

Analysis of Creative Thinking Ability and Learning Outcomes Through the Treffinger Learning Model

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Abstract: This study aims to describe creative thinking skills and learning outcomes through learning with the Treffinger model. The subjects of this study were Biology Education students who took the Animal Structure course in the odd semester of the 2024/2025 academic year, with a total of 24 students. Creative thinking data were collected using instruments with a Likert scale, while tests collected learning outcomes. The collected data were analyzed qualitatively into five categories. The results of the analysis of creative thinking skills showed students with the very good category as many as 11 people (46%) and the good category 13 people (54%). Students with a very good category had the most fluency indicator of 19 people, while those with the good category had the most elaboration indicator for 16 students. Learning outcomes are more in the good ranking of 16 people than the very good category (8 people). Through learning the Treffinger model, creative thinking ability, and learning outcomes of animal structure, students vary in the categories of good and very good.

Keywords: Creative Thinking; Learning Outcomes; Treffinger Model.

Introduction

Education plays an important role in the development and progress of a nation. [1] stated that education is one of the basic human needs in living and surviving. The problem that often arises in education is the learning process, which is more theoretical and focuses on students' ability to understand teaching materials [2]. Students are less encouraged to develop their thinking skills in the learning process [3]. High-level thinking skills are also important for mental development and changes in students' mindsets. One of the thinking skills at a high level that can be used to solve a problem is creative thinking skills. Creative thinking skills receive relatively high attention in the field of education. Thinking creatively is an important competency that students must have in 21st-century learning [4].

Effective learning starts in a student-centered environment, where students passively receive information and knowledge from educators and can improve their thinking skills [5]. Thinking skills students need to be developed to face the increasingly advanced world of science and technology. Learning is needed in the Industrial Revolution 4.0 era to form a creative, innovative, and competitive generation [6]. Students are required to learn and be able to apply their knowledge to solve or resolve real problems. This educational interaction occurs not only in educational institutions but also in the family and community environment.

The learning process of the Animal Structure course emphasizes providing direct experience so that students get good learning outcomes. Learning activities allow students to explore, think, discuss, interact with peers, and work together well. Students must be more active and creative in building understanding from their experiences with new experiences. The chosen learning also provides the widest opportunity for students to develop themselves individually and in groups. The Treffinger Learning Model was chosen because it allows students to participate in learning actively. Finding information or concepts is the main key so that the concepts obtained by students are stored longer in memory.

The most dominant characteristic of Treffinger learning is its effort to integrate students' cognitive and affective dimensions in finding solutions that will be taken to solve problems. This means that students are free to solve their problems in the ways they want creatively. The task of the lecturer is to guide students so that what is taken by students is not out of the problem. Educators can utilize the Treffinger learning model in various situations [7]. This model combines complex thinking, so it can be utilized to develop critical and creative thinking in students.

Research Method

This study aims to describe students' creative thinking ability and learning outcomes after learning with the Treffinger model. The subjects of this study were Biology Education students who took the Animal Structure course in the odd semester of the academic year 2024/2025,

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with a total of 24 students. Students in groups get a topic that follows the subject matter being discussed. Then, students must develop materials and collect learning resources according to the discussion grid provided by the lecturer. Students then complete the task by compiling articles and making presentation sheets. From this activity, the creative thinking skills of students in completing their tasks and learning outcomes can be seen.

Creative thinking skills data were collected using instruments derived from the creative thinking skills indicators of [8] and [9], with Likert scale answer choices of 1-5 [10]. The creative thinking data of each student was obtained from the average of all indicators. In contrast, data for each indicator was obtained from the average of each indicator achieved by all students. The average results were then analyzed qualitatively with 5 categories (Table 1): Very bad (1), Less good (2), Quite good (3), Good (4), and Very good (5) [10]. Learning outcome data was collected through written tests in multiple-choice format. The scores obtained from the learning outcomes were then made into a scale of 100 then analyzed qualitatively with 5 categories (Table 1) as follows:

Table 1. Categories of Learning Outcome Scores and Creative Thinking Skills

No	Score	Category
1	0-20	Very not good
2	21-40	Not good
3	41-60	Fairly good
4	61-80	Good
5	81-100	Very good

