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Research Article

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Improving students' creative thinking in biology learning through Remap-TPS integrated flipped classroom

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ABSTRACT

Implementation of the Remap-TPS integrated flipped classroom has not yet been carried out to improve creative thinking skills in biology learning. This study aims to determine the effect of the Remap-TPS integrated flipped classroom model on students' creative thinking skills in biology learning. This study is a mixed method. The research design used was a pretest-posttest nonequivalent control group design. The research sample comprised 72 class X students at SMAN 9 Malang, East Java, Indonesia. They were divided into one experimental class and one control class. The Remap-TPS integrated flipped classroom was taught in the experimental class, while the TPS model was taught in the control class. Quantitative data was collected through pretest and posttest using essay question that refer to creative thinking indicators: curiosity, fluency, originality, elaboration, flexibility, divergent, messiness/risk taking and with others. This essay's questions have previously been tested to show valid and reliable results because Cronbach's alpha value is 0.778. Qualitative data is used together with quantitative data from the results of student answers. Analysis was carried out using the ANCOVA test with a significance level of 5%, then continued with the LSD test. Data is also explained qualitatively from the results of student answers. The study results show that the Remap-TPS integrated flipped classroom model affects students' creative thinking skills. This is proven by a significant value of 0.00<0.05. Therefore, the Remap-TPS integrated flipped classroom can be used as an alternative learning model to improve students' creative thinking in biology learning. Implementing the Remap-TPS integrated flipped classroom requires adapting learning instruments and tools to the learning model used and the skills measured to improve learning activities, especially in improving students' creative thinking skills.

Keywords: Creative thinking; flipped classroom; Remap-TPS

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INTRODUCTION

Creative thinking skills are very important in the current era (Erscy & Başer, 2014; Lee & Carpenter, 2015; Ritter & Mostert, 2017). Creative thinking skills are producing new products, creating ideas, changing the ability to think flexibly, and developing ideas to solve problems (Katz et al., 2019; Sheu & Chen, 2014). Creative thinking skills can also be defined as combining or reinventing elements in new and imaginative ways (Aljaafil, 2019). Kwangmuang et al. (2021) stated that creative thinking skills play a role in creating ideas or finding solutions to overcome problems in everyday life, and these skills are also important for students in the learning process. Students with good creative thinking skills will gain a deeper understanding during learning (Huang et al., 2020).

As previously explained, creative thinking skills are critical, but several research results show that these skills still need to be improved. According to Florida & King (2015), in The Global Creativity Index, the level of creative thinking skills of students in Indonesia is ranked 115th out of 193 countries. The results of research from Sugiyanto et al. (2018) and Madyani et al. (2020) reported that students' creative thinking skills in learning are relatively in the low category. Apart from that, the results of research from Sihaloho et al. (2017) reported that the average creative thinking skills of students taught using conventional learning were classified as low.

The results of a preliminary study conducted at SMA Negeri 9 Malang in July 2023 showed that the creative thinking skills of class X students in biology learning were still unsatisfactory. This is proven by the results of teacher interviews at SMA Negeri 9 Malang, showing that the learning carried out so far has not empowered students' creative thinking skills to the maximum. The low level of students' creative thinking skills is also supported by the average results of students' creative thinking skills tests at SMA Negeri 9 Malang. The average test results of students' creative thinking skills on the curiosity indicator were 46.9% (less), fluency was 43.8% (less), originality was 40.6% (less), elaboration was 55.3% (enough), flexibility amounted to 43.8% (less), divergent amounted to 43.8% (less), messiness/risk taking amounted to 40.6% (less) and with others amounted to 56% (enough).

A lack of creative thinking skills empowerment can cause students to be passive in studying biology (Berestova et al., 2021). Students who are less skilled in creative thinking may experience difficulty in facing tasks that require problem-solving and creativity (Ahmad et al., 2020; Lucchiari et al., 2019). This can impact students' ability to understand more complex concepts and integrate information from various sources (Pieczki & Kárpáti, 2021). Also, low creative thinking skills can affect students' learning motivation because students find it difficult to find connections between learning material and experiences and daily life (Wu & Wu, 2020). Considering the low impact of creative thinking, creative thinking skills need to be empowered.

Creative thinking skills should be empowered by utilizing innovative learning models, one of which is the Reading Concept Mapping Think Pair Share (Remap-TPS) learning model. The Remap-TPS learning model is a learning model that requires students to read, and then students are asked to make concept maps, the learning uses one of the cooperative learning models, namely the think pair share model (Zubaidah, 2014). Think pair share is a learning model that allows students to think, respond to opinions or questions, and collaborate with each other (Linsenmeyer, 2021; Raba, 2017). The syntax of the think pair share model is to think independently called think, work in pairs to discuss the answers that come up with each other called pair, and share thoughts with the whole class called share (Sharma & Saarsar, 2018). Several studies on the Remap-TPS can improve student learning outcomes, followed by various improvements in thinking skills, such as creative thinking skills (Ilham et al., 2023; Jatmiko et al., 2018; Tendrita et al., 2016).

