

The Level of Students' Creative thinking Skills in Solving Probability Problem through Scientific Approach

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Abstract— This study aims at describing Mathematics students' creative thinking skills through scientific approach. This study employed descriptive study with qualitative approach and the data collection employed test to determine the levels of students' creative thinking skills. Three indicators of creativity comprised of fluency, flexibility, and novelty. Those indicators determined the five levels of the students' creative thinking, inter alia (0) not creative, (1) hardly creative, (2) fairly creative, (3) creative, and (4) very creative. The research findings have found that there are four levels of student' creative thinking. Every group of creative thinking level in completing the test through scientific approach are able to accomplish the test using divergent stages. The creativity indicator is evident in every step of scientific approach. The steps of scientific approach are observing, asking, trying, reasoning, and communicating.

Keywords— Levels of Creative Thinking, Scientific Approach.

I. INTRODUCTION

Education is an important issue inseparable from human life. The education quality in Indonesia is considered still not good enough as measured by the learning process or the students' learning outcomes. To date, students' competence, which is deemed essential for students, is in fact given only peripheral priority [1].

In order to improve those qualities, the government always makes improvements to every curriculum across education levels and, these days, they take into consideration the curriculum of 2013. According to Hosnan, learning activities in 2013 curriculum are directed to empower every student's potential in order to achieve expected competencies through the efforts to grow and improve their attitude, knowledge, and skill [2]. Scientific approach is one of the approaches applied in 2013 curriculum. The learning process using scientific approach is a learning system designed in such a way to empower students to actively construct concepts, judgements, or principles through observing stages (to identify and discover problems), propose or formulate

hypothesis, collect data using various techniques, analyse problems, draw conclusion and communicate learnt concepts. Therefore, they can solve problems at hand. Applying the scientific approach requires particular conditions and learning environments, which ensure that students play an active role in every learning process [3]. The scientific learning process is a combination of learning processes focusing on exploration, elaboration, and confirmation complemented by observing, examining, trying, reasoning, and communicating [4].

A fun learning process is not understood merely the extent to which students feel interested in it but also to what extent they are capable of searching and finding out learning information and then constructing it into a new comprehension [3]. The process of searching and finding the information independently by the students in order to construct the understanding becomes the hallmark of the implementation of scientific approach. Recently, the scientific learning process has been implemented in the schools that apply the curriculum 2013 but it focuses only on the scientific learning process but it has not been able to improve creative thinking ability.

The urgency of creative thinking ability is stipulated in Government Regulation Number 19 of 2005 concerning National Education Standard Article 19 Section 1. It states that learning process in educational unit is held interactively, inspiring, fun, challenging, and motivating to learners in order to take active role in learning. What is more, the learning process is to provide enough space for initiative, creativity, independence with talent, interest, and the physical as well as psychological development of learners [5]. This study applied three components frequently used according to Silver, which include fluency, flexibility, and novelty. Silver states that to assess the creative thinking ability of children and adults The Torrance Tests of Creative Thinking (TTCT) oftentimes comes into use. The three key components of creativity assessed by TTCT are fluency, flexibility, and novelty [6]. According to Siswono, fluency refers to a students' ability in generating the right solution to various problems, and flexibility refers to students' ability in

solving the problems using divergent solutions. Another concept, novelty, refers to a students' skill in proposing various right solutions or one "unusual" answer beyond their knowledge level [7].

Table.1: The indicators of creative thinking skills

The Characteristic of Creative Thinking	The Creative Thinking Indicators
Fluency	The students are able to solve problem correctly and fluently.
Flexibility	The students are able to solve problems with various solutions.
Novelty	The students are able to create a new problem or different ideas from problems in general.

Furthermore, those three indicators determined the five levels of students' creative thinking, namely (0) not creative, (1) hardly creative, (2