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Constructivism-Based Learning Module for Middle School Students' Creative Thinking on the Interaction of Living Things and Their Environments

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A B S T R A C T

Constructivism-based learning module research aims to analyze the effect of using the module on the creative thinking of junior high school students regarding the interaction of living things and their environment. This quasi-experimental study used the Pretest Posttest Control Group design with the research subjects being grade VII students of SMP Negeri 2 Kampar. At the beginning of the implementation, students were given creative thinking pretest questions, then students studied constructivism-based learning modules and were given posttest questions. The parameters of creative thinking are 4 indicators, each indicator has 5 questions. Hypothesis analysis using t-test. The results showed that the control class has an average pretest of 61.75 (quite creative). Meanwhile, in the experimental classhas an average posttest of 81.25 (creative). The results of hypothesis testing show tcount > ttable with a value of 3.891 > 2.010. In conclusion, the use of constructivism-based learning modules has an effect on increasing students' creative thinking regarding the interaction of living things and their environment.

1. Introduction

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Human resources need improvement in the quality of education. Where students must be active, able to think at higher levels to form a good attitude. Education has a goal to develop the potential of students to become human beings who are faithful, devoted, have noble character, have knowledge, think creatively, and act independently in accordance with the function of national education in the Law of the Republic of Indonesia in 2003 (Rahardjanto, 2019).

The results of the questionnaire obtained at the Science Subject Teacher Group (MGMP) in Kampar Regency showed that 80% of teachers had not used the learning module. Existing modules have not used an approach that is able to build

students' initial knowledge. Researchers set SMP Negeri 2 Kampar to be the subject of research, because of the limited teaching materials and less varied teaching materials. From the observations made in class VII obtained several problems in the learning process, namely: (1) limited and less varied teaching materials, (2) teachers have not used learning modules that are able to make students learn independently and build their own concepts based on activities that take place in activities teaching and learning, (3) students are not fluent in generating ideas, asking questions, answering questions, and expressing ideas; (4) students' ideas are less varied to see a discourse from different angles; (5) students' thinking is not new and the ideas given are not detailed.

Implementation of the 2013 curriculum, students become the center of learning (student centered) where schools must prepare facilities and infrastructure that support the learning process. One of them is the existence of teaching materials and approaches used in learning to make students active and creative. An approach that can make students active and think creatively in the learning process is by using a constructivist approach (Yustina, 2019).

Constructivism is an ideal combination of behavioral and cognitive in which students have a solid and solidly formed idea related to the phenomena they are concerned with in their lives. Constructivism includes 5 phases, namely orientation, originator of ideas, structuring of ideas, application of ideas, and reflection. Constructivism-based learning module teaching materials give an impression on students and make students active and creative in learning activities (Nurdalilah, 2019). Based on this description, this study aims to determine the effect of constructivism-based learning modules on students' creative thinking in the interaction of living things and their environment. The benefits in this study make students learn independently and can contribute learning resources as enrichment materials, especially KD 3.7 Analyzing the existence of an interaction between living things and their environment as well as population dynamics.

2. Methodology

The quasi-experimental research in this research was carried out from April 2020 to January 2021, at SMP Negeri 2 Kampar with a population of 75 people who were grouped into 3 classes and samples were control and experimental classes with random sampling technique. The research parameter in the research design is the pretest posttest control group design (Table 1).

Table 1. Research Design

Class	Uji Pra (*Pretes*t)	*Treatment*	Ujian Pasca
Experiment	O_1	X	O_2
Control	O_3	-	O_4

Information:
$O1$ = Pretest is used to test the initial knowledge of the experimental class
$O3$ = Pretest is used to test the initial knowledge of the control class

O2 = Posttest is used to test the final knowledge of the experimental class
O4 = Posttest is used to test the final knowledge of the control class
X = The treatment given by the learning module based on constructivism and mind mapping (Yustina, 2019)

The technique of collecting and analyzing test data on creative thinking pretest and posttest as many as 20 questions on the indicators of fluent thinking, flexible thinking, authentic thinking, and thinking in detailing each indicator consists of 5 questions. To determine the students' initial abilities, a pretest was given, and a posttest was carried out after the material was completed and the entire treatment process was carried out. The questions used for the pretest and posttest are the same questions, this is intended so that there are no differences in knowledge and understanding that occur. The grid for creative thinking questions (Zubaidah, 2017) can be seen in Table 2 below.

