

THE EFFECT OF MIND MAPPING ASSIGNMENT ON CREATIVE THINKING SKILLS AND BIOLOGY CONCEPTS MASTERY IN SENIOR HIGH SCHOOL

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Abstract: This study aims to ascertain how grade XI students at SMAN 8 Mataram's mind mapping assignment affects their capacity for original thought and their grasp of biological ideas. On samples chosen by random sampling, this study employed a pretest-posttest control group design and a quasi-experiment. While written assessments in multiple-choice questions were used to get information on topic mastery, mind-mapping assignments were used to gather information on students' creative thinking abilities. The findings demonstrated that mind-mapping exercises significantly impacted students' comprehension of biological topics and enhanced their capacity for creative thought, moving them from less creative to highly creative criteria. Pearson correlation test results showed a positive relationship between creative thinking skills and students' mastery of biological concepts in the medium correlation category. Mind mapping assignment has a positive influence in improving creative thinking skills and mastery of biological concepts of high school students, where students become more creative by simply connecting their prior knowledge with subsequent knowledge.

Keywords: *Mind Mapping, Creative Thinking Skills, Concepts Mastery*

INTRODUCTION

The skills of the twenty-first century are becoming more and more important as civilization expands. These skills include life and job skills, learning and innovation skills, and technology skills related to information media. Learning and innovation abilities grow due to problem-solving, critical thinking, creativity, and invention [1]. The four are critical thinking, creative and inventive thinking, communication, and collaboration [2].

One of the 4C skills is creative thinking skills. Creative thinking is one of the four 21st-century competencies. Creative thinking skills are influenced by the learning process that encourages students to think about problems, especially ill-structured problems [3], actively involves students in finding their problem-solving, and encourages student-centered learning, with teachers only as facilitators [4].

Creative thinking skills can help find solutions in solving a problem that is being faced if students are given a problem and have been able to solve it by proposing new opinions or ideas well. Everyone's capacity for creative thought will grow via the phases of concept synthesis and application planning [5]. Students need to be aware of the pertinent rules in order to solve problems. These guidelines are predicated on the knowledge acquired during the educational process [6]. The initial concepts students receive will be the first step for mastering the next concept and affect their learning experience.

However, the high-level thinking skills (critical and creative thinking) of students in

Indonesia are still low. This happens because Indonesian students are generally less stimulated in the learning process at school to improve higher-level thinking skills [7]. The low level of creative and critical thinking skills is partly due to the Biology learning activities carried out so far are still limited through lectures, discussions, and practicums that are still based on teacher direction (Teacher Centered Learning) [8]. Students are also less given the opportunity to find their solution to a problem but are only faced with how to solve it, not why the solution or solution is so [9].

In terms of learning biology, learning the concept will be emphasized. So far, students still listen to biological concepts given by the teacher directly and memorize these concepts without understanding their meaning and essence. If the basic concepts received are wrong, it is challenging to correct them [10]. Learning that emphasizes concepts and processes is very important because later, the student can understand the concepts of biology in a meaningful way.

One of the efforts that can be made to solve the above problems is by using mind-mapping assignments. Mind mapping is a way that can be said to be effective and creative in making it easier for students to understand subject matter and concepts [11]. Mind mapping can be presented visually so students can connect concepts thoroughly [12]. Making mind maps involves the creator using their imagination to create images, symbols, charts, color schemes, and the ability to combine creativity and association in a single piece. According to the description above, a study

was conducted at SMAN 8 Mataram to ascertain the impact of mind mapping assignments on students' capacity for original thought and understanding of biological subjects.

RESEARCH METHODS

The study was conducted at SMAN 8 Mataram during the even semester of March and April in the academic year 2022/2023. This study uses a quasi-experiment with a pre-test and post-test control group design. The 107 participants in the research were split into 4 classes, including the whole class XI student body. The MIA-1 class was the experimental class, while the MIA-2 class was the control class. The study sample was established utilizing the random sampling technique implemented in the classroom. An inquiry learning model was used to assign a mind mapping assignment to the experimental class, whereas a traditional lecture-based learning approach was used in the control group.

The inquiry approach is used in experimental classrooms to apply learning through mind-mapping exercises. The phases involved include orienting, problem formulation, formulation of hypotheses, data collection, testing of hypotheses, and conclusion drawing.

At the orientation stage, students are given a stimulus in the form of images related to the material to focus their attention on the learning material. At the problem formulation stage, students can identify as many questions as possible that arise at the orientation stage. When formulating hypotheses, students provide temporary answers to the problems discussed together. At the data collection stage, students are formed into several groups to discuss and exchange information about the material and then work on independent tasks to make mind mappings. At the hypothesis testing stage, some students present the results of the mind mapping task classically observe and respond to the results of their friends' presentations. When concluding, the teacher and students conclude the essential points arising from learning activities about the material learned.