The Remap-TPS cooperative model often requires a long class learning time for interaction and collaboration between students. Therefore, efforts need to be made to be more time efficient. One way to streamline learning time in class is to integrate with flipped classroom (Lai & Hwang, 2016; Zheng et al., 2020). Flipped classroom is a type of blended learning that can increase student involvement in the learning process (Alwa et al., 2022). This method utilizes teaching materials provided by the teacher, which students can study at home before participating in class learning on the following material (Sohrabi & Iraj, 2016). The flipped classroom relies heavily on visualization, especially videos and presentations, and can significantly support generating creative ideas (Jovanović et al., 2017). The flipped classroom is not only used to improve student learning outcomes but also helps individual students, creates more opportunities for independent learning, and trains students' thinking skills during the learning process in the classroom (Gaughan, 2014).

By integrating the Remap-TPS model with the flipped classroom, it is hoped that students can improve their creative thinking skills and gain meaningful and engaged learning experiences in biology. Several study results show that the Remap-TPS model influences several 21st-century skills. Still, no study on Remap-TPS integrated flipped classrooms has been found to improve students' creative thinking skills. Previous research conducted by Setiawan et al. (2020) shows that the TPS remap model can be used as an alternative to empowering students' reading interests and metacognitive skills in biology learning. Other research also reveals that Remap-TPS can improve cognitive learning outcomes (Tendrita et al., 2017). Similar research by Antika (2018) shows that Remap-TPS contributes to empowering metacognitive skills and student achievement in biology learning. Therefore, this study aims to determine the effect of the Remap-TPS integrated flipped classroom learning model on students' creative thinking skills in biology learning.

RESEARCH METHODS

This study is a mixed method. In this research, quantitative and qualitative data were collected simultaneously, with the same priorities. Quantitative data was obtained from students' creative thinking skills test scores. Qualitative data is used together with quantitative data from the results of student answers. The research design used is a pretest-posttest nonequivalent control group design, as seen in Table 1.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Remap-TPS integrated Flipped Classroom	O_1	X_1	O_2
TPS	O_3	X_2	O_4

Source: (Leedy et al., 2021)

Description

O_1, O_3 : Pretest
O_2, O_4 : Posttest
X_1 : Remap-TPS integrated flipped classroom
X_2 : TPS

The research was conducted from August to October in the odd semester of the 2023/2024 academic year. Learning is carried out using two classes offline. The difference between the two classes is based on learning models: the Remap-TPS integrated flipped classroom and TPS models. The experiment class applies the Remap-TPS integrated flipped classroom model, while the control class applies the TPS model. The detailed learning activities of both classes are presented in Table 2.

Table 2. Learning Activities

Model	Syntax	Materials
Remap-TPS integrated flipped classroom.	The learning syntax for the Remap-TPS integrated flipped classroom is as follows: a. At home: (1) Warm-up Activities by Reading Literature, (2) Q&A Time on Video, (3) Concept Mapping b. In the Classroom: (1) Think,(2) Pair, (3) Share	Biology material (one material every week) includes: (1) Classification of Living Things, (2) Levels of Diversity of Living Things, (3) Distribution of Flora and Fauna in Indonesia, (4) Preservation and Benefits of the Diversity of Living Things, (5) Diversity Problems Living Things.
TPS	The learning syntax for the TPS model is as follows: (1) Think,(2) Pair, (3) Share	Same with the Remap-TPS integrated flipped classroom

This study has received approval from the school and participating students. The population in this study were all class X students of SMA Negeri 9 Malang for the 2023/2024 academic year. Determination of samples through an equality test analyzed using a single ANAVA technique. Determining the classes used as research samples through random sampling techniques in equivalent classes. The classes used are class X.5 and X.6.

The instrument used to measure creative thinking skills is in the form of 10 essay questions on the diversity of living things. Indicators of creative thinking skills refer to indicators from Greenstein (2012), including curiosity, fluency, originality, elaboration, flexibility, divergent, messiness, risk-taking, and with others. Examples of questions on the creative thinking skill test used in this study can be seen in Table 3.