Table 2. Creative Thinking Questions

No	Indicator	Descriptor	No Instrument	Total
1	Fluency	a. Answer with a number of answers if there are questions b. Fluently expresses his ideas c. Can quickly see the faults and weaknesses of an object or situation	1,3,8,10,15	5
2	Flexibility	a. Provide various interpretations of an image, story, or problem b. If you are given a problem, you usually think of different ways to solve it c. Classify things according to different divisions (categories)	2,7,12,13,16	5
3	Originality	a. Thinking something out of the ordinary b. Able to give birth to new and unique expressions c. After reading or hearing ideas, work on finalizing new ones	5,9,11,14,18	5
4	Elaboration	a. Looking for a deeper meaning to the answer or problem solving by performing detailed steps b. Develop or enrich the ideas of others c. Tried/tested the details to see which way to go	4,6,17,19,20	5
		Number of Questions		20

Analysis of the percentage increase per indicator of creative thinking, in order to determine the increase in students' creative thinking per indicator. For the analysis of the percentage improvement per creative thinking indicator, the data obtained from the results of the creative thinking ability test were analyzed using a formula.

$$\text{Value} = \frac{Jumlah\ Skor\ yang\ diperoleh}{Jumlah\ skor\ maksimal} \times 100\%$$

The criteria used to determine students' creative thinking (Djandji, 2014) are in Table 3.

Table 3. Intervals and Categories of Students' Creative Thinking

Interval %	Value Weight	Category
$85 \leq x < 100$	5	Very creative
$76 \leq x < 85$	4	Creative
$60 \leq x < 76$	3	Pretty Creative
$55 \leq x < 60$	2	Less Creative

To improve creative thinking, the data used is in the form of a gainscore, which is the result of reducing the average value of the final test (posttest) with the average value of the initial test (prettest) divided by the result of the reduction of the maximum score with the average score of the initial test (prettest).). The results of the interpretation of the gain index (g) (Hake, 2017) for creative thinking can be seen in Table 4.

Table 4. Normalized Gain Index Value

Normalized Gain Index	Persentase	Classification
$(g) \geq 0,70$	>70	High/Highly Effective
$0,30 \leq (g) \geq 0,70$	56-76	Moderate/ Effective
$(g) < 0.30$	40-50	Low/ Less Effective

3. Results and Discussion

The cover of the constructivism-based learning module and mind mapping is designed according to the material on the interaction of living things and their environment. The cover module is designed using a Cover Page which can be seen in Figure 1.

This learning module contains steps of 5 phases of constructivism learning activities. Phase 1 orientation, which requires students to construct initial knowledge and relate it to the learning experiences they have gone through. An example of a design for constructivism learning phase 1 orientation can be seen in Figure 2.

Figure 1. Cover of Constructivism-Based Learning Module and Mind Mapping

Figure 2. Display of questions for phase 1 idea orientation

Phase 2 is the originator of ideas, namely by asking questions that are in accordance with the phenomena, issues, events related to the topic shown in Figure 3.

Figure 3. Display of questions in phase 2 of idea generation

Phase 3 of structuring ideas, namely asking more challenging questions as shown in Figure 4.

Figure 4. Display of questions in phase 3 structuring ideas

Phase 4 of the application of ideas, which requires students to be active in responding to environmental problems that are close to their daily lives, can be seen in Figure 5.

Figure 5. Display of questions in phase 4 of the application of ideas

Phase 5 reflection makes conclusions about the lesson material that has been passed can be seen in Figure 6.
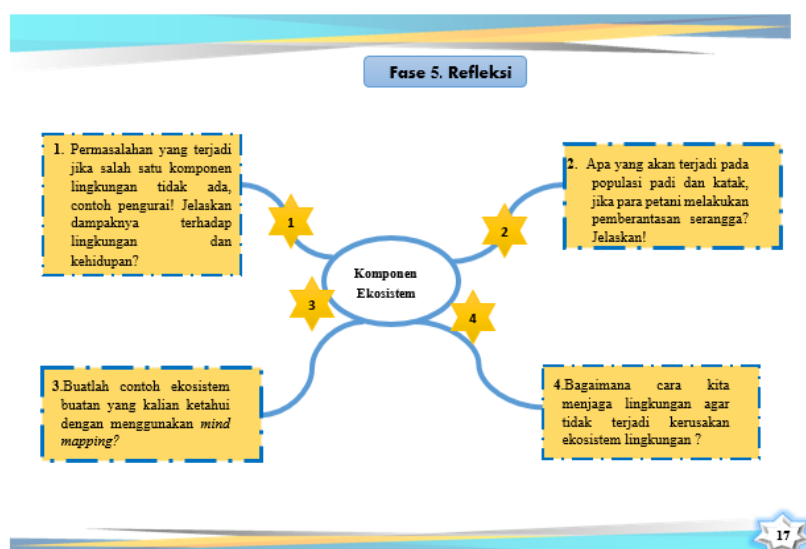

