Application of *Reading-Mapping Team Games Tournament* in Human Nervous System Material to Improve Critical Thinking Skills and Learning Outcomes of Class XI Students of SMA Negeri 1 Gandapura

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Abstract:
Background*: Critical thinking skills are a part of high-order thinking activities (High Order Thinking Skills) that students must master in 21st century learning. The use of Remap-Team Games Tournament (Remap-TGT) aims to create a quality learning experience such as an active-interactive learning atmosphere, interesting / not boring, excited and enthusiastic students in following the learning. This research is expected to increase the achievement of learning outcomes and be able to improve students' critical thinking skills as has been done by previous researchers.*
Materials and Methods*: The research method used is an experimental research method which aims to reveal whether or not there is an effect of the treatment on the variables that have been chosen to be used as research. The design of this study used the one-group pretest-posttest design which was carried out in a single group which was carried out in three ways, namely: the implementation of the pre-test to measure the dependent variable, the implementation of experimental treatment (independent variables) for the subjects studied, and the implementation of the post-test. to measure the dependent variable after experimenting or treatment (experimental group). The treatment is carried out by implementing learning using the Remap-TGT learning model. Data analysis using Paired Sample T-test to see whether there is an effect of treatment before and after the implementation of learning on the subject.*
Results*: The results of this study indicate that there are differences in student learning outcomes from the results of the acquisition of scores between pretest and posttest scores, data analysis of students' critical thinking skills as a whole shows that there are differences between before and after learning activities using the Remap-TGT learning model. In addition, there is a positive relationship or correlation with a very strong category between critical thinking skills and student learning outcomes and students' responses to learning using the Remap-TGT learning model on the human nervous system material show results that are not too different.*
Conclusion: *There is an effect of the application of the Remap-TGT learning model on the human nervous system material on improving learning outcomes and critical thinking skills of class XI students of SMAN I Gandapura. There is a positive correlation between critical thinking skills and the learning outcomes of class XI students of SMAN I Gandapura. Student response data show that the application of the Remap-TGT learning model is very effective and has a positive impact on students participation in learning activities.*
Key Word*: REMAP-TGT; Nervous system; Critical Thinking Skills; Student learning outcomes.*

I.   Introduction

Critical thinking skills are one part of high order thinking activities *(High Order Thinking Skills)* that students must master in 21st century learning. This is because the challenges in the future are increasingly complex and require students to be skilled in thinking and learning skills. Critical thinking is the ability possessed by students in analyzing, interpreting, evaluating, summarizing, and gathering information. The learning that has been carried out so far has not fully pursued the application of critical thinking skills so that it has an impact on low student learning outcomes[1].

The learning process using Remap-TGT (Reading Concept Map Team Game Tournament) is a learning activity designed to stimulate and develop critical thinking skills of students by combining reading activities to understand learning materials and building concept maps. After that, students will go through a learning

experience through the application of the TGT learning model[2]. The implementation of learning using the type of cooperative learning model Teams Games Tournament (TGT) aims to create an interesting and active-interactive learning atmosphere. This is in line with the opinion expressed by Tarigan (2012), that the learning Teams Games Tournament (TGT) involves the activities of all students without any difference in status, involves the role of students as peer tutors and is game-oriented in learning[3].

Research on the implementation of the learning process using Remap-TGT is still not widely carried out, it needs further development. In addition, the material on the nervous system in humans is one of the materials in learning biology which has a high level of complexity. The learning material uses a lot of term language (Latin) which requires a special way of learning it so that students can remember it. Therefore, learning must be designed very well in order to stimulate students to think critically.

The use of Remap-TGT aims to create a quality learning experience such as an active-interactive learning atmosphere, interesting / not boring, excited and enthusiastic students in following the learning. The learning design is expected to stimulate students in understanding the concept of the nervous system material, building reasoning skills and reflective thinking through a game that contains questions about the concept / material of the nervous system. Thus students can remember longer about the concept through an interesting learning experience. This research is expected to increase the achievement of learning outcomes and be able to improve students' critical thinking skills as has been done by previous researchers.

II. Material And Methods

This research uses a quantitative approach to the type of evaluation research that measures the results or impact of an activity carried out in educational activities. Evaluation research is useful for determining the level of success of the learning process by comparing the success achieved with a set of expected successes.

