7.36217276		Q 11: 1
	Type 2 (M2) misconception	20	7.337086615		Q 11: 8
	Not Understanding type 1 (TM1)	46.67	8.781660208		Q 11: 5
Photosynthesis	Understanding (M)	46.67	9.860555575		Q 12: 10 Q 13: 5 Q 14: 4
	Type 1 (M1) misconception	10	9.493792709	Complex	Q 12: 4 Q 13: 1 Q 14: 4
	Type 2 (M2) misconception	36.67	15		Q 12: 2 Q 13: 9 Q 14: 9
	Not Understanding type 1 (TM1)	6.67	4.056368719		Q 12: 7 Q 13: 8 Q 14: 6

From the data, it is known that there is a significant increase in students' understanding of the topic of food as a source of energy, which on the results of the misconception diagnosis test shows that 65.12% of students understand the concept correctly, increasing to 100% of students who can answer questions and their reasons correctly. On the topic of Change and Energy Transfer, there was also an increase from 8.69% of students to 60% who could correctly identify the phenomenon of energy transfer in nature.

On some topics, there was an increase but not as significant as in works materials. There was an increase from 8.69% of students who understand the concept of work to 20%. As many as 66.67% of students still do not understand the concept of works correctly, for further discussion will be presented in the discussion section. Students' understanding decreased from before on the topic of respiration in humans. 39.14% to 33.33%. As many as 20% of students incorrectly answered pictures-related questions, causing the answers to be categorized as type I misconceptions or not understanding.

Based on the exposure of students' misconception profiles before and after the treatment, it can be seen that the highest decrease in misconceptions is in the concept of food as a complex energy source. Followed by changes and transfers of complex energy, the concept of work is definitive, and with an increase in the concept of energy and energy sources and kinetic energy and other potential energies that are definitive, concrete, and complex. There was a decrease in students' understanding of the concept of respiration by 5.81%. Respiration in humans is a complex concept, so it can be concluded that the SSCS model does not have a particular relationship with reducing misconceptions based on abstract, concrete, definitive, or complex concepts.

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Another note in this study was the decline in students' misconceptions after the treatment was on food material as a source of energy from the percentage of students who understood at 65.12%. Students' misconceptions on material changes and energy transfer was decreased from 8.69% to 60%. Both are complex concepts but have differences in the demographics of student understanding.

It is similar to the research of Satriawan (2017) and Andiska (2016), which shows that SSCS mediates concepts that students have not understood and strengthens students' understanding of concepts that have been widely understood before through discussion activities with peers who already understand the concept.

Discussion

The paired sample t-test was conducted to determine whether there was an effect between giving the treatment and decreasing student misconceptions. A paired sample t-test was conducted to compare student scores before receiving the SSCS treatment and after the SSCS treatment. The results of hypothesis testing are shown in Table 5 and Table 6.

Table 5. Paired samples statistic

Paired Samples Statistic					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Pretest	44.07	15	12.770	3.297
	Postest	63.60	15	13.627	3.518

Table 6. Paired samples test result

		Paired differences					**t**	**df**	**Sig. (2-tailed)**
		Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
					Lower	**Upper**			
Pair 1	Pretest – Post-test	-19.533	17.250	4.454	-29.086	-9.981	-4.386	14	.001

There was a significant difference in the scores for the condition before the treatment (M = 44.07; SD = 12.770) and after the treatment (M = 63.60;SD = 13.627); t(14) = -4.386, p = 0.001. This means that there is an average difference between pretest and posttest learning outcomes and results in the effect of using the SSCS method in remediating misconceptions in junior high school students on the matter of work and energy.

Based on the types of student errors according to Majid (2017), there are differences in the types of student errors between giving misconceptions and posttest diagnostic test questions and doing assignments in learning using the SSCS model. Students' answers to the misconceptions diagnosis test and post-test tend to show the types of errors, Careless Errors and Transform Errors.

For example, students answered question number 14 shows that eight answered correctly that the photosynthesis process requires energy from sunlight, while as many as nine answered that the photosynthesis process produces energy that plants use to live. However, in question number 14, 14% of students answered that photosynthesis requires energy from sunlight, as much as 14%. It means that there are indications that students are stuck in the type of sloppy error because they are not careful in reading the questions or changing errors. After all, students cannot change the concept of photosynthesis that they already know into appropriate scientific language.

Students' performance in carrying out syntax online tends to show the types of reading comprehension and transformation errors. Some students answer with answers that do not follow what is asked in the question. Researchers suspect that students who experience this have difficulty understanding the intent of the question or writing answers from the results of their experiments in questions. The other finding is, overall, it appears that after giving the action, the percentage of students who answered the question correctly in the form of image interpretation decreased from the percentage of students who answered correctly before giving the action.