Table 3. Questions on the Creative Thinking Skill Test

Indicator	Questions
Curiosity	Hadira, as a botanist, identified five types of flowering plants and labeled them K, L, M, N, and O. K, M, and N plants have different colors, and when mated between the three, they can produce fertile offspring. L and O plants have the same color and cannot produce offspring when crossed. K and L plants also cannot produce offspring when crossed. Describe why plants K, M, and N can produce fertile offspring when crossed, while L and O plants cannot produce offspring when crossed? (Relate this case to the diversity of living things at the gene level).
Fluency	Hadira, as a botanist, identified five types of flowering plants and labeled them K, L, M, N, and O. K, M, and N plants have different colors, and when mated between the three, they can produce fertile offspring. L and O plants have the same color and cannot produce offspring when crossed. K and L plants also cannot produce offspring when crossed. Describe why plants K, M, and N can produce fertile offspring when crossed, while L and O plants cannot produce offspring when crossed? (Relate this case to the diversity of living things at the gene level).
Originality	In East Java, a forest is a habitat for various endemic bird species, including the Javanese Peacock, whose population is decreasing. However, poachers often capture these birds to trade as exotic pets. Illegal logging also occurs in the forest, threatening the natural habitat of various rare plant species. As a generation Z student, provide two recommended solutions that can be implemented to protect the Javan Peacock and prevent the exploitation of rare plants in the forest!
Elaboration	On a small, remote island, there is a very high diversity of living things. The island is known for its natural beauty and is a habitat for various unique species, including several endemic species only found on the island. However, the island has experienced significant changes in recent years due to human activity. A mining company has obtained permission to exploit natural resources on the island, and forests that are essential habitats for many species have begun to be cleared. Based on this case, provide alternative solutions that can be taken to maintain the diversity of living things amidst destructive human activities!
Flexibility	South Sulawesi has a tropical rainforest, a habitat for various rare and endemic species. However, the diversity of living things in the forest is increasingly threatened due to rampant illegal logging

Indicator	Questions
	and poaching. A biology student named Akbar had the opportunity to conduct research in the area and witnessed the damage firsthand. a. In your opinion, what efforts can Akbar take to combat illegal logging in the forest? b. What advice can you give Akbar to protect the rare and endemic species in the forest?
Divergent	The local government has implemented a conservation policy prohibiting illegal logging and hunting to maintain biodiversity in East Java Province. However, some local communities argue that this policy limits access to important natural resources for daily life. If you, as a conservation biologist, are asked to propose alternative solutions that can accommodate the needs of local communities while maintaining diversity. a. Give two examples of other alternative solutions that you can propose! b. Explain the benefits and consequences of each solution for biodiversity and local communities!
Messines/risk-taking	In a tropical forest threatened by deforestation, a scarce endemic monkey species, namely the golden fur monkey. Golden fur monkeys have an important role in maintaining the balance of the forest ecosystem. As a conservation effort, some experts have proposed relocating a group of golden fur monkeys to a remote island with a habitat similar to its natural forest. However, there is a risk that relocated golden-haired macaques will face competition from other animal species already on the island and problems obtaining sufficient food resources. Is relocating the golden fur monkey to a remote island the right solution to preserve this species? (Give reasons to support your opinion).
With others	Reporting from several recent studies, it was found that the diversity of living things in a tropical forest ecosystem has decreased significantly. The study shows that the main factors contributing to this decline are deforestation caused by illegal logging activities and the expansion of oil palm plantations in the region. Apart from that, it was also found that the decline in the diversity of living creatures had far-reaching impacts. Populations of rare and prote[26] endemic species are threatened with extinction, the ecosystem balance is disturbed, and the quality of water and soil around the area is also decreasing. In yo[26]pinion, how is the decline in the diversity of living creatures related to the decline in the quality of water and soil around the area?

This instrument ha[22]reviously been tested to show valid results because the calculated r-value> r-table (0.294), and the results are [12]lable because Cronbach's alpha value is 0.778. The creative thinking skills test is assessed using the creative thinking skills scoring rubric presented in Table 4.

Table 4. Creative Thinking Skills Scoring Rubric

Indicator	Score			
	4 (Exemplary)	3 (Proficient)	2 (Basic)	1 (Novice)
Curiosity	I am intrigued by novel elements and ideas and actively seek them out	I am curious about some things and usually am willing to explore new ideas.	With some help, I will explore new ways of thinking and doing	I hardly ever wonder about ideas and things
Fluency	I can look at things in various ways and describe their different purposes.	I can usually come up with some alternative ways of looking at things	If I work with someone else, I can find other ways of looking at things	Usually, I just sess things from my perspective
Originality	I can come up with many new ideas and products on most topics and bring something new to fruition.	I can come up with some new ideas on my own and, if it's easy, work toward using it.	If I have some guidelines, I can usually come up with new ideas	I need help thinking of new things
Elaboration	It's easy and fun to add details to something to make it better	I can usually come up with ways to add details to something to make it better	Maybe a few ideas come to me if I think really hard	Sometimes, I just can't think of ways to make something better
Flexibility	I adapt well to new situations and can see many possibilities	I can work effectively even when things cange	Sometimes, it's hard for me to adjust to change. When	I am unable to be productive when things change. It's