Study Design: *One-group pretest-posttest design.*

Study Location: SMA Negeri 1 Gandapura, Bireuen Regency.

Study Duration: March 2021, semester II of the academic year 2021/2022.

Sample size: 468 students consisting of 16 classes.

Subjects & selection method: The population in this study were all grade 2 science students at SMA Negeri 1 Gandapura. Sampling using the technique *total sampling* , the sample is taken from the total population. The sample in this study were all science students of class XI in three parallel classes.

Procedure methodology: Data collection techniques in this study used questions given at thestages *pretest* and *posttest,* student response questionnaires and documentation. *The pre-test is* used to measure the students 'initial ability while the *post-test is* used to measure the students' ability after participating in the lesson. In addition, data was also obtained through student response questionnaires that were given after students participated in learning and documentation of research activities in the form of photos as supporting data in the implementation of research, list of student test scores and data about school conditions.

Statistical analysis

Data analysis is the process of processing raw data into valid data based on the research trials that have been obtained. In this study, researchers used the SPSS statistical application to analyze data in order to make it easier for researchers to process data and reduce the rate of errors that occurred.

1.   N-gain test

The calculation of the gain index aims to determine the pre-test and post-test values of the class under study. To calculate the amount of the gain index (g) according to Meltzer, (2002) is as follows:

$$\text{N - gain} = \frac{Postest-Score\ Pretest}{Score\ Maximum\ score\ Class-Score\ Pretest}$$

Information Ahmad, (2010):

High   : N-Gain> 70

Medium   : $30 \leq N-Gain \leq 70$

 Low   : N-Gain <30

2.   Normality test

Test of normality is a test performed as a prerequisite for conducting data analysis. This aims to detect the distribution of data in one variable that will be used in the study. Normally distributed data can be tested using parametric statistical analysis using analysis Paired Sample T-test and if the sample is not normally distributed then the data is analyzed using non-parametric statistical tests. The normality test used is the Kolmogorov-Smirnov test. The Kolmogorov-Smirnov formula is as follows[4]:

$$KD : 1{,}36\ \frac{\sqrt{n_1 + n_2}}{n_1\ n_2}$$

Description:

KD : The number of Kolmogorov-Smirnov counted
n_1 : The number of samples obtained
n_2 : The number of samples expected

Data is said to be normal, if the significant value is greater than 0.05 at (P>0,05). Conversely, if the significant value is less than 0.05 at (P<0.05), then the data is said to be abnormal.

3. Different T-test *(Paired Sample Test)*

Paired sample T-test is a test that is carried out on two paired samples. The paired data sample is data before treatment (pre-test) and data after treatment (post-test). The statistical test for testing the paired hypothesis is stated as follows[5] :

$$t = \frac{\overline{X}_b - \overline{X}_a}{S_d / \sqrt{n}}$$

Where:

$$S_d = \sqrt{\frac{\sum D^2 - \left(\sum D\right)^2 / n}{n - 1}}$$

Information:

X_b : Average posttest
X_a : Average pretest
S_d : Standard deviation
N : Number of samples

Statistical testing is assisted by the SPSS application with a significance level (α) fault tolerance = 0.05. The way of drawing conclusions from the hypothesis test is that if the significant value is ≥ 0.05 then H_0 is accepted (there is no difference) and if the significant value is <0.05 then H_0 is rejected (there is a difference).

4. Correlation Test

Correlation test is a test conducted on two variables to find a relationship or linkage between them. In correlation analysis, the Pearson product moment formula is used and what is sought is the correlation coefficient, which is a number that states the degree or level of relationship between the two variables (critical thinking skills and learning outcomes). This aims to determine the strength or weakness of a relationship. The formula used to find correlation is as follows[6] :

$$r_{xy} = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{(N \sum X^2 - (\sum X)^2)(N \sum Y^2 - (\sum Y)^2)}}$$

Description:

rxy : Correlation coefficient between X (CBC) and Y (learning outcomes)
N : Number of subjects or students studied
X : Variable X (CBC)
Y : Variable Y (results learning)
$\sum X$: Total total score X (CBC)
$\sum Y$: Total total score Y (learning outcomes)
$\sum X2$: Sum of squares of variable X
$\sum Y2$: Sum of squares of variable Y
$\sum XY$: Total multiplication of CBC scores and learning outcomes