Table 1 Criteria for the Percentage Score of Creative Thinking Skills

Value Range	Criteria
$0 \leq q < 40$	Not Creative
$40 \leq q < 55$	Less Creative
$55 \leq q < 70$	Creative Enough
$70 \leq q < 85$	Creative
$85 \leq q < 100$	Very Creative

Data on the assessment of students' creative thinking skills were obtained through mind mapping tasks, while data on the assessment of concept mastery were obtained through tests. The

data on the value of creative thinking skills obtained in the form of a 0-100 scale, then analyzed qualitatively and categorized according to 5 criteria referring to [4], namely as follows Table 1.

Concept mastery data was analyzed using the ANACOVA test, and qualitatively analyzed according to 5 criteria referring to [13], namely as follows.

Table 2 Criteria for the Percentage of Concept Mastery Score Results

Value Range	Criteria
0 – 50	Very Low
51 – 64	Low
65 – 74	Medium
75 – 84	High
85 – 100	Very High

The Pearson correlation test was employed to determine the relationship between topic mastery and creative thinking abilities.

RESULTS AND DISCUSSION

Creative thinking skills are a way of expressing creative ideas or ideas and are one form of cognitive aspect that requires each individual to strive to produce creative solutions or products [14]. According to the definition of concept mastery given by [15], concept mastery is the capacity to comprehend, interpret, and apply information in a simpler way. Students apply the concepts and principles they learned to solve problems, which is how creative thinking is developed.

Creative Thinking Skills

Creative thinking skills are assessed through mind-mapping tasks made by students 3 times (P1, P2, and P3). Mind mapping tasks are made by students based on the material at each meeting through steps including starting from the center, determining the main idea according to the material, using color, connecting the main branches to the main idea, making branches in the form of curved lines, using one connecting word on each line and using supporting images.

The scores obtained by students who have been converted to a scale of 100, then grouped based on the criteria for creative thinking skills, then grouped again based on the number of students who get per criteria in Figure 1.

Figure 1 shows the assessment of criteria using mind mapping data. There are differences at each meeting. The percentage of students in P1, dominated by less creative criteria 73%. The percentage of students in P2, dominated by moderately creative criteria, 46%, and less creative criteria, 50%. The percentage of students in P3,

dominated by moderately creative criteria, 58%, and less creative criteria, 38%.

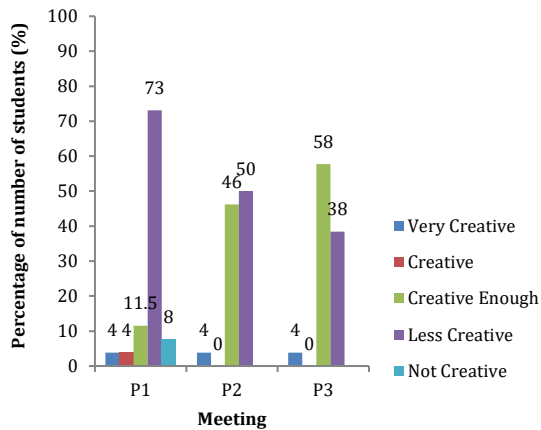


Figure 1 Percentage of Number of Students Based on Achievement of Creative Thinking Skills Criteria through Mind Mapping Tasks

Information on creative thinking abilities derived from three mind mapping assignments (P1, P2, P3). From the calculation of the average mind-mapping assignment, it is found that there is an effect of mind-mapping assignments at each meeting. The score is also increasing towards the quality of the criteria that are getting better. Students' abilities can improve in each repetition of mind mapping assignments because they become accustomed to and understand the steps and how to make mind mapping according to the directions. Mind mapping can train students to think of releasing a variety of ideas and good ideas. The average student mind mapping score is presented in Figure 2.