Results and Discussion

Creative Thinking Skills

The Treffinger learning model is the understanding challenge stage, generating ideas, and preparing for action [11]. The learning process in this study begins by focusing the student's attention so they can think openly without thinking about whether their opinions are right or wrong. Students are given topics and subtopics of discussion, and then they are required to develop their thinking skills. In groups, students collect sources of learning under their assignments, and then articles and PowerPoint presentation sheets are compiled. At this stage, students sort and determine important concepts that will be used to solve problems, so this stage helps students understand the concept. In the third step of learning, students apply skills in the previous stage in the real world, looking for concrete examples from the material discussed in everyday life. Then, students present their work results, and class discussions are held. The lecturer's task at this stage as a facilitator is to correct concepts that are still not quite right and provide confirmation or reinforcement of already correct concepts.

The results of calculating students' creative thinking skills in developing materials and problem-solving show no students in the very poor, poor, and fairly good categories.

Students in the very good category are 11 people (46%) and 13 people (54%) students in the good category (Table 2). Students in the very good category can develop material in assignments according to indicators of creative thinking skills. Students convey ideas fluently in constructing sentences that are also easy to understand, not intermittent. Developing ideas also shows variations in answers to concepts presented, and how to display them in presentations still follows developments. An open atmosphere positively impacts creativity and motivation, such as high interest and curiosity [12]. Creative thinking is thinking that students must do, including new ideas and smooth ideas [13]. Ideas from a problem as solving the problem well. Thinking is the human ability to understand all events that occur and respond (find gaps) in a problem [14].

The Treffinger learning model is a model that deals with creativity issues directly by involving cognitive or affective skills at each stage, showing the interrelationship and interdependence between the two in encouraging creative learning. The Treffinger learning model encourages creative learning methods that can develop students' creativity, involving affective and cognitive abilities that are described through three levels of thinking. Creativity will improve understanding and encourage students' cognitive development. Creative thinking skills play an important role in learning and are part of the higher-order thinking skills that must be developed. This learning model has great potential to train students' thinking processes that lead to creative thinking skills, creating students' curiosity and improving creative thinking skills. In the learning process, lecturers must create a learning environment that makes students the center of learning [15]. The learning process must be centered on students [16].

Table 2. Students' Creative Thinking Skills

No	Category	Total	%
1	Good	13	54
2	Very good	11	46

As many as 11 (46%) students (Table 2) were able to think creatively in developing the material in the assignment very well. On average, students utilized learning resources well, developed concepts correctly, and wrote well and systematically with good grammar. In completing the assignment, students utilized the internet as a medium, as seen from the references. The Treffinger learning model improves sensitivity to problems around students, thus generating current ideas or inspiration. Treffinger's teaching and learning activities can produce student creativity to think creatively and produce the desired process [17]. In a model that requires students to learn to solve problems that exist in everyday life, students can be more skilled and more able to think creatively to solve problems [18].

When viewed from each indicator, students' creative thinking skills are ranked very good and good, which vary, but no students occupy the category of quite good to very bad (Table 3). For students in the very good category, the highest percentage on the fluency indicator was 19 people.

This is understandable because fluency is related to many ideas, concepts, methods, suggestions, or answers with a fast time that emphasizes the quality of the answers. Students compare materials from various sources and summarize them into a solution to the problem as requested in the assignment. The next very good category is the flexibility indicator, with 17 people. Flexibility is not much different from fluency to several materials from various sources and summarizing them into a solution to the problem as requested in the assignment. The next very good category is the flexibility indicator, with 17 people. Flexibility differs

Table 3. Students' Creative Thinking Ability in Each Indicator

No	Category	Fluency	Original	Flexibility	Elaboration	Evaluation
1	Good	5	7	13	16	14
2	Very good	19	17	11	8	10

The ability to think creatively is a very good category, at least in the elaboration indicator for 8 students (Table 3). This can be understood because elaborate ability is included in high-level creative thinking ability. Students are required to be able to develop a product or idea and add or detail the details of an object. This kind of learning process should be developed in every learning process. The task of educators is to develop learning to provide students with the widest possible opportunities to develop their potential. Students can continue to improve brain function through creative thinking. Educators must accustom students to thinking by training and exploring knowledge to find answers with creative ideas and produce a product at the end of learning [21]. Elaboration activities are related to the ability to think in detail and systematically, which can be done by developing existing ideas and providing ideas or problem-solving [22].