Data the correlation coefficient obtained is then carried out by a significance test which aims to determine whether or not the relationship between critical thinking skills and learning outcomes is significant, then the t test formula is used as follows[6] :

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Information:

t : Significance of the correlation coefficient
r : Correlation coefficient
n : Number of respondents / subjects research
r^2 : The square of the correlation coefficient

Criteria for the interpretation of the correlation coefficient proposed by Sugiyono (2015) are in the table below[6] :

Interval Coefficient	Level of Relationship
0.00 - 0.199	Very low
0.20 - 0.399	Low
0.40 - 0.599	Moderate
0.60 - 0.799	Strong
0.80 - 1,000	Very strong

II. Results

Student Learning Outcomes

Data used to analyze student learning outcomes consists of scores of pretest, posttest and N- Gain. An overall average of data pretest, posttest and N-learners gain as many as 94 students of class XI SMA N 1 Gandapura presented in Figure 1.
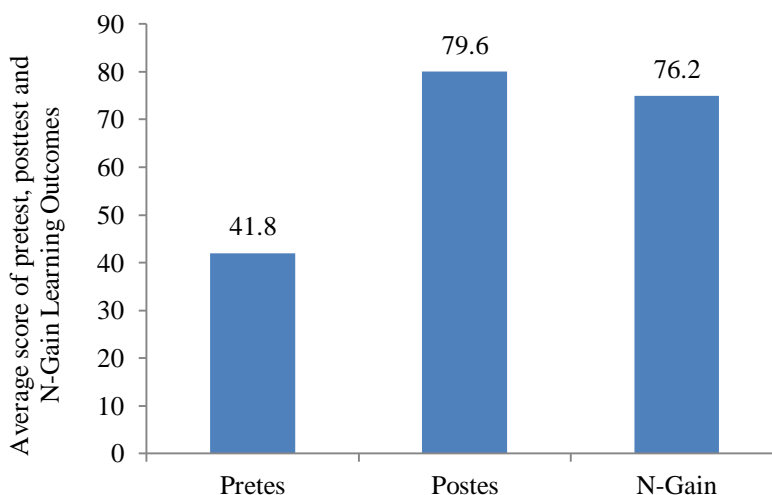

Figure 1. Average score of pretest, posttest and N-Gain Learning Outcomes

The results of the pretest, posttest and N-Gain scores on Figure 1 shows that the overall pretest mean score is 41.8 and post-test is 79.6. This shows that there is a difference in the results of the scores between the pretest and posttest scores. Students experience an increase in knowledge about the material of the nervous system in humans after receiving treatment for the application of the Remap-TGT learning model. We can see this increase in the knowledge of students from the post-test score data and N-Gain. The average N-Gain score was 76.2 which indicated that the learning outcomes of students were included in the high category. The results of the mean difference test between the pretest and posttest scores and the pretest scores with the N-Gain score showed a significant difference.

Table 1. Summary of different test average pretest and posttest Learning Outcomes of Students Class XI SMAN I Gandapura

Learning Results	The average value	Normality	Test t	Ket
Pretest	41.8	0.093> 0.05 (Normal)	t_{count} (56.20) > t_{table} (1.98)	Significant Different
Posttest	79.6	0.053> 0.05 (Normal)		
Pretest	41.8	0.093> 0.05 (Normal)	t_{countt} (24.80)> t_{table} (1.98)	Different Significant
N-Gain	76.2	0.20> 0.05 (Normal)		

Based on the calculation of the average pretest-posttest and pretest-N-Gain scores, the learning outcomes of students have a difference between the average post-test score and the average score pretest. The average post-test score was 79.6 and the pretest average score was 41.8, which means that the average post-test score was higher than the pretest average score with the t-test results t_{count} (56.20) > t_{table} (1.98) is significantly different. In addition, the difference between the N-Gain mean score and the pretest mean score was also different. The average N-Gain score was 76.2 (high category) and the pretest average score was 41.8, which

means that the average N-Gain score was higher than the pretest average score with the t test results t_{count} (24.80) > t_{table} (1.98) was significantly different. This shows that students experience an increase in learning outcomes in the material of the human nervous system after participating in learning using the Remap-TGT learning model and it can be concluded that the application of the learning model using the Remap-TGT has a good effect / affects student learning outcomes in a better direction. good at mastering the nervous system material in humans.