Figure 6. Display of questions for phase 5 reflection

Furthermore, after the evaluation/assessment the formulation of the module is designed including: formative assessment of creative thinking as well as answers, feedback, and follow-up. An example of a module formulation design can be seen in Figure 7.

Figure 7. Display module formulation

The module formulation contains questions with formative assessments to find out which materials are mastered by students with creative thinking questions accompanied by answer keys, so that students are able to assess the extent of their mastery of the material. In addition, there is feedback to calculate the correct answers done by students using the mastery level formula with intervals and categories of values obtained.

The value obtained by students is more than 70%, then students can continue studying the next module, if the value obtained is less than 70% then a follow-up is carried out where students must read and understand the material in the module.

The results of the research on students' creative thinking are as follows:

Table 5. Values of pretest, posttest and N-Gain for Control and Experiment Class

Class	*Pretest*			*Posttest*			*N-Gain Index and categories*	
	Value	**Criteria**	**Standar Deviasi (SD)**	**Value**	**Criteria**	**Standar Deviasi (SD)**	***Indeks n-Gain***	**Category**
Experiment	70,5	Pretty Creative	8,954	88,5	Sangat Kreatif	5,649	0,330	Efektif
Control	61,75	Pretty Creative	9,713	81,25	Kreatif	7,000	0,309	Efektif

Table 5 shows that the average pretest score of students in the experimental class is 70.5, the criteria are quite creative with a standard deviation of 8.954 but after receiving treatment using the module, the posttest average is 88.5 criteria, very creative with a standard deviation of 5.649 with an N-Gain 0.330 (effective classification), while the control class has a mean pretest score of 61.75 with a fairly creative criteria with a standard deviation of 9.713 and a posttest average of 81.25 with a creative criterion with a standard deviation of 7,000 with an N-Gain of 0.309 (effective classification).

The average pretest creative thinking is not much different in the experimental class with the control class, while the posttest creative thinking is very significant, this means that the module developed is very effective in improving students' creative thinking. Constructivism-based learning modules can improve students' creative thinking (Alharthi, 2020), namely from the average pretest score of 70.5 increasing to an average posttest score of 88.5, which means an increase of 18.0. So by using the learning module there is a difference between student achievement before and after.

The use of constructivism-based learning modules and mind mapping in the experimental class makes learning easier for students to understand and interesting, a lot of material with the help of mind mapping media can be more easily understood by students compared to the control class with conventional learning that only uses textbooks and worksheets .

Thus overall the experimental class is high compared to the control class, students are better able to express their ideas or ideas with the 5-phase activity in constructivism that can train students' creative thinking. The development of constructivism-oriented modules equipped with mind maps makes students very interested in learning, increasing memory and improving learning outcomes (Angela, 2019).

The comparison of the average value of each creative thinking indicator in the control class and the experimental class can be seen in Table 6 below.

Table 6. Indicators of the value of creative thinking in the control class and the experimental class

No	Learning Motivation Indicator	Class Control			Experiment Class		
		Pretest	*Posttest*	N-Gain Index and categories	*Pretest*	*Posttest*	N-Gain Index and categories
1	Fluent	65 (creative)	85 (very creative)	0,333 (effective)	72 (quite creative)	90 (very creative)	0,339 (effective)
2	Flexible	62 (quite creative)	80 (creative)	0,286 (less effective)	70 (quite creative)	87 (very creative)	0,309 (effective)
3	Authenticity	60 (quite creative)	82 (creative)	0,338 (effective)	75 (quite creative)	92 (very creative)	0,340 (effective)
4	Detail	60 (quite creative)	78 (creative)	0,277 (less effective)	65 (quite creative)	85 (very creative)	0,333 (effective)
	Average	61,75 (quite creative)	81,25 (creative)	0,309 (effective)	70,5 (quite creative)	88,5 (very creative)	0,330 (effective)

