

## CONCEPT MAPPING EFFECT ON THE COGNITIVE LEARNING OUTCOMES OF THE CONCEPT OF CLASSIFICATION MATERIALS AND THEIR CHANGES

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**Abstract:** This research aimed to describe the effectiveness of concept mapping in improving student cognitive learning outcomes in material classification materials and their changes implemented in the public Junior High Schools in Surabaya, Indonesia. The research design used one group pretest-posttest. This research involved 16 students from class VII. This research's data collection methods included observation, test, and questionnaire. The results showed that the implementation of learning got 88.15% and 97.36%, with excellent categories at the first and second meetings. The average N-Gain for all students is 0.5 in the medium category. The students' responses to learning got excellent results. Concept mapping with a cooperative learning type Student Teams Achievement Division STAD can improve student cognitive learning outcomes on classification materials and their changes.

**Keywords:** *Concept Mapping, STAD type Cooperative Model, Cognitive Learning Outcomes*

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### INTRODUCTION

Education aims to develop one's attitudes, knowledge, and skills, where the knowledge gained, is beneficial for oneself and around them, so education is very important for a person [1]. Science can be interpreted as the science of nature that has a relationship with each other and is systematically obtained from activities that involve the mind to express something related to nature. Science learning in schools hopes to be able to provide basic knowledge of concepts and principles that benefit life, namely providing scientific attitude abilities, skills, appreciation, habits, and appreciation [2].

The learning process of science so far has only centered on the development of intellectual aspects that refer to student textbooks as the main learning resource [3]. Science learning takes place when there is a physical and mental activity from within the student. In the teaching and learning process, it is always passive, and students have a sense of boredom if there is no interaction between fellow students and teachers so that the material to be studied by students will be difficult to understand properly, which allows to affects student learning outcomes [4].

Learning outcomes include the abilities that a person gets after learning activities. In seeing student learning outcomes, it is necessary to conduct an assessment that is used to determine students' mastery or knowledge of the material that has been studied. Therefore, with science learning activities that provide opportunities for students to build their knowledge or ideas, it will be better for students to be more active and motivated to learn in a more comfortable and interesting learning atmosphere [5].

The learning process that does not allow students to be active and creative does not need to be applied or changed with a learning model or student-centered approach. The existence of student-centered learning and learning activities can provide changes to each individual, which are not only related to increasing knowledge but also in the form of skills, attitudes, interests, skills, and self-adjustment [6].

The application of media can be used in the learning process so that student learning outcomes increase. Media use makes students more active in learning. It increases a sense of interest in the material so that learning is more interactive, where students can actively ask questions and discuss with friends [7].

Learning with media can have a pleasant effect so that students can be more relaxed and not boring [8]. Learning media is effective in delivering material because it is active where students are directly involved in teaching and learning activities. Concept mapping is one of the media that can be applied in the learning process. In the era of the Covid-19 pandemic, teaching and learning activities are currently carried out online, therefore with learning media in the form of concept mapping. It is hoped that it will be more effective because, with this, students can understand concepts without learning from student textbooks alone or without conducting investigations, but by doing works in the form of concept mapping using the Microsoft word application. It is because the use of media can assist students in connecting real examples with concepts that can make students better understand the concept of science so that student learning outcomes will increase [9].

In addition, the process of learning science that is still fixated on explanations from the teacher can make students have difficulty remembering the material for a longer time [4]. Therefore, to help students remember the concept of material classification and its changes over a longer period, they can use concept mapping.

The use of concept mapping is an alternative to taking notes to be more creative and effective in mapping thoughts that can make information shorter, which is changed in the form of schemes and color diagrams with a regular arrangement. Therefore students can be easier to remember. Students are also trained to build their understanding with the help of concept mapping media [10].

An effective learning model that makes students more active in teaching and learning activities is a cooperative learning model where students learn by forming groups with different abilities [11]. With the application of this cooperative model, it is hoped that it will be able to make students express their opinions and appreciate friends. Foster various positive impacts in interacting and communicating, practice working together to help solve problems, and motivate students in learning so that learning outcomes also increase. With this, the teaching and learning process in the classroom will make students more active.

The use of concept mapping makes it a habit for students to read briefly and look for important information by recording keywords or sentences involving images or symbols to make it easier to remember the material [12].

The use concept mapping is more effectively used in science learning because there is an advantage to using concept mapping. It allows students to focus on discussion, give a clear picture in one paper, and group concepts to improve student learning outcomes [13]. Science learning at one of the public Junior High Schools in Surabaya during the Covid-19 Pandemic was carried out by explaining the material through PowerPoint media. The teacher only displayed the material through power points and explained it to students without any discussion between students or between students and teachers so that learning that was not student-centered became more passive.

