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Research Article

Exploring Students' Creative Thinking Skills When Learning Biology Through the Reading Concept Mapping Team Quiz (Remap-TQ)

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Abstract.
A supportive learning model can influence the development of creative thinking skills. Remap-TQ is an acronym for a learning model with stages of reading, concept mapping, and Team Quiz (TQ). The steps of the Remap-TQ learning model are expected to train students' creative thinking skills. The purpose of the study was to determine the contribution of Remap-TQ to students' creative thinking skills in learning biology. This study was a quasi-experimental design with a pretest-posttest non-equivalent control group design. Participants involved in this research were science students from one state senior high school in Jember, East Java, Indonesia, who had been tested for equality. Respondents came from three randomly selected classes, totalling 105 students. The indicators of creative thinking measured are curiosity, fluency, originality, elaboration, flexibility, divergence, messines/risk-taking, and others. The results showed that the Remap-TQ model could improve students' creative thinking more than the TQ model and conventional learning. The posttest mean value of learning with Remap-TQ is 85.89, compared to students taught by TQ of 78.64 and conventional learning of 68.03. The findings of this study can provide new references to educators regarding innovative learning models to develop students' creative thinking skills in learning biology.

Keywords: exploring, creative thinking, skills, biology, Remap-TQ

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1. INTRODUCTION

Biology as an applied subject can bring positive life changes [1]. Biology studies cover a wide range of topics, but students are most interested in studying problems related to human body systems because their application is relevant to everyday life [2]. In fact, students still have difficulty learning the concept of system material in the human body, because it is considered broad and abstract [3]. Students need to study and understand the body's biological system because it teaches students to appreciate the subject

and see how it works or processes in real life [4]. Biology learning also emphasizes student interactions and experiences in understanding everything that happens in life [5]. Students' experience in studying biology related to real-life can be a means to develop 21st-century skills [6].

The 21st-century skills include creative thinking, critical thinking, problem-solving, collaboration, information technology, literacy, and social, cultural, and metacognitive awareness [7]. One of the 21st-century skills, namely creative thinking, is a crucial ability that must be possessed in education [8]. In biology learning, students must carry out thinking activities and processes to find facts, concepts, and new knowledge. Students must also observe the pattern of relationships of the material being studied and practice determining the causes and consequences of the problems encountered in learning based on direct experience. Those processes affect students' curiosity and various other aspects of creative thinking [9]. Therefore, it is necessary to empower students' creative thinking skills in studying biology.

Creative thinking includes the ability to create and develop ideas, produce something with imaginative skills, and create and realize something new [10]. This ability aims to generate ideas, solve problems, result orientation, hone thinking speed, and practice openness to new experiences [11]. Students need to develop creative thinking as it can help students expand their knowledge, so they can see problems, provide innovative ideas, and find smart solutions to the problems they face [12]. The way to develop creative thinking skills is to invite students to find innovative and new ideas. Previous research showed that creative thinking can also be developed by forming study groups to study material and solve problems so that students can work together and focus on generating creative thinking [13].

In fact, previous research showed that students still have low creative thinking skills [14]. Other research also shows that in biology learning there are more than 50% of students in the low category in all indicators of creative thinking [9]. Those results because students have not been able to think fluently, solve problems from various points of view, and produce new and unique things. The results of interviews with the biology teachers at SMAN 2 Tanggul in August 2021 showcase that students' creative thinking skills in learning biology are quite sufficient. This phenomenon is evidenced by the results of the average initial test score for students' creative thinking skills of 46.01% in the adequate category. The causal factors indicate that students still have low interest in reading, rarely make concept maps before learning, still have difficulty expressing things they have not/already understood, and lack group cooperation and activeness in learning. Students also only rely on material sources from the teacher, and the teaching

materials do not include activities/questions that train creative thinking skills. Therefore, students' creative thinking skills still need to be developed.

The development of students' creative thinking skills, one of which is influenced by the learning model used [15]. Several learning models are used to develop students' thinking skills in biology learning, namely Problem Based Learning/PBL; Team Quiz; and Remap-STAD [16–19]. The application of several previous learning models has not been able to measure the overall increase in creative thinking indicators, including curiosity, fluency, originality, elaboration, flexibility, divergence, messines/risk taking, and others. The results of an interview with a biology teacher in August 2021 indicate that the Team Quiz (TQ) and Remap-STAD models have never been used in biology learning. Therefore, one of the learning models that is expected to improve students' creative thinking skills is Remap-TQ (Reading, Concept Mapping-Team Quiz). Remap-TQ requires students to read and create concept maps at home, then use the Team Quiz type of cooperative learning model in class [18].