Indicator	Score			
	4 (Exemplary)	3 (Proficient)	2 (Basic)	1 (Novice)
	in my everyday learning and living.	and notice the potential of some things as I learn.	someone reminds me to think differently, I usually can do so.	hard for me to "think outside the box"; I like things as they are.
Divergent	It easy for me to combine ideas, modify and adapt them, and rearrange them to improve the outcomes.	I can do two or three of these to change a product or process: combine, modify, adapt, or rearrange.	I can do one or two, but my ideas are relatively simple.	This is hard for me to do because I tend to see things as they are rather than how they could be.
Messines/risk-taking	I know that creativity can be messy, but still strive to try new things. I don't worry much about my mistakes because I learn from them.	I'm willing to try to projects and don't worry too much about making mistakes.	Sometimes, I hold myself back because I might make mistakes, and it won't come out right.	I feel nervous and try to avoid the messier aspect of creativity.
With others	I'm most creative when I use the synergy that comes from working with others.	My ideas get better when I work with others to improve on something.	I usually watch and listen before sharing my creative ideas, but then I add new	It's hard for me to tell if any of my ideas are worth sharing with others, so usually, I don't

Source: Greenstein (2012)

Quantitative data were analyzed using covariance analysis (ANCOVA). The purpose of using the ANCOVA test is to determine whether there is a significant influence between Remap-TPS integrated flipped classrooms on students' creative thinking skills. Before conducting the ANCOVA test, it is necessary to carry out prerequisite tests in the form of normality and homogeneity. The normality test uses the Kolmogorov-Smirnov test, while the homogeneity test uses the Levene test. The Least Significant Difference (LSD) test is used if the test results are significant (the independent variable affects the dependent variable). Data is also explained qualitatively from the results of student answers.

FINDING AND DISCUSSION

The results of statistical tests on creative thinking skills show that the data is normally distributed and homogeneous; this is proven by a significance value of 0.200>0.05. Table 5 shows the results of the ANCOVA test analysis of the effect of the Remap-TPS integrated flipped classroom on students' creative thinking skills.

Table 5. Hypothesis Test Results of the effect of Remap-TPS integrated Flipped Classroom on Students' Creative Thinking Skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4604.003[a]	2	2302.001	88.737	.000	.720
Intercept	1052.725	1	1052.725	40.580	.000	.370
XLD	1350.447	1	1350.447	52.056	.000	.430
KELAS	2400.486	1	2400.486	92.533	.000	.573
Error	1789.997	69	25.942			
Total	465276.000	72				
Corrected Total	6394.000	71				

Data from Table 5 shows that the treatment significance value for the learning model is 0.00<0.05, which means the research hypothesis is accepted. This shows significant differences in creative thinking skills between one class and another. Thus, the Remap-TPS integrated flipped classroom learning model influences students' creative thinking skills. The LSD test results of the effect of the learning model on creative thinking skills in two classes, namely the experimental class (Remap-TPS integrated flipped classroom) and the control class (TPS), can be seen in Table 6.

Table 6. Least Significant Difference Test Results on Creative Thinking Skills

Class	Corrected Average	LSD Notation
Remap-TPS integrated flipped classroom	85.715	a
TPS	73.952	b

Table 6 shows that the class taught with the Remap-TPS integrated flipped classroom model obtained a corrected mean of creative thinking skills of 85.715, which means it is significantly different from the corrected mean of creative thinking skills taught with the TPS model of 73.952. The results of the LSD test show that the two treatments given obtained significantly different results as indicated by the LSD notation, which is not the same. Table 7 shows the results of students' creative thinking skills tests in the experiment and control class.

Table 7. Results of Students' Creative Thinking Skills Test

Category	Experiment Class (Remap-TPS integrated Flipped Classroom)		Control Class (TPS)	
	Pretest (%)	Posttest (%)	Pretest (%)	Posttest (%)
Excellent	0.00	58.33	0.00	2.78
Good	2.78	33.33	2.78	27.78
Enough	75.00	8.33	58.33	61.11
Less	19.44	0.00	27.78	8.33
Very Less	2.78	0.00	11.11	0.00
Average Value	65.00	87.00	63.00	73.00

Based on Table 7, the test results show that the percentage of scores and categories of student's creative thinking skills in the posttest is higher than in the pretest. The study results showed that of the 36 students, 58.33% of students taught with the Remap-TPS integrated flipped classroom model had the creative thinking category excellent, 33.33% good, and 8.33% enough. Meanwhile, of the 36 students taught using the TPS model, 2.78% had the creative thinking category as excellent, 27.78% as good, 61.11% as enough, and 8.33% as less. Overall, students taught using the Remap-TPS integrated flipped classroom learning model experienced a more significant increase in creative thinking skills. This is proven by the average creative thinking posttest score for students taught using the flipped classroom integrated TPS Remap model, which is 87.00 compared to the TPS model of 73.00. The increase in the percentage of creative thinking indicators can be seen in more detail in Figure 1 regarding the increase in the percentage in the experiment class (Remap-TPS integrated flipped classroom) and Figure 2 regarding the increase in the percentage in the control class (TPS).