Based on the results of interviews with science teachers, information was obtained that student learning outcomes in the material classification material and changes were only 11 out of 32 students who experienced completion.

In previous research using concept mapping to learning, student learning outcomes have improved [14]. Concept mapping improves student activities and learning outcomes [15]. In addition, stated that concept mapping learning is more effective in improving learning outcomes compared

to the application of conventional model learning in the classroom. However, the study was conducted under normal conditions before the emergence of the Covid-19 pandemic [16].

In the era of the Covid-19 pandemic, it has caused several changes, one of which is in the field of education, where learning is not carried out face-to-face in person but is carried out online or online. Therefore, this research was conducted by utilizing technology in the form of a Microsoft word application that makes it easier to make concept mapping online. Based on the description that has been explained, further research will be carried out on the effectiveness of concept mapping in improving cognitive learning outcomes, student responses, and the implementation of concept mapping on material classification materials and their changes.

## RESEARCH METHOD

This type of research is an experiment where collecting data is carried out by observing aspects of student knowledge by applying concept mapping media and STAD-type cooperative learning models to improve student learning outcomes. The research design used is a one-group pretest-posttest design which is carried out only in one class [17]. The research was conducted at one of the public Junior High Schools in Surabaya in the odd semester of the 2021/2022 academic year. The subjects of this study were class VIIC students, totaling 16 students, of which 16 were selected using a simple random sampling technique.

Data collection is carried out online or online through Microsoft Teams Video Conference, Whatsapp Group, and Google Form. The data collection methods in this study were observation, tests, and response questionnaires. In the observation method, two observers were carried out, namely science teachers at one of the public Junior High Schools in Surabaya and students majoring in science at Surabaya State University, by filling out learning implementation sheets using concept mapping and cooperative models. The test method is carried out twice, namely by providing a pretest before the learning activity is carried out and a posttest after the learning activity is carried out, which aims to determine the improvement of student cognitive learning outcomes. Response questionnaires are given to students after learning activities to find out students' responses to science learning using learning media in the form of concept mapping. The research instruments used are learning implementation sheets, pretest-posttests, and response questionnaires.

The data obtained from this study are observational, student test results, and response questionnaires. The data obtained are then analyzed descriptively to determine the implementation and improvement of learning outcomes that have been

carried out using concept mapping. In science learning, the material classification of the material and its changes using concept mapping and cooperative learning models can be judged from the implementation or non-implementation of the items in the lattice of the observation sheet and the appearance or absence of these aspects. The data in this research instrument are further analyzed by the formula:

$$\% \text{ Implementation} = \frac{\text{Acquisition score}}{\text{Maximum score}} \times 100\%$$

The observation data is then analyzed to determine the value of the statement on the observation sheet. The obtained values can be interpreted in the following table.

Table 1. Interpretation of Learning Implementation

Implementation (%)	Category
0-20	Very Less
21-40	Less
41-60	Enough
61-80	Good
81-100	Excellent

This pretest-posttest result data aims to determine the improvement of student learning outcomes regarding understanding concepts in material classification materials and their changes. The scoring of each question is given a score of 10 for the correct answer and a score of 0 for the wrong answer. The formula then analyzes the assessment of the results of this pretest-posttest:

$$\text{Value} = \frac{\text{Score Gained}}{\text{Max Score}} \times 100\%$$

Pretest-posttest data results are also searched for gain scores which aim to determine whether or not there is an increase in students' understanding of concepts in material classification materials and their changes. The gain score is calculated using the formula:

$$G = \frac{(T2-T1)}{(Is-T1)}$$

Information:

T1 = value of pretest result

T2 = Posttest result value

Is = Maximum pretest or posttest score

The results of the gain score analysis are then interpreted in the following table:

Table 2. Interpretation of Gain

Gain Value	Interpretation
$g \geq 0.7$	High
$0.7 > g \geq 0.3$	Medium
$< 0.3$	Low

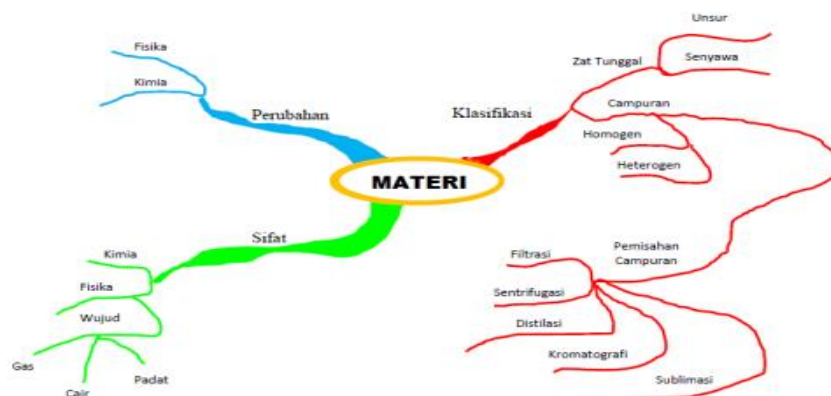
Data on student responses to learning using concept mapping are analyzed using quantitative descriptive techniques, which are carried out by describing or describing numerical or numerical data. Quantitative descriptive technique is a way of data processing that is carried out by systematically processing numbers or percentages [18]. The percentage results are then qualified in the following table:

Table 3. Achievement Rate Conversions

Achievement Rate (%)	Qualification
90-100	Excellent
80-89	Good
65-79	Enough
55-64	Less
0-54	Very Lacking

## RESULT AND DISCUSSION

The research conducted at one of the public Junior High Schools in Surabaya discussed the effectiveness of using concept mapping in material classification materials and their changes with cooperative learning models in terms of student cognitive learning outcomes, learning implementation, and student responses. The results of the students' concept mapping work are in the picture 1.



Picture 1. Concept mapping of Students

**Student Cognitive Learning Outcomes**

Data on student cognitive learning outcomes were obtained from pretests conducted before learning and posttests conducted after learning. Based on the results of the pretest-posttest obtained data in the following table.

Table 4 indicates an increase in the average pretest and posttest from 50.62 to 80.62. This average score increases after being given learning using concept mapping. The increase in the average score of the pretest-posttest shows that the use of concept mapping effectively improves student cognitive learning outcomes because it can make students more active and creative so that

learning is not boring and feels more interesting. The use of concept mapping in learning is more effective in improving student activities and learning outcomes. The use of keywords, images, and colors gives students the ability to remember well and be more interested in the subject matter [15]. A study stated that the use of concept mapping did not show a critical attitude towards the reading of informants [19]. However, the

research stated that student creativity in critical thinking could be developed using concept mapping so that with frequent learning that uses concept mapping, students' creativity in thinking will be well trained [12].

Table 4. Student Learning Outcomes Based on Indicators

No	Indicator	Pretest	Post-test	N-Gain	Category
1.	Classifying material characteristics	11.87	16.87	0.6	Medium
2.	Explaining the difference in elements, compounds, and mixtures	20.87	36.87	0.8	High
3.	Describe the mixed separation method	10.62	16.25	0.6	Medium
4.	Explaining physical properties and chemical properties	4.37	6.25	0.3	Medium
5.	Describes physical changes and chemical changes	3.12	4.37	0.2	Low
	Average	50.62	80.62	0.5	Medium

The N-Gain value of each indicator obtained a different result where the average N-Gain was 0.5 with a moderate category. In the first, second, and third indicators, a yield of 0.6 is obtained; 0.6 and 0.3 with moderate category. The second indicator obtained a 0.8, which belongs to the high category. The fifth indicator obtained a result of 0.2 with a low category. The improvement of learning outcomes based on indicators with different categories cannot be separated from the treatment of teachers who apply cooperative learning models. Cooperative learning allows students to work together in doing assignments. The characteristics of cooperative learning: (1) Groups are formed at various student ability levels (2) Students cooperate. (3) Group members come from different genders, tribes, and cultures [20]. So that with this statement, the value of student learning outcomes based on their indicators has increased differently because the ability of each student is different in capturing the material: some have low, medium, or high abilities. The average posttest value in the second indicator obtained a high result of 36,875, while the fifth indicator obtained an average result of 4,375. In the second indicator, students experienced group cooperation very well compared to the fifth indicator, where each

student's ability was different in capturing the material carried out in cooperation activities between group members.

**Learning Implementation**

The implementation of learning can be seen from the implementation of preliminary, core, and closing activities following the syntax of the cooperative learning model using concept mapping, which is carried out through the Microsoft Teams Video Conference at two meetings. Teachers observed the implementation of learning at one of the public Junior High Schools in Surabaya and students of Surabaya State University. Data from observations of learning implementation are presented in the figure.