Students' Critical Thinking Skills
Data analysis of students' critical thinking skills as a whole shows that there are differences between before and after learning activities using the REMAP-TGT learning model. The average score of critical thinking skills after learning using the Remap-TGT (posttest) learning model is better than the score before the implementation of learning activities with Remap-TGT (pretest). Summary data of critical thinking skills score pretest, posttest and N-Gain learners as a whole is presented in Figure 2.
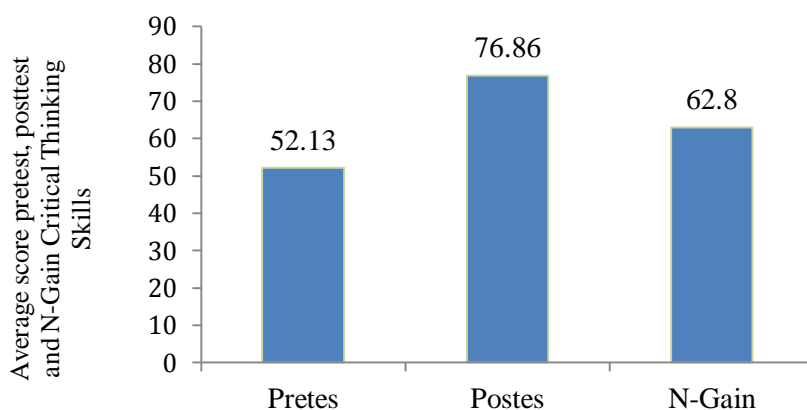

Figure 2. Average score pretest, posttest and N-Gain Critical Thinking Skills

The average score pretest was 52.13 and the mean Post-test score average 76.86. The results of the mean difference test between the pretest and posttest scores showed a difference. Before getting treatment using Remap-TGT, the average pretest score did not reach the minimum completeness criteria (KKM). However, after learning using the Remap-TGT learning model, the average post-test score increased compared to the average pretest score. This shows that the mastery of the nervous system material in humans by students increases after the learning process is carried out using the Remap-TGT learning model.

The process of analyzing critical thinking skills of students is carried out using multiple choice test questions by taking into account 5 indicators, namely: *focus, reason, clarity, situation* and *inference*[7].
The results of the critical thinking skills test for each indicator showed an average difference between the pretest and posttest scores. The average difference can be seen in Figure 3.
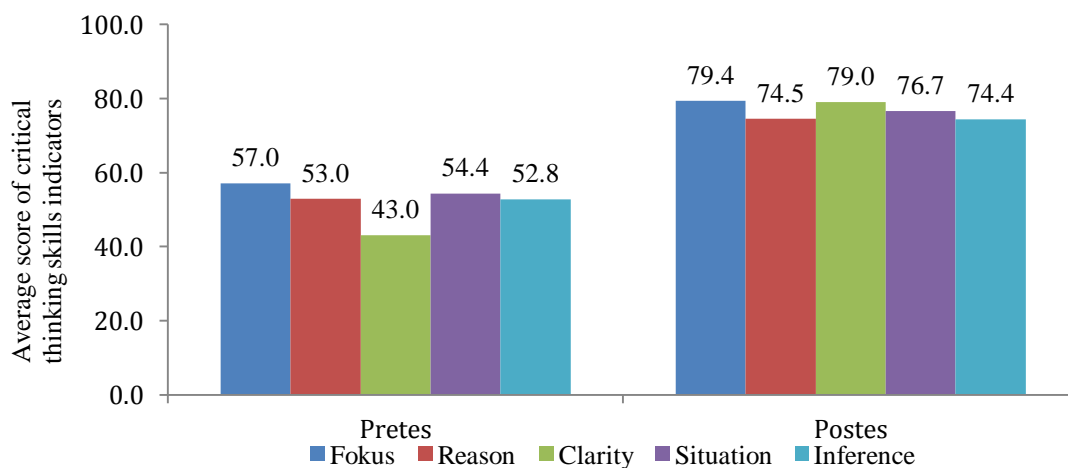

Figure 3. Average score of critical thinking skills indicators

Posttest scores obtained by students after participating in the learning process by using Remap-TGT learning model, so get a higher score than the acquisition of the pretest score on each indicator skill critical thinking. The pretest was carried out to test the students' initial abilities before participating in learning using Remap-TGT. Based on Figure 3 he indicator focus gets the highest average score percentage compared to other indicators. *Focus* is one of the indicators contained in critical thinking skills related to the ability of students to detect problems and the problem solving process does not go out of the way so that students find the right solution / answer[8].