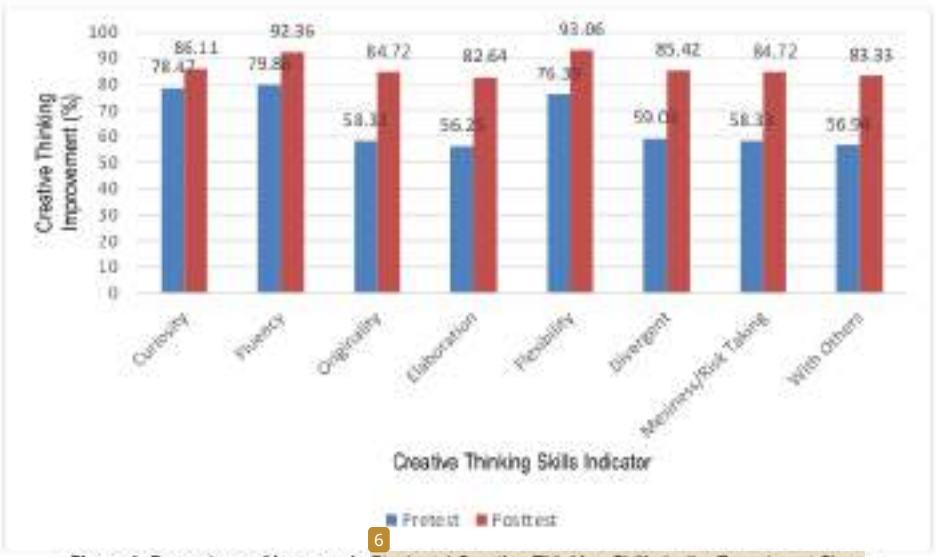

Figure 1. Percentage of Increase in Students' Creative Thinking Skills in the Experiment Class (Remap-TPS integrated Flipped Classroom)

Figure 1 shows the increase in each indicator of creative thinking skills in the experimental class from pretest to posttest. This is evidenced by the difference in percentage increase from pretest to posttest, including curiosity at 9.74%, fluency of 15.65%, originality of 45.24%, elaboration of 46.92%, flexibility of 21.82%, divergent of 44.71%, mesiness/risk taking of 45.24% and with others amounted to 46.35%.

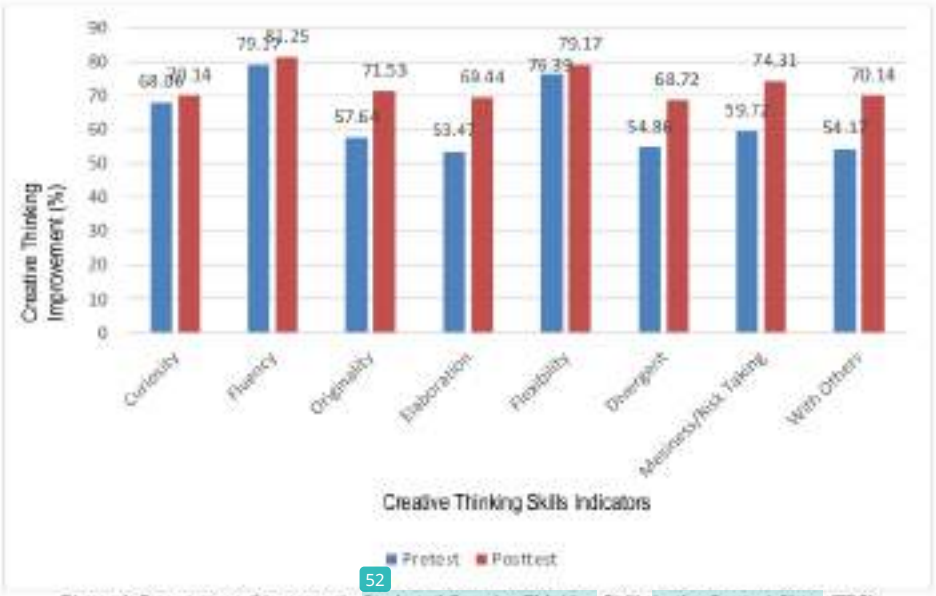

Figure 2. Percentage of Increase in Students' Creative Thinking Skills in the Control Class (TPS)

Figure 2 shows the increase in each indicator of creative thinking skills in the control class, but the increase is lower than in the experiment class. The difference in percentage increase from pretest to posttest for each indicator includes curiosity at 3.06%, fluency at 2.63%, originality at 24.10%, elaboration at 29.87%, flexibility at 3.64%, divergence at 25.32%, messiness/risk-taking at 24.43% and with others by 29.48%. The results of the analysis of student answers for each indicator of creative thinking skills can be seen as follows.