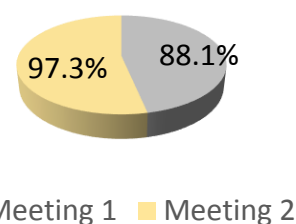


Figure 2. Implementation of Cooperative Model Learning Using Concept mapping

Based on Figure 2, the implementation of learning with a cooperative model using Concept mapping is carried out in very good categories. The implementation of the learning increased from the first to the second meeting, from 88.15% to 97.36%. At the first meeting, students are new to learning with a cooperative model and use concept mapping. In implementing the learning, group work is carried out online by concept mapping through Microsoft Word. The second meeting increased because students had begun to get used to learning that applied a cooperative learning model. The use of concept mapping where the presentation activities were carried out made students more active and better than in the first meeting. Learning with a cooperative model is carried out by forming groups of 4-5 people who work together to achieve a goal. By applying learning with a cooperative model and concept mapping, students can communicate well between members and groups. Implementing learning with a cooperative model and concept mapping shows that the improvement is effectively applied in

learning. It is in line with the researcher's opinions, where cooperative learning by forming groups aims to make students help each other, discuss each other, and exchange opinions to improve student learning outcomes. These improved student learning outcomes make the cooperative learning model effectively used in learning activities [21]. The STAD-type cooperative learning model implementation increased at the second meeting compared to the first meeting. It was because students were still unfamiliar with learning science, the STAD type cooperative model at the first meeting, so they were less enthusiastic about participating in learning [22].

### Student Responses

The response questionnaire was given to 16 students to know the student's responses to learning using concept mapping and cooperative models through a Google Form. The results of the questionnaire of student responses to learning are presented in the following figure 3.

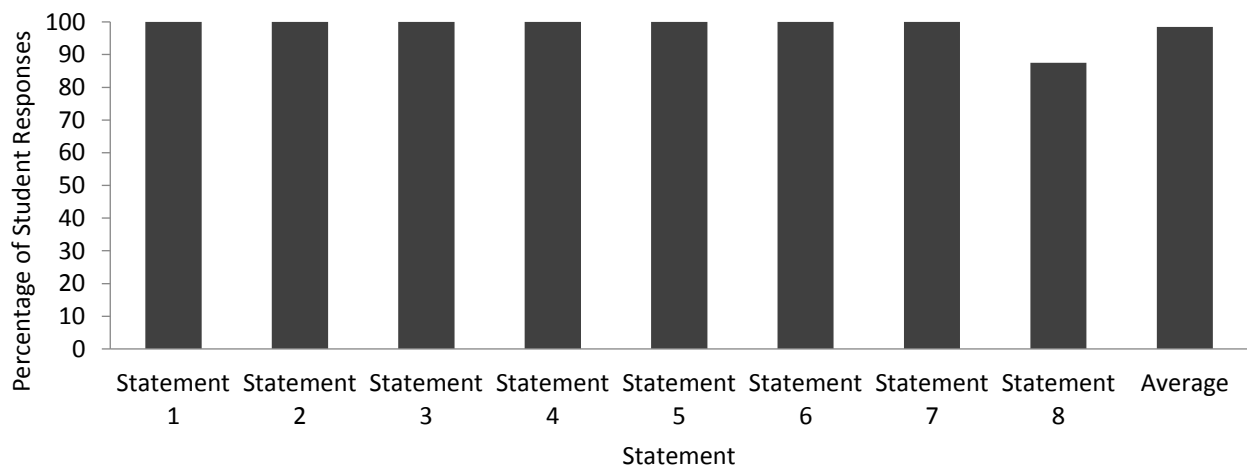


Figure 3. Student Questionnaire Results

Figure 3 shows that in statements 1 to 7 all respondents chose to agree so the percentage obtained was 100%. In comparison, in statement 8 two respondents chose to disagree because they thought that not all concept mapping learning media could be applied in other subjects, so the percentage obtained was 87.5% where the statement was reviewed from learning activities, students' interest in learning and learning atmosphere. The average result of the student response questionnaire was 98.43%. This figure shows an excellent score that makes learning using concept mapping effective. Concept mapping can increase understanding and create a pleasant atmosphere because it combines imagination with student creativity, which can make learning more enjoyable than making

summary notes [23]. Learning through media can also have a pleasant effect so that students can be more relaxed and not boring [8]. Research conducted by one of the researchers stated that making concept mapping can increase student creativity and can make it easier for students to learn so that learning feels more enjoyable [24]. The concept mapping model also made students happier in following lessons, and students always try to be disciplined and punctual in every activity, enthusiastic about expressing opinions and asking questions about material that is not yet understood by the teacher [25].

### CONCLUSION

Learning using concept mapping with a cooperative model improves student cognitive

learning outcomes so that it can effectively be used during learning. The improvement of these students' cognitive learning outcomes can be seen in the average pretest and posttest scores of 50.62 to 80.62, with an N-Gain result of 0.5 in a moderate category. The implementation of learning at the first and second meetings was obtained by percentages of 88.19% and 97.36% with excellent categories. Student responses to learning showed positive results with an average percentage of 98.43%. Based on the research that has been carried out, the advice given by researchers is that teachers should apply learning that uses concept mapping with a cooperative model following the material to be delivered. In addition, it is expected that subsequent researchers will conduct similar research by developing research variables.

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