In addition, the average score of the N-Gain value is 62.8, which means that the thinking skills of students are at the moderate category level. The results of the mean difference test between the pretest and posttest scores show a significant difference in Table

Table 2. Recapitulation of the Average Pretest and Posttest Differences for Students' Critical Thinking Skills of Class XI of SMAN I Gandapura

KBK	Average Value of	Normality	Test	Information
Pretest	52.13	0.058> 0.05 (Normal)	t_{count} (18.31)> t_{table} (1.98)	Significantly different
Postes	76.86	0.127> 0.05 (Normal)		
pretest	52.13	0.058> 0.05 (Normal)	t_{count} (3.08)> t_{table} (1.98)	Significantly different
N-Gain	62.8	0.20> 0.05 (Normal)		

Based on the calculation of the pretest-posttest and pretest-N- mean scores Gain, critical thinking skills of students have a difference between the average post-test score and the average pretest score. The average post-test score was 76.86 and the average pretest score was 52.13, which means that the average post-test score was higher than the average pretest score with the t-test results t_{count} (18.31)> t_{table} (1.98) significantly different. In addition, the difference between the N-Gain mean score and the pretest mean score was also different. The average score of N-Gain is 62.8 (moderate category) and the average pretest score is 52.13, which means that the average score of N-Gain is higher than the average score of the pretest with the t-test results t_{count} (3.08) > t_{table} (1.98) was significantly different.

Relationship between Critical Thinking Skills andLearning Outcomes

Skills Critical thinking is part of the competence of students which when trained will have an impact on other aspects such as improving learning outcomes. The results of the correlation test between the acquisition of critical thinking skills scores and students' learning outcomes scores can be seen in Table

Table 3. The Correlation Results of Critical Thinking Skills and the Learning Outcomes of

Group	Skills Critical Thinking(X)	Outcomes Learning(Y)	Correlation (r)	Correlation Coefficient (r^2)
Value	7225	7521	0.9951	0.9902

Based on Table 3 the results of the correlation test between critical thinking skills and learning outcomes obtained a value of r = 0.9951 and a value of r^2 = 0.9902. This shows that there is a positive relationship or correlation with a very strong category between critical thinking skills and student learning outcomes. The next correlation data analysis was carried out by a statistical test of the correlation between critical thinking skills and learning outcomes. The statistical test used is the t test which can be seen in Table 4.

Table 4. Statistical test of the Correlation of Critical Thinking Skills and the Learning Outcomes of

Group	Skills Critical Thinking(X)	Outcomes Learning(Y)	t-test	Information
Value	7225	7521	t_{count} (96.50)> t_{table} (1.98)	Significant

Based on Table 4, it shows that there is a relationship between critical thinking skills and student learning outcomes. This can be seen from the results of statistical tests between critical thinking skills (X) and learning outcomes (Y), namely t_{count} (96.50)> t_{table} (1.98) which means that between critical thinking skills and learning outcomes there is a significant correlation. significant. The regression description between critical thinking skills and student learning outcomes can be seen in Figure 4.
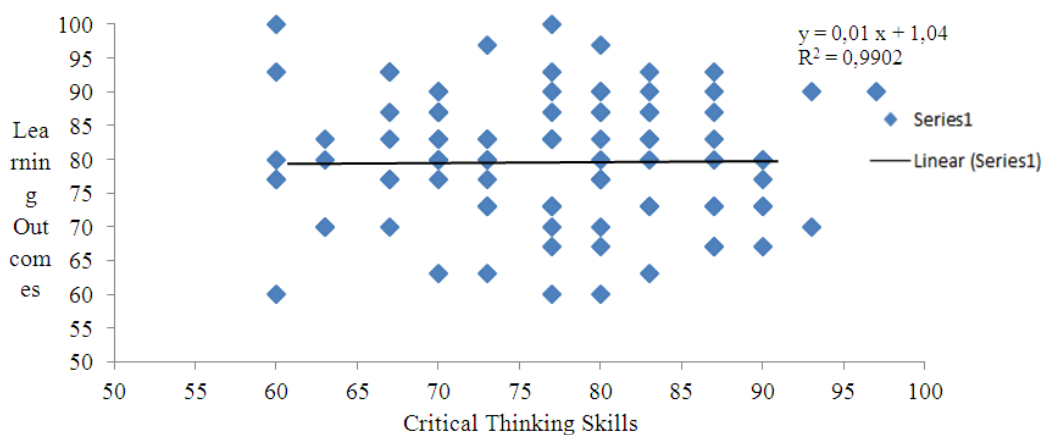
Figure 4. The regression description between critical thinking skills and student learning outcomes