The evaluation ability is almost the same as the elaboration indicator, and the number of students is higher in the good ranking than the very good category. As with elaboration, the evaluation indicator is also highly creative thinking; someone can certainly evaluate, find strengths and weaknesses, and decide to find the right solution to the problem. The Treffinger model not only requires students to identify problems and then find solutions but also requires them to combine knowledge and creative thinking skills to solve problems. The characteristics of assessing/evaluating include finding the truth of a question or the truth of a problem-solving plan and having reasons that can be accounted for in reaching a decision [12].

The ability to think creatively in the original indicator (Table 3) shows that the number of students in the good category (13 people) is not much different from the very good category (11 people). This can be understood because Treffinger's learning always includes discussions in its activities. The existence of discussions can reveal ideas and concepts. The ideas and concepts obtained are solutions to problems using situations different from usual and related to the ability to create something that already exists into something new. It can produce extraordinary ideas to solve problems [23]. Students try to solve problems and provide

from fluency; students can utilize learning resources well. For example, when choosing an appropriate anatomical image for their assignment, students adjust the image and concept very well. The characteristics of fluency indicators include generating many ideas and providing many answers, while flexibility indicators include presenting different concepts and producing a variety of answers [12]. In learning, teachers must be able to coordinate the atmosphere and time of the class and summarize the material being taught [19]. Students can be more active and express their ideas when solving problems [20].

solutions to their problems [[24]. Emphasized that originality is related to the ability to generate new ideas [25].

Learning Outcomes

The learning outcomes of students' Animal Structure after learning with the Treffinger model showed good and very good ratings; there were no students with very poor to fairly good ratings. As many as 8 (33%) students are in the very good category, and 16 (67%) students are in the good category (Table 4). This result can be understood because learning with the Treffinger model contributes to solving problems creatively through group activities that balance thinking and various ideas, which means choosing the best option among many ideas. The Treffinger learning model trains students to solve problems so that learning experiences are obtained independently, and presenting the results of problem-solving creates a strong sense of self-confidence, which impacts good learning outcomes. In the Treffinger learning model, the cognitive domain is developed at each level or step of the Treffinger model and can develop students' affective aspects [26]. Teachers must support students to find and discuss various solutions by providing sufficient time [27].

Table 4. Learning Outcomes of Animal Structure

No	Category	Total	%
1	Good	16	67
2	Very good	8	33

The number of students who obtained learning outcomes in the good category was higher than those in the very good category, and this shows that the learning carried out not only provides problem-solving skills but also increases social interaction, develops skills, and makes students learn to be responsible and cooperate. This also means that students who carry out the learning process and understand the products of the process can explain in detail using their language, even though only 8 students obtained results in the very good category. In line, the Treffinger learning model affects learning outcomes with very good criteria [28]. The advantages of Treffinger learning include a).

Allowing students to understand concepts by solving a problem; b). Making students active in learning; c). This develops students' thinking skills because problems are presented at the beginning of learning and allows students to find solutions [7].

Conclusion

The Treffinger learning model trains and facilitates students to think creatively and develop themselves both academically and practically to find solutions in solving problems. Based on the results and discussion, it can be concluded that: (a) Students' creative thinking skills vary in the very good and good categories. The number of students in the good category is higher than in the very good category; (b) The very good category is most often achieved by students in the fluency indicator, while the good category is most often achieved by students in the elaboration indicator; (c) Learning outcomes in the good category are higher than in the very good category; (d) Through the Treffinger learning model, students' creative thinking skills and Animal Structure learning outcomes vary in the good and very good categories.

Author's Contribution

Kusmiyati: designed the research and compiled the scientific article. I Wayan Merta: Compiled and validated the research instrument.

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