Team Quiz (TQ) includes active learning, whose application uses a fun way to increase student responsibility for something that has been learned. The steps of the Team Quiz learning model include: selecting learning topics, forming groups, delivering learning formats and learning materials, and group quizzes [20]. Application of Team Quiz in learning could help students improve life skills, build learning communities, and increase knowledge [21]. Team Quiz can provide opportunities for each student to participate in group discussions and question and answer and encourage students to collaborate and be actively involved in group activities [22]. Students need to collaborate in learning activities to make them more creative to think [23]. Team-based learning can also invite students to understand content more deeply and improve learning outcomes [24]. Biology has broad, complex content and is considered rote and abstract material, so group discussion and question and answer are needed. Students can share learning experiences and help students understand the material. Previous researchc proves that the application of the Team Quiz model can increase activity and influence students' critical thinking skills, problem solving skills and improve learning outcomes [17, 25].

In its application, the Team Quiz learning model has shortcomings, namely the lack of preparation of students in taking group quizzes, and the contribution of each group member is still lacking [26]. Therefore, additional activities such as reading and making concept maps are needed because they can help students gather information, expand knowledge, and stimulate creative thinking [27, 28]. The information and knowledge obtained previously are expected to make it easier for students to participate in group discussions and question and answer activities. Thus, the application of the Team

Quiz (TQ) model can be added with Reading and Concept Mapping (Remap) activities to become a Remap-TQ learning model. Remap activities can be carried out before learning, so that students are better prepared to take part in learning in class, while TQ is done when learning in class [29].

The first stage of the Remap-TQ model is that students do reading activities. Students need to read in order to more easily understand the content of the material being studied, because biology material has a broad and complex scope. Reading is an effective way to make students more focused and have broad knowledge, thus helping students progress and self-development [30]. Reading activities can bring up creative thinking [31]. Reading can expand knowledge and experience from what has been experienced to what is found in reading, thus supporting a variety of mental representations that are useful for manipulation during creative thinking [32]. The next Remap-TQ stage is concept mapping. Students need to make concept maps to make it easy to find and understand essential concepts from the material because the scope of biology material is very broad and is considered to be demanding memorization, so concept maps help make it easier for students to remember material for a long time. Concept mapping activities can help students learn to visualize scientific concepts from learning materials in a meaningful way [33]. Concept mapping can facilitate meaningful high-level performance, thereby enabling creative thinking processes to emerge during concept mapping construction [34]. After reading and concept mapping, the next stage is carrying out classroom learning using Team Quiz. Thus, the Remap-TQ learning model, which refers to Remap-Coople, is expected to be an alternative solution to improve students' creative thinking skills in learning biology.

Previous research has proven that Remap-Coople has the potential to improve students' creative thinking skills in learning biology, one of which is Remap-STAD [18, 19]. However, the prospect of Remap-TQ to enhance students' creative thinking skills is still unknown in biology learning. Therefore, this study aims to determine the improvement of creative thinking skills in biology learning through Reading, Concept Mapping-Team Quiz (Remap-TQ).

2. RESEARCH METHOD

This research employed a quasi-experimental design using a pretest-posttest non-equivalent control group design. The research was conducted in SMAN 2 Tanggul in Jember Regency, East Java, Indonesia. The research was conducted in October-December 2021, the odd semester of the 2021/2022 academic year. Participants

involved in this study were science students from seven classes, and then the class equivalence test was carried out. The equivalence test results showed that the seven classes were equal, and then the research class was chosen randomly. The selected class consists of three classes, totalling 105 students. The three classes are assigned as experimental groups using the Remap-TQ model (N = 35 students); a positive control group using the TQ model (N = 36 students); negative control group using conventional learning (N = 34 students).

The measurement of students' creative thinking skills uses an instrument in a question form of description, which is equipped with a creative thinking scoring rubric [10]. The creative thinking indicators measured include curiosity, fluency, originality, elaboration, flexibility, divergence, messines/risk-taking, and with others. The question has previously been tested, to obtain valid and reliable results. The results are valid because the calculated r-value is 0.665 > r table and reliable because the Cronbach's alpha value is 0.891. Questions that have been valid and reliable are then used for pretest and posttest. The treatment instruments used include the syllabus, lesson planning, and student worksheet.