Based on Figure 4 shows the direction of the regression line between the two variables. The equation is in accordance with the data obtained to form a scatter diagram. The linear regression line has a value of $y = 0.01 x + 1.04$ forming a straight line with a slight incline. The correlation between critical thinking skills and learning outcomes is strong. This is because in the learning process students are trained to build concept maps and solve questions that contain indicators of critical thinking skills that affect students to understand the concept of the human nervous system material. The ability of students to understand the concept affects the ability of students to answer the questions given by choosing the right steps to solve questions or problems so that it has an impact on positive learning outcomes.

Student Responses to Remap-TGT Learning Student
Response data were obtained from student response questionnaires given after learning activities were carried out with the REMAP-TGT learning model. Results learner responses to learning activities by using Remap-TGT learning model on the material of the nervous system can be seen in Figure 5.
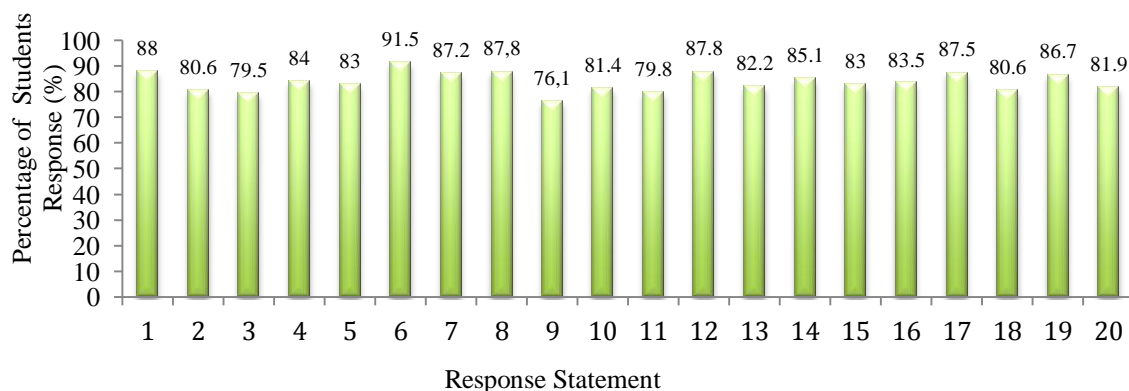

Figure 5. Percentage of Students Response Class XI SMAN I Gandapura

Based on Figure 5 it can be seen that the response of students to study by using a model Remap-TGT learning on the material of the human nervous system shows the results that are not too different. Students give a very positive response to the learning activities they have participated in. The results of the analysis of students' response statements, only 3 items were in the good category consisting of numbers 3, 9 and 15, while the other 17 items showed very good response categories.

III.   Discussion
Student Learning Outcomes
The use of the Remap-TGT learning model on difficult learning materials can be a good solution to make it easier for students to understand learning materials so that learning objectives can be achieved optimally. According to Roestiyah (1989), the learning system using the right learning model will create a

pleasant learning atmosphere and produce a quality learning process so that it will have an impact on better learning outcomes (increased)[9].

The results of the study which showed a positive influence on student learning outcomes as a result of the application of the Remap-TGT learning model had also been carried out by several previous researchers. Research conducted by Pengestuti (2015) revealed that the learning process carried out using the Remap-TGT learning model in high school in biology subjects can improve the cognitive learning outcomes of students[2]. This is similar to research conducted by Rohmawati (2011) that learning using Remap-TGT which focuses on concept map assignments can improve students' understanding[10]. In addition, students who are taught using the Remap-TGT learning model have better performance in completing tasks compared to students who are taught using conventional learning systems and students are more enthusiastic in participating in learning. Based on the research above, it can be concluded that the application of the Remap-TGT learning model to the material of the human nervous system can increase student activity, interest in learning and student attention in participating in learning, so that it has a positive impact on increased student learning outcomes.