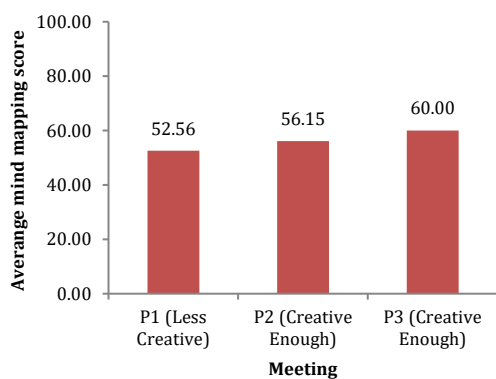


Figure 2 Graph of Average Score and Criteria for Creative Thinking Skills through Mind Mapping Tasks

According to the study's findings, mind mapping assignments help students become more adept at using their creative ideas. Mind mapping can trigger students to think about how ideas or ideas related to the concept are developed through

depicting symbols, words, lines, and colors. Mind mapping is a graphical technique that allows students to thoroughly explore their brain abilities in learning [16]. This finding indicates that mind-mapping assignments can trigger the brain to explore all its learning abilities. A study conducted [17] found that the mind mapping learning model was considered to have a positive relationship with improving students' ability to think creatively.

The results of this study prove that the average value of mind mapping tasks increases from tasks 1, 2, and 3. Qualitative improvement occurs from less creative criteria to moderately creative criteria. This indicates an upward trend towards achieving better quality criteria. The more often students make Mind Mapping, the more creative they will be [18]. Mind mapping is categorized as a creative note-taking technique that can help students develop their ability to remember material and think creatively during the learning process.

The aspects of mind mapping assessment refer to [19], namely ideas, aesthetics, skills, perseverance, and linkage, which are adapted into indicators of creative thinking skills referring to [20], namely fluency, flexibility, originality, and elaboration. Ideas and aesthetics are adaptations of fluency indicators, skills are adaptations of flexibility indicators, perseverance is an adaptation of originality indicators, and interconnectedness is an adaptation of elaboration indicators.

Concept Mastery

The results of pre-test and post-test research data on students' mastery of biological concepts in experimental and control classes have different average values. The average value of the pre-test in the experimental class was 41.20 and the control class was 34.25, meaning that students had mastery of initial concepts that were still at the same level.

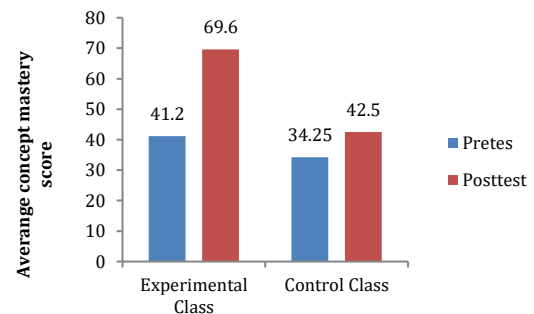


Figure 3 Graph of Average Concept Mastery Score

After being given the treatment, the average pre-test value in the experimental class using mind mapping assignment is 69.60, higher than the control class, which is 42.50. Diagrammatically, the comparison of pre-test and post-test scores of experimental and control classes is presented in Figure 3.

Table 3 Recapitulation of Pre-test and Post-test Values, and Statistical Test of Concept Mastery

Component	Experimental Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
The Number of Students	25	25	20	20
Average Score	41.20	69.60	34.25	42.50
Minimum Value	20	55	15	25
Maksimum Value	50	80	45	70
Standar Deviation	7.94	5.93	8.31	15.43
Normality Test	0.060	0.060	0.181	0.181
Homogeneity Test	0.582	0.508	0.582	0.502
Linearity Test	0.005	0.005	0.005	0.005
ANACOVA test pretest and posttest score for mastery concept of experimental class and control class ($\alpha=0,05$)			Significance value is 0.000, which is less than 0.05 ($\alpha < 0.05$), then H_0 is reject	

In Table 3, the data from the results of hypothesis testing using the Anacova test on post-test data for mastery of biological concepts for normally distributed data has a homogeneous and linear variance. The significance value is 0.000, which means less than 0.05.

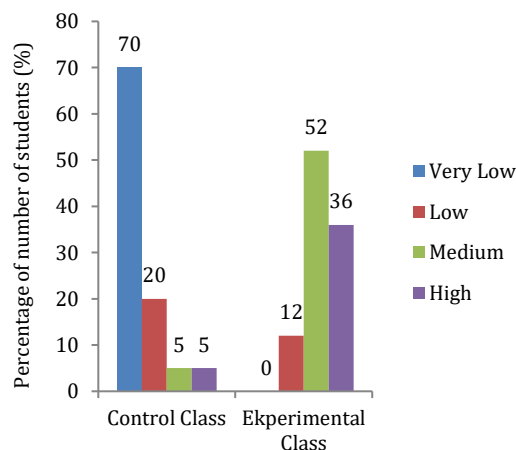


Figure 4 Comparison of Percentage Change in Concept Mastery Achievement of Post-test Results of Control Classes and Experimental Classes

Post-test results in the experimental and control groups increased, as seen in Figure 4. However, although there are none in the experimental class, there are still those in the control class that meet the extremely low requirements. The control class included very low (70%), low (20%), medium (5%), and high (5%) criteria. The experimental class included low (12%), medium (52%), and high (36%) criteria. This shows an increasing trend towards achieving better quality criteria.