Question number 1 (Curiosity): MDF students provide the following explanation: K, M, and N plants can produce fertile offspring because they have diverse genetic variations, allowing the offspring to form unique gene combinations. In contrast, L and O plants failed to produce offspring because they had similar genotypes, which reduced genetic variation and offspring vitality. Genetic diversity has a crucial role in supporting the survival and reproduction of a population.

MDF students' answers are relevant to the concept of gene-level diversity in flowering plants and have linked this concept to the situation described in the case given. Students already have curiosity about the diversity of living things that occur in everyday life, so from this curiosity, new ideas emerge from students. According to Greenstein (2012), curiosity is the ability to be interested in new things and ideas. This curiosity can encourage students to explore unusual ideas, look for solutions that have not been considered before, and expand the boundaries of their thinking (Hines et al., 2019). Curiosity can be an important catalyst for improving creative thinking skills (Chang & Shih, 2019).

Question number 2 (Fluency): MHAG students outline concrete steps that can be taken to protect and restore the Javan rhinoceros population and provide solutions that can help maintain overall biodiversity in their natural habitat.

a. Concrete efforts to protect and restore the Javan rhino population involve several steps, namely:
   1) Synergize with the government, NGOs and local communities to reduce illegal poaching and trade in rhino products.
   2) Restoring and preserving natural habitat through planting rhino food plants and restoring damaged land.
   3) Implement selective breeding and breeding programs to increase the rhino population.
   4) Hold a public education campaign to increase awareness of the importance of preserving the Javan rhinoceros.

b. This solution supports biodiversity as a whole in the following ways.
   1) Maintaining ecosystem balance through the role of rhinos as plant eaters and seed dispersers.
   2) Maintaining genetic diversity is crucial for rhino adaptation to environmental changes.
   3) Encourage broad conservation efforts, potentially positively impacting other species and habitats.
   4) Demonstrate commitment to nature conservation to the community, opening the door for participation in preserving the environment.

MHAG students' answers raised several ideas relevant to solving the problem and its objectives regarding the diversity of living things. According to Greenstein (2012), fluency is the ability to see something in various ways and explain various purposes. Fluency influences a series of cognitive activities involved in creative thinking, such as goal setting, work effort, and strategy selection (Jia et al., 2019; Lucas & Nordgren, 2015).

Question number 3 (Originality): ADS students design ideas related to recommended solutions that can be implemented to protect the Javanese peacock and prevent exploitation of rare plants in East Java: As Generation Z, two recommended solutions can be implemented to protect Javanese peacocks and prevent exploitation of rare plants in the forest, namely as follows.

1) Education and awareness campaigns can be realized by creating innovative digital and social campaigns to increase awareness of the importance of preserving biodiversity and forest ecosystems. Short videos, infographics, and other interesting content can be used to explain the negative impacts of poaching and illegal logging on the environment. Collaborating with influencers from Generation Z can also have a more significant impact and inspire positive action.
2) Collaborate and monitor through the development of technology-based applications or platforms that enable the public to report illegal activities such as poaching and illegal logging. The data collected can help local authorities to respond more quickly and effectively. Collaboration with environmental organizations, students, and local communities can strengthen monitoring and protection efforts.

ADS students' answers gave rise to several innovative, relatively new, unique and relevant ideas as Generation Z. According to Greenstein (2012), originality is the ability to see things with lots of new ideas and products on most topics and can bring something new to fruition. Originality is the main characteristic of creative thinking skills (Mayseless et al., 2015). According to Scheffer et al. (2017), originality diperlukan untuk membangkitkan keterampilan berpikir kreatif di bidang sains dan seni. originality is needed to generate creative thinking skills in science and arts.

Question number 4 (Elaboration): ATH students explain efforts to maintain the diversity of living things as follows. Several alternative solutions can be considered to maintain the diversity of living things on the island:

a) Sustainable Forest Management: Mining companies can implement sustainable forest management practices in this case. They can keep parts of the forest as conservation areas and only cut down the necessary trees while ensuring replanting and maintenance of the ecosystem.
b) Ecotourism development, in this case, introducing responsible ecotourism, can be an alternative source of income. This can encourage nature conservation and create public awareness about the importance of biodiversity. Income from ecotourism can help replace economic needs that rely on mining.
c) Environmental Research and Education, in this case, supporting scientific research and education about the environment on the island can increase understanding of the important value of biodiversity. This information can be used to persuade companies and communities about the impacts of natural resource exploitation.
d) Public Awareness Campaigns, in this case through media and education campaigns, are important to increase global public awareness about the need to maintain biodiversity. Public pressure can influence company and government policies.