Students' Critical Thinking Skills

The use of the Remap-TGT learning model can be used as a solution in carrying out biology learning activities with complex material. Rahayu (2016) said that the human nervous system material has its own uniqueness with a high level of complexity and complexity. Therefore, the application of Remap-TGT will create a more relaxed / pleasant learning atmosphere, motivate students to be involved in learning, create independence in solving problems, be able to think systematically and suggest the human nervous system material as part of the necessary biological material. be conquered through increasing learning activities carried out by students[11].

The Remap-TGT learning model has a very good role in improving critical thinking skills. This is supported by research conducted by Pangestuti (2014) which states that the application of Remap-TGT can improve critical thinking skills of students of Class X IPA 4 SMA Laboratorium UM[2]. In addition, according to Mahanal et., Al (2016) the Remap-TGT learning model is able to improve student learning achievement and thinking skills of students[12].

Relationship between Critical Thinking Skills and Learning Outcomes

. The correlation between critical thinking skills and learning outcomes is strong. This is because in the learning process students are trained to build concept maps and solve questions that contain indicators of critical thinking skills that affect students to understand the concept of the human nervous system material. The ability of students to understand the concept affects the ability of students to answer the questions given by choosing the right steps to solve questions or problems so that it has an impact on positive learning outcomes.

Student learning outcomes are one of the indicators of the learning process with regard to cognitive changes that students get after experiencing learning activities. These changes do not happen by themselves but require practice and habituation to hone students' abilities in mastering learning material. Students are trained using LKPD based on indicators of critical thinking skills (*focus, reason, inference, situation* and *clarity.* In LKPD there is a material description of the human nervous system that must be understood with their group friends so that students can make concept maps by connecting important concepts in a comprehensive manner. systematic and interrelated. In addition, students are also trained to reason and use a frame of mind in order to find the right answer based on the questions contained in the LKPD.

The habit of working on LKPD to solve problems or questions based on critical thinking skills makes it easier for students to answer the learning outcomes related to these indicators. Therefore, critical thinking skills have a positive relationship with learning outcomes. This is in accordance with what was stated by Ramdani (2018) that learning outcomes will increase as skills increase. critical thinking and both have a positive relationship[13]. In addition, learning that emphasizes critical thinking skills will have an effect on student learning outcomes which includes skills and accuracy in solving problems so that students are accustomed to arguing with various points of view according to the context of the problem[14].

Student Responses to Learning Remap-TGT

The overall response of all samples totaling 94 students with an average response score of 84% with a very good category, indicating that the learning activities they go through using the Remap-TGT learning model are very interesting and memorable . This is because the learning process with complex material is carried out by training students in understanding the material through concept map construction with the aim of making it easier for students to group the material so that it is easy to learn. In addition, game-based learning makes students more relaxed and fun, stimulates enthusiasm and encourages students to compete in winning the tournaments that are given so as to create an active-interactive and energetic learning atmosphere.

Slavin (2008) explains that the TGT learning model can foster joy in students because it uses games. If students feel happy, comfortable and enthusiastic in learning, their interest in learning will increase. Learning using Remap-TGT is very useful in increasing students' learning interest in complex material[15]. This learning model is also useful for fostering responsibility, self-confidence, respect for others, discipline, competition, sportsmanship, cooperation and learning involvement of all students so that it helps in achieving better learning achievement[16].

Based on the response data / opinions of students, the application of the Remap-TGT learning model is very effective in using learning activities. In addition, this learning model can also assist teachers in delivering difficult learning materials so as to stimulate students to be enthusiastic about participating in learning.

IV. Conclusion

Based on the results of data analysis on the application of the Remap-TGT learning model on the nervous system material to improve learning outcomes and critical thinking skills of students, it can be concluded that there is an influence from the application of the Remap-TGT learning model to the human nervous system material on improving learning outcomes and thinking skills. critical class XI students of SMAN I Gandapura. Based on the results of data analysis about the application of the Remap-TGT learning model on the nervous system material to improve learning outcomes and critical thinking skills of students, it can be concluded that there is a positive correlation between critical thinking skills and learning outcomes of class XI students of SMAN I Gandapura. Student response data show that the application of the Remap-TGT learning model is very effective and has a positive impact on students in participating in learning activities.

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