Based on the study's results, it was found that before the application of learning, the two sample classes had initial concept mastery abilities that were not much different and experienced an increase after the intervention. Based on the hypothesis test using the ANCOVA test, the

significance value is 0.000, which is less than 0.05 ($\alpha < 0.05$), which shows a difference in concept mastery between the two sample classes.

The results of this study showed that mind-mapping assignments had a significant effect on students' concept mastery. This finding supports the research results, stating that mind-mapping strategies can improve students' concept mastery [21]. Mind mapping assignments tend to provide meaningful experiences for students where students can connect one concept with another. The mind mapping assignment in this research can train students to connect one concept with another, be proficient and precise in determining the direction of the arrows, and place suitable colors. Exciting and unique because when making it, students channel ideas or ideas according to their abilities.

Concept mastery is capturing understanding, such as expressing the material presented in a more straightforward, easier-to-understand form. Using Mind mapping does not need to capture every word explained. It is enough to capture the main idea points conveyed [21] and improve understanding fun because Mind mapping combines students' unlimited creativity and imagination. It is to be more fun when compared to taking ordinary notes [22].

Relationship between Creative Thinking Skills and Concept Mastery

Students' mastery of topics and capacity for creative thought are indicators of a successful learning process. The degree of student comprehension of the content offered throughout the learning process is determined by their capacity for original thought and their grasp of concepts. According to the findings of Pearson's correlation analysis, students' conceptual knowledge and their capacity for creative thought have a strong and positive link [20].

Table 4 Correlation Test Results between Creative Thinking Skills and Concept Mastery

		KBK	PK
KBK	Pearson Correlation	1	.415*
	Sig. (2-tailed)		.039
	N	25	25
PK	Pearson Correlation	.415*	1
	Sig. (2-tailed)	.039	
	N	25	25

Table 4's data indicates a connection or association between creative thinking skills and concept mastery because the Sig value is 0.039 and less than $\alpha = 0.05$. Concept mastery and creative thinking abilities have a 0.415 connection coefficient. There is a relationship between students' mastery of concepts through mind-mapping assignments and their creative thinking skills, as demonstrated by test results using Pearson Correlation. The results of the correlation coefficient calculation show a significant relationship with a moderate correlation category. The data is normally distributed.

Students' ability to think creatively and grasp the material demonstrates how well a learning process is going. Students' comprehension of the content presented during the learning process will rise due to their ability to think creatively and grasp concepts. There is a strong and favorable correlation between students' conceptual comprehension and their creative thinking abilities, according to research from [23].

Students apply the concepts and principles they learned to solve problems, which is how creative thinking is developed. Concept mastery is a learning activity for students to understand and understand an object, experience, and observation of students in solving problems. Students' thinking skills have described the ability of students' cognitive processes, where students who master high-level thinking skills are proven to have surpassed low-level thinking skills or basic-level thinking skills, including the ability to understand and master concepts [24].

Creative thinking skills can help solve a problem if students are given a problem and can solve it by proposing new opinions or ideas well. Students need to be aware of the pertinent rules in order to solve problems. These guidelines are predicated on the knowledge acquired during the educational process. The initial concept students receive will be the first step to mastering the next concept and affect their learning experience.

The achievement of creative thinking skills indicators of fluency (ideas and aesthetics), flexibility (skills), originality (perseverance), and elaboration (interconnectedness) of each student must be different. Students with high ideas and aesthetics do not necessarily have high skills, and

vice versa. For students with high perseverance, it is not sure that the connection is high, and vice versa. This also applies to the concept mastery score, where the pre-test and post-test achievements are mostly different. This indicates a tendency for a better improvement between creative thinking skills and students' concept mastery, where students with creative thinking skills have good concept mastery or understanding. Research [25] supports that creative thinking skills have a relationship with learning outcomes while improving student academic achievement.

CONCLUSIONS

The mind mapping assignment affects improving the creative thinking skills of class XI students at SMAN 8 Mataram seen from the increasing trend in the achievement of mind mapping assignment scores on three assessments, namely from less creative criteria to quite creative. It has a significant effect on students' mastery of biological concepts. There is a positive relationship between creative thinking skills and students' mastery of concepts through mind-mapping assignments, which shows a significant relationship in the medium correlation category.

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