The research was carried out for seven meetings on the circulatory system and digestive system material. The pretest was carried out before the treatment, while the posttest was after the treatment. The continuity of the learning process, including students and teachers activities, was observed by observers to assess the implementation of the syntax of the learning model. The syntax of the Remap-TQ learning model can be seen in Figure 1.

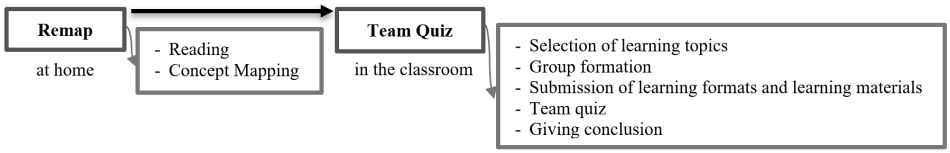

Figure 1: Remap-TQ learning learning model syntax.

The improvement of students' creative thinking is known from the results of the percentage of pretest and posttest scores on each indicator of creative thinking ability. The results of the percentage scores are then categorized based on the level of mastery of students' creative thinking; if the creative thinking test score ≤ 20 means very less, 21≤ x ≤ 40 means less, 41 ≤ x ≤ 60 means enough, 61≤ x≤ 80 means good, and 81 ≤ x ≤ 100 means very good [35].

3. RESULTS AND DISCUSSION

The students' pretest and posttest percentage values were calculated in each class and on each indicator of creative thinking. These calculations indicate that the level of mastery of students' creative thinking has different categories. It can be seen that the increase in students' creative thinking skills from pretest to posttest results. Data on students' creative thinking skills test results can be seen in Table 1.

TABLE 1: Student's creative thinking skills test results.

Creative Thinking Indicator	Experiment Class (Remap-TQ)		Control Class (+) (TQ)		Control Class (-) (conventional)	
	Percentage (%)					
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Very good	0	80.00%	0	50.00%	50.00%	8.82%
Good	48.57%	20.00%	38.89%	44.44%	47.06%	70.59%
Enough	51.43%	0	61.11%	5.56%	2.94%	20.59%
Not enough	0	0	0	0	0	0
Very less	0	0	0	0	0	0
Average Value	60.43	85.89	59.56	78.64	60.03	68.03

Table 1 indicates that the posttest improvement category of students' creative thinking in the experimental class is higher than that of students in the control class. Students taught with the Remap TQ model have the highest percentage of students at 80% in the very good category, while with TQ the percentage is still 50% in the very good category. Students who are taught by conventional learning actually have the least percentage of students, namely 8.82% very well. Thus, students who are taught to use the Remap-TQ model have a greater increase in creative thinking, as evidenced by the posttest average value of students' creative thinking of 85.89, compared to the TQ model of 78.64, and conventional learning of 68.03. The percentage increase from pretest to posttest of students' creative thinking on each indicator and in different treatment classes (Remap-TQ, TQ, and conventional) can be seen in Figure 2.

The percentage of students' creative thinking indicators in the experimental class (Remap-TQ) shown in Fig. 2a has a higher range of improvement compared to the positive control class (TQ) and the negative control class (conventional). Figure 2b shows that the range of improvement of the creative thinking indicators of students in the positive control class is lower than in the experimental class but higher than in the negative control class. In Figure 2c, the range of improvement in the indicators of creative thinking of students in the negative control class is lower than in other classes. Thus, the data from this study proves that the Reading learning model, Concept