Based on Table 6, the indicators of fluent thinking in the control class obtained an average pretest score of 65 (quite creative) and an average posttest score of 85 (very creative) with an N-Gain of 0.333 (effective category), while the experimental class obtained an average pretest of 72. (quite creative) and posttest average of 90 (very creative) with an N-Gain of 0.339 (effective category), judging from the indicators of fluent thinking in the control and experimental classes, obtaining this effective category means that students have shown fluent thinking in responding to questions from the teacher.

Thinking flexible control class average pretest 62 (creative enough) and posttest average 80 (creative) N-Gain index 0.286 (less effective category), the experimental class obtained an average pretest score of 70 (quite creative) and an average posttest average of 87 (very creative) with N-Gain 0.309 (effective category), seen from flexible thinking the control class obtained the less effective category and the experimental class obtained the effective category, this means that the experimental class is better able to provide various alternative answers to the existing questions than the experimental class. control class.

Thinking of the authenticity of the control class the average pretest 60 (quite creative) and posttest average 82 (creative) N-Gain index 0.338 (effective category), the experimental class obtained an average pretest score of 75 (quite creative) and an average value posttest 92 (very creative) with N-Gain 0.340 (effective category), judging from the indicators of thinking authenticity of the control class and the experimental class, the effective category means that students are able to express ideas and ideas with confidence.

Thinking into detailing the control class, the average pretest was 60 (creative enough) and the posttest average was 78 (creative) with an N-Gain of 0.277 (less

effective category), the experimental class obtained an average pretest of 65 (creative enough) and an average score of 65. The posttest average was 85 (very creative) with an N-Gain of 0.333 (effective category), judging from the indicators of thinking in detailing the control class obtained the less effective category and the experimental class obtained the effective category, this means that the use of constructivism-based learning modules and mind mapping in the experimental class makes students able to think in detail, able to develop and enrich the ideas of others.

The N-gain test was carried out to find out how much creative thinking increased students at KD 3.7 analyzing the interactions between living things and their environment as well as population dynamics due to these interactions before and after using the constructivism learning module with N-Gain criteria, namely g 0.7 = high , 0.3 g > 0.7= moderate and g < 0.3 = low. The N-Gain value for the experimental class is 0.330, where 0.3 g >0.7 is in the effective category and the N-Gain value for the control class is 0.309, where 0.3 g >0.7 is in the effective category. So the constructivism learning module has an effect on students' creative thinking with a higher N-Gain value for the experimental class than the control class. Research conducted (Hidayati, 2020) states that the use of constructivism-based learning modules affects students' creative thinking actively and productively based on previous knowledge.

Creative Thinking Hypothesis Test

The next stage is a t-test for creative thinking variables in the control class and the experimental class. The results of the t-test are in Table 7.

Table 7. Independent t-test of Students' Creative Thinking

N	Df	Sig.	T_{hitung}	T_{tabel}
50	48	0,000	3,891	2,010

Table 7 shows student learning outcomes with a significance (2-tailed) of 0.000 < 0.05, so it can be stated that H0 is rejected and H1 is accepted. That is, the influence of constructivism-based learning modules on students' creative thinking. In addition, the value of tcount > ttable is 3.891 > 2.010, which means that H0 is rejected and H1 is accepted stating that there is a significant effect between the two classes. The results of the overall t-test state that there is an influence of students' creative thinking on the use of constructivism-based learning modules.

The aspect of fluency in terms of students' ability to answer questions and convey their ideas. It can be seen from the ability of students to answer questions, students can answer questions correctly based on the ideas they have, where students in the control class and experiment class are very creative in solving problems thinking smoothly. The question of the fluent thinking aspect aims to stimulate students' mindsets in generating various ideas.
Based on the posttest mean value and n-gain index, the experimental students' fluent thinking ability was higher than the control class. In the learning process of the experimental class students have been trained by being given problems or

phenomena that are able to stimulate students' ideas in answering questions with various ideas, so that students' fluent thinking skills are higher. While in the control class, students tend to expect explanations and answers from the teacher without first trying to find answers. In line with research (Rahardjanto, 2019) conventional learning makes students less creative in expressing their thoughts where students are only learning objects who know something, not able to do something.