ATH student's answers gave rise to several ideas explained in detail by adding several existing facts about efforts to maintain the diversity of living things. Elaboration refers to a person's ability to develop ideas in detail (Greenstein, 2012; Trisnayanti et al., 2020; Zubaidah et al., 2017). Elaboration encourages students to expand their ideas and organize their thinking and helps students improve their creative thinking (Sitorus & Masrayati, 2016).

Question number 5 (Flexibility): DPNS students provide the following ideas.

a) Akbar can collaborate with local authorities and conservation organizations to monitor and report illegal logging activities. He can also organize educational campaigns for residents regarding the urgency of protecting forests and the detrimental impacts of illegal logging activities.
b) Akbar can research to gather information about rare and endemic species and their habitats. Furthermore, the results of this research can be used to support forest conservation advocacy,

increase public awareness, and encourage the establishment of stricter conservation areas in the region.

DPNS students' answers gave rise to several ideas which were explained in detail by adding facts about efforts to maintain the diversity of living things. This is in accordance with the statement from Greenstein (2012), that flexibility is the ability to generate ideas that give rise to various possibilities. Flexibility includes generating ideas, providing varied answers, using various solving strategies, providing examples related to concepts, and looking for different alternative solutions. Flexibility relates to the initial stage in the creative thinking process, which involves having several possible solutions to solve problems openly (Zabelina & Hanna, 2016).

Question number 6 (Divergent): HPM students provide the following explanation. The following are two alternative solutions that can be proposed.

a) The first solution is sustainable management. The government can develop sustainable natural resource management programs that involve local communities. This could include education about the importance of conservation and training in responsible use of natural resources. Consequently, natural resources will remain available for people's daily needs while biodiversity is protected.
b) The second solution is ecotourism and providing economic value. Focus on developing ecotourism and products of economic value from biodiversity. Local communities can get involved in this industry, creating jobs and additional income. With the associated economic value, people will be more interested in protecting the surrounding natural environment. However, you need to remember to manage ecotourism carefully so as not to damage the ecosystem.

HPM students' answers combine ideas, modify, and comply with the concept of diversity of living things. According to Greenstein (2012), divergent includes combining ideas easily, modifying and adapting them and rearranging them to improve results. Divergent indicators include associating and combining unrelated knowledge in new and meaningful ways (Mamon & Faust, 2018). This is crucial in developing creative thinking skills (Sun et al., 2020).

Question number 7 (Messines/risk taking): HAA students provide the following ideas. Relocating golden fur macaques to a remote island may be a suitable alternative; however, this step should be accompanied by a thorough evaluation of its impact on the balance of the island ecosystem, potential competition with other species, and the availability of food resources. In conservation efforts, careful planning based on scientific knowledge is needed to prevent the potential for new problems to arise in the newly formed ecosystem.

HAA students' answers gave rise to new ideas in accordance with the concept of diversity of living things. According to Greenstein (2012), machine/risk-taking includes the ability to keep trying new things and not worry about mistakes due to learning. The research results from Daly et al. (2014) dan Creely et al. (2021) show that students' creative thinking skills will increase when risk-taking is implemented in the learning process.

Question number 8 (With others): SDA students provide the following explanation. A decrease in the diversity of living things can cause a decrease in water and soil quality. A richly diverse ecosystem helps balance soil nutrients and water quality. The existence of various organisms supports optimal decomposition processes, nutrient circulation, and water filtration. A reduction in species that play a role in this process can disrupt ecosystem cycles and potentially reduce the quality of natural resources around the area.

HAA students' answers give rise to new ideas and can link the decline in the diversity of living things to the decline in water and soil quality. This is in accordance with the statement from Greenstein (2012)

that with others (relationships with others) means the ability to use synergy comes from working with other people and can show that he is the most creative. In other words, this creative thinking emerges from dialogue, interacti and practice with others (Elisondo, 2016; Glăveanu, 2015).

Increasing creative thinking skills is influenced by the learning model applied during the learning process. This is proven by the differences in percentage scores and categories of students' creative thinking achievement levels resulting from the two treatments applied in biology learning: Remap-TPS integrated flipped classroom and TPS. Students taught with the Remap-TPS integrated flipped classroom had higher posttest percentage scores and creative thinking achievement level categories than students taught with the TPS model. Thus, it is proven that applying the Remap-TPS integrated flipped classroom learning model can improve high school students' creative thinking skills in biology learning. This is in line with the results of research conducted by Tendrita et al. (2016), Zubaidah et al. (2018), and Irawan et al. (2021) that the application of the Remap Coople model in biology learning has the potential to improve various student skills including creative thinking skills.