It can be concluded that the SSCS model does not affect the remedial type of errors in understanding the data in the form of tables or graphics. Research on remediation in the future needs to

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consider remediation activities not only on subject matter, but also the types of errors that exist in students, so an instrument is needed that can not only map students' misconception profiles materially, but also in error type.

Another note in this study is that students' responses during online learning tend to be low. In the research process, only 15-25 students provided feedback during learning and followed the assignments given. This research was originally planned to use a questionnaire, but because it was given after the learning was finished the number of students who filled out the questionnaire was only 5 people. So that the qualitative data collection instrument is based on field notes and researcher observations, according to Purwanto et al., (2020) the pandemic conditions that took place when this research was conducted would provide several obstacles in the implementation of learning. Constraints experienced by students during the pandemic include inadequate infrastructure to run online learning in real time and the lack of an online learning culture for all students.

This statement is reinforced by the results of research by Mufida& Widodo which states that during the pandemic, the delivery of concepts and the interrelationships between concepts in science learning at the junior high school level tends to be simple and less in-depth. The explanation of the concept is only limited to understanding and examples. The number of sub-concepts in each concept is still relatively small, as is the explanation of the sub-concepts. It is because in distance learning, the teacher conveys the concept only in the form of soft material files and videos found on Youtube. In addition, the limited time and media explaining the concept is also a factor in the lack of depth of the concept conveyed by the teacher. It is known that the concepts conveyed by teachers at the junior high school level are dominated by several concepts that should have been conveyed to students at the elementary level, so the teacher seems to repeat the concepts that should have been taught (Mufida & Widodo, 2021).

The researcher also found that there were records of internship activities at Junior High School Surakarta in the previous year where interns stated that learning at Junior High School Surakarta was carried out through Whatsapp and google classroom by the teacher with the main methods in the form of assignments, exercises, and evaluation of material by the teacher (Octavia, 2020). There is a need for further research on the relationship between learning methods and students' understanding of concepts, especially when carrying out online learning.

The researcher interviewed several students about their obstacles in understanding the concepts of work and energy in this research. The following is a transcript of the interview conducted online with children who did not show a significant reduction in the level of misconceptions:

Researcher:*"Bro, how was the implementation of learning when this material was first delivered?"*
Student A:*"Through the WA group, the teacher conveys material in the form of power points and questions and students work on it and then collect it."*
Researcher:*"According to you, have you understood this material?"*
Student A:*"I don't really understand, because the material contains formulas and calculations."*
Researcher:*"Are there any obstacles when learning online?"*
Student A:*"The problem is that the material contains a lot of calculations and formulas. Especially online, sir. It's not taught directly by the teacher, so it's very difficult."*

The second interview was conducted on children with scores > 80. So they are considered to have understood most of the concepts in the material:

Researcher:*"Bro, you stated that the event that the lamp is turned on and the iron that is touched feels cold there is no transfer of energy, and two children who move with the same mass and speed can't determine the kinetic energy, really why?"*
Student B:*"I feel that my answer is correct when I think about it."*
Researcher:*"When the school delivered this material, was it online?"*
Student B:*"Yes."*
Researcher:*"Are there any obstacles during learning?"*
Student B:*"No, I quite enjoy online school."*
Researcher:*"Why?"*
Student B:*"I can do other activities and/or then do assignments when I want."*
Researcher:*"Do you think you understand this material?"*

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Student B:*"It's been okay, just a little forgot because it has been taught for a long time."*

It can be concluded that classroom learning has not been effective in teaching the correct concepts to student A regarding the material of work and energy. The lack of direct learning by the teacher makes it difficult for student A to understand the material, in contrast to student B who claims to be a self-study so that he can understand most of the concepts of work and energy correctly.

CONCLUSION

Based on the result, we can see that the condition of misconceptions in seventh-grade students regarding the concept of work and energy varies for each learning indicator. For example, some students think that when a subject exerts a force on an object, but there is no displacement, the subject is said to have done work. Some students believe photosynthesis produces energy for plants to do activities and does not require energy during the process.

There is a change in students' misconceptions after giving the treatment by applying the SSCS model in learning. As evidence, 100% of students no longer have misconceptions, and 65% of students had misconceptions. After being treated with the remediation, students can understand that food stores chemical energy in the form of compounds that depend on food, and the body carries out digestion and catabolism processes to get energy from food. Students also understand that humans need food as a source of energy and as materials to build and repair cells and tissues in the body.

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