Second, the aspect of flexible thinking in terms of students' ability to provide various interpretations of an image or problem; complete a variety of different ways; and classify different divisions (categories). It can be seen from the way students answer questions are able to interpret questions and provide alternative answers so that they are able to develop thinking skills in accordance with the reality obtained in everyday life. In addition, with the 5-phase constructivism module applied in the learning process, the idea-structuring phase will improve students' flexible thinking skills. Research (Qomariyah, 2021) also states that in flexible thinking students must come up with varied ideas in answering a question by developing students' rational abilities.

Third, the aspect of originality in terms of students' ability to answer questions based on their own ideas or findings. Where students are required to be able to think of answers in accordance with the knowledge and understanding based on the subject matter that is passed. The aspect of original thinking in the experimental class is higher than the control class because learning using constructivism and mind mapping-based modules makes students think more freely and freely according to their own thoughts, without being burdened, without fear of being wrong where every answer is appreciated by the teacher and it will be formed. by thinking about the authenticity of students. In line with that (Acesta, 2020) states that students' original thinking skills are able to answer questions in their own sentences without having to use book language or other references.

Fourth, the aspect of the ability to think in detail (elaboration) in terms of the ability of students to detail an idea and be able to provide in-depth answers. It can be seen from the ability of students to answer, where students are required to be able to analyze questions and be able to develop them by taking detailed steps. With the problem of thinking in detail, it trains students to be able to detail ideas in more detail in accordance with the constructivism phase of structuring ideas where students have been trained to think in detail. In line with research (Yuningsih, 2018) which states that the ability to think in detail (elaboration) is used to develop or detail ideas in more detail and interestingly with students understanding and mastering the material well.

Based on the results obtained before the treatment, the lowest creative thinking indicator in the experimental class and control class was thinking in detail. After the treatment, the experimental class improved much than the control class, because the experimental class was more fluent in expressing their ideas based on the activities they went through with 5-phase constructivism compared to the

control class. The indicator of flexible thinking makes students' thinking skills in responding to a problem more developed by being able to think of various ways to solve it. Thinking authenticity in the experimental class is higher than the control class, it can be interpreted that the experimental class using the constructivism learning module and mind mapping can think about something unusual, reveal something new based on the ideas obtained in the lesson.

The indicator of thinking in detail is an indicator that requires a deep thought for students, students are required to be able to analyze a problem, work in a detailed way with systematic steps. With constructivism learning modules and mind mapping as teaching materials, students give a deep impression for students to be able to construct their knowledge so that their knowledge changes based on the activities they go through, making it easier to understand the subject matter in teaching and learning activities. Research conducted by (Alharthi, 2020) states that constructivism-based learning modules can improve creative thinking, making students active and productive based on the expertise and understanding embedded in them.

The ability to think creatively in each class increases. After the treatment of detailed thinking obtained the lowest average, this is because detailed thinking requires a deep thought for students, students are required to be able to analyze a problem, work in detail with systematic steps. While the original thinking indicator obtained the highest average where the 5-phase constructivism approach students were free to express their ideas and thoughts until new ideas and thoughts were formed as a result of assimilation and accommodation of students themselves by developing thinking activities in all directions.

It was concluded from the overall thinking indicators detailing obtaining N-gain with a less effective category, this is because students are less able to provide various alternative answers and analyze questions in detail, students still use the language in books and LKPD have not been able to issue ideas and his own thoughts.

The results of the treatment in the experimental class were higher than the control class without treatment. In line with the results of the study (Simamora, 2020) that the results of the t-test on the experimental and control groups showed different results, where the experimental group with the treatment of learning resources in the form of learning modules obtained effective results compared to the control class without treatment. Innovative teaching materials in learning are able to make students think creatively (Yustina, 2020).

4. Conclusion

This research has shown that the constructivism learning module has an effect improvement of students' creative thinking on the indicators of fluent thinking, flexible thinking, authentic thinking and detailed thinking. Overall, the N-Gain

value is obtained with a very effective category. Generally, the constrctism-based learning module is effective to be used in the real class.

Acknowledgement

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