Increasing students' higher creative thinking skills is supported by the syntax of the Remap-TPS integrated flipped classroom learning model. The stages of the Remap-TPS integrated flipped classroom include warm-up activities by reading literature, Q & A time on video, concept mapping, and Think-Pair-Share. All of these stages are carried out according to the teaching module that has been prepared. During learning activities, each student is also given a student activity sheet based on the Remap-TPS integrated flipped classroom by the teacher so that students can follow and understand every activity in this learning model. The first stage is warm-up activities by reading literature or students reading material and watching videos sent by the teacher on Google Classroom. Students can also read material from various sources such as biology textbooks from school, internet sources, articles, and other relevant sources. By ing reading assignments, students will actively seek information and knowledge independently so that students' creative thinking skills can be empowered indirectly (Segundo et al., 2020; Sur & Ateş, 2022). Reading activities are supported by constructivist learning theor because students are required to actively look for sources of information from various reading materials so that students are able to build and discover for themselves everything they learn (Petscher et al., 2020; Yang, 2022). Reading activities have an important role because they can stimulate students' thinking processes in understanding the material (Annamalai & Muniandy, 2013) so that the information obtained can become a provision for learning in class (Sadeq et al., 2021).

The second stage is Q&A time on video, o dents ask questions about the material based on the learning videos t have observed on Google Classroom. This stage is carried out at each student's home. At this stage, the teacher gives students the opportunity to ask questions in the Google Classroom comments column and allows other students to answer their friends' questions. Question-and-answer activities and discussions during the online learning cess can empower students' thinking skills, including creative thinking skills (Kalelioglu & Gulbahar, 2014.; Kim et al., 2014). Apart from that, students are also directed to answer questions and conduct class discussions in order to clarify misunderstandings (Asmara et al., 2023).

The third stage is concept mapping. Students make concept maps after reading the material or watching learning videos. This activity is supported by constructivist learning theory because it helps students to organize and build their cognitive maps. Ausubel's theory of meaningful learning also underlies the need to use concept maps because students must link new information to relevant concepts that exist in their cognitive structures (Tytenko, 2021). Concept mapping is pr red by students at each meeting using various concept mapping applications that can hone students' creative thinking skills. The concept

maps that have been created are then collected via Google Classroom (Tseng et al., 2013). Moreover, Silva et al. (2022) reported that concept mapping can help improve students' creative thinking skills in learning.

The results of students' concept map assignments were mixed. Some students apparently made mind maps because they thought that concept maps and mind maps were the same, even though they had previously been given instructions regarding their differences. An example of a student's concept map on the diversity of living things can be seen in Figure 3. The next stage is applying the Think Pair Share (TPS) model during classroom learning. The stages in implementing the TPS model include thinking independently (think), pairing up to discuss the answers that each person comes up with (pairs) and sharing thoughts with the whole class (Sharma & Saarsar, 2018). Research results from Kirana & Cahyowati (2020) and Afifah et al. (2023) show that applying TPS in the classroom learning process can empower students' creative thinking skills.

(a)

(b)

(c)

Figure 3. Concept Map: (a) Material on the Distribution of Flora and Fauna, (b) and (c) Material on the Problem of Diversity of Living Things

On the other hand, implementing TPS in biology learning requires the teacher's competence to remind and direct students so that they can understand each indicator of creative thinking skills that must be developed at each stage of the learning model. This is because the time allocation for group activities in class is very limited due to the diversion of learning time for P5 activities in the independent curriculum. Therefore, the existence of additional activities in the form of a remap integrated with the flipped classroom is a solution to overcome the weaknesses of TPS. This activity can help students gain knowledge and concepts related to learning material so that when studying biology in class, students can more easily understand the material and answer questions even though discussion time is limited.

CONCLUSION

The Remap-TPS integrated the flipped classroom, can improve students' creative thinking skills in high school biology learning. This is proven by a significance value of 0.00<0.05. Thus, teachers can use the Remap-TPS integrated flipped classroom as an alternative learning model to empower students' creative thinking skills in biology learning. Implementing the Remap-TPS integrated flipped classroom requires adapting learning instruments and tools to the learning model used and the skills measured to improve learning activities, especially in improving students' creative thinking skills. Apart from that, it is necessary to pay attention to the time allocation when implementing learning in class because group activities when implementing the Remap-TPS integrated flipped classroom model require quite a long time.

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