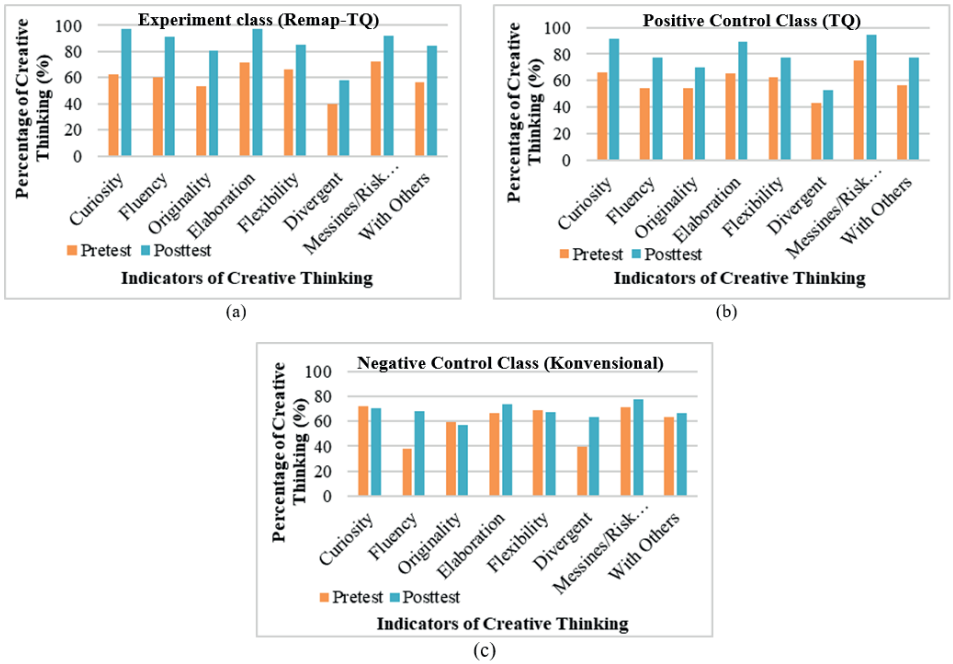

Figure 2: The percentage of increasing students' creative thinking on each different indicator and treatment.

Mapping-Team Quiz (Remap-TQ) can improve students' creative thinking in biology learning. This result is in line with previous research that the Remap Coople learning model can improve students' creative thinking skills in biology learning [18, 19].

The improvement of students' creative thinking skills is influenced by the learning model that supports the student's learning process. The stages of the Remap-TQ model that were applied in the experimental class, including reading, concept mapping, and Team Quiz activities, were in fact able to provide a higher increase in creative thinking, compared to students who were taught by the stages of the TQ model (positive control class) and conventional learning (negative control class). This is because, in the first stage of Remap-TQ, students are required to read the material before learning. Reading helps students expand knowledge, which is useful as a resource for developing creative ideas. Students who have read are proven to be able to prepare concept maps well, are able to answer questions during group quiz activities, are able to answer questions related to questions that train creative thinking skills in LKPD well, and are fluent in discussions during learning. Reading can develop creative thinking skills. Unlike the control class, students were not assigned to read [32]. This causes about 40% of students in the control class to be less active in giving opinions during discussions and questions and answers, because students lack the knowledge that is the basis for generating creative ideas, while in the experimental class the activeness of students has reached 90%.

The second stage of the Remap-TQ model is that students make concept maps to apply reading results. The concept map assignment was only given to students taught by Remap-TQ in the experimental class, while students in the control class did not receive a concept map assignment. When in class, students who have made concept maps are seen to be active in providing feedback during learning, are fluent in giving opinions during group discussions and can answer questions that arise without looking at the reading source. In contrast to students in the control class, they seemed less active in providing feedback. They often answered questions by reading from sources because they did not understand the concepts and contents of the material discussed. Students make concept maps at each meeting. An example of a concept map made by students can be seen in Figure 3. about the material of the digestive system.

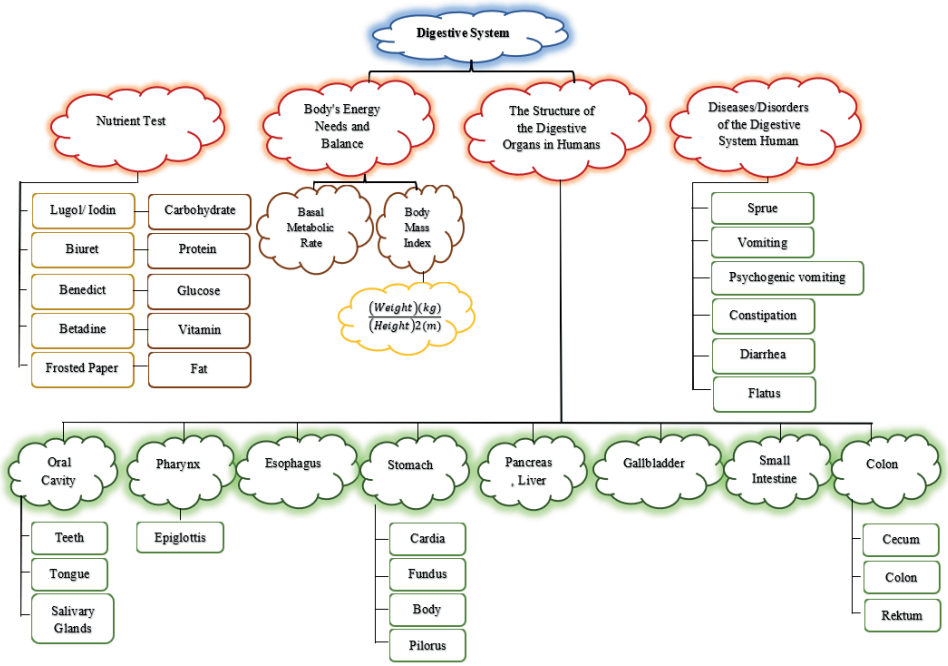

Figure 3: Example of student concept map on digestive system material.

Figure 3 shows that students can carry out three main processes in compiling a concept map. First, students are able to see the consistency of the sequence of concepts from top to bottom, and it takes accuracy to adjust the concept links horizontally and vertically with the help of straight lines. Second, the linear position on the concept map is used by students to identify general concepts, and write them at the top of the digestive system material. Students divide the general concept into four main sub-sections: the test of food substances, the body's energy needs and balance, the structure of the human digestive organs, and diseases or disorders of the human digestive system. Students then review how to classify each derivative from the four main subsections:

test materials and various kinds of food content, differences in energy needs and balance, the sequence of food digestion processes, and various types of digestive system disorders. In the last process, students connect between concepts using the help of lines and limit the writing of concepts with different shapes. The process of students finding and determining the relationship between concepts, creating key concepts and giving different colours and unique shapes to concepts, can stimulate students' creative thinking. Concept maps are important in facilitating creative thinking skills. The concept map can also make it easier for students to understand biology material that is considered broad, complex, and requires a lot of memorization because it is concise and exciting, making it easy to remember for a long time [36].

The third stage of Remap-TQ is conducting classroom learning using the Team Quiz (TQ) model. The application of the TQ model was only carried out in the experimental class and the positive control class. In contrast, the negative control class used conventional learning in the form of lectures, discussions, questions and answers, and giving assignments. The TQ learning model can help students learn to work together in groups to make questions and predict answers that involve creative thinking skills. Students in the experimental class had a higher increase in creative thinking than students in the positive control class. This phenomenon is because students in the experimental class get additional activities in reading and concept mapping (Remap). Students can more easily understand the learning material, and the team quiz activities in class run smoothly. Reading and concept mapping activities allow students to understand the material being studied more easily [30]. Students are ready to take part in learning activities in class. Students in the positive control class did not get the Remap activity and were only taught the TQ model. This phenomenon causes some students to have still difficulty making questions and predicting answers during team quiz activities. Students do not understand the studied material, so the time required is longer. In contrast to students in the negative control class, they tend to be passive during discussion and question and answer activities. This phenomenon is because learning does not emphasize student activities, which causes students' creative thinking skills to be lower than students in other classes.

Students' creative thinking skills need to be empowered, especially in learning biology. Biology has a broad and complex scope of material and is considered rote, so applying the right learning model becomes an educator's strategy to help students understand the material being studied. The application of the Remap-TQ model certainly has problems, especially when conducting team quiz activities in class. Team quiz activities take longer than the allotted time because some students show long

responses when making questions for other groups, so their activities are hampered. Thus, educators can overcome these obstacles by paying attention to time; if possible, they can add time allocation during team quiz activities so that the student learning process becomes optimal and the material studied becomes more meaningful.

4. CONCLUSION

The application of the Remap-TQ learning model is proven to improve students' creative thinking skills in learning biology. The improvement of students' creative thinking skills is known from the results of the posttest mean scores. Students taught by Remap-TQ have a higher score of 85.89 than the TQ model of 78.64, and conventional learning of 68.03. Therefore, educators can apply Remap-TQ as an alternative learning model to develop students' creative thinking skills in learning biology. If doing learning with Remap-TQ, you should pay attention to the time allocation in implementing each activity in the learning model to make the implementation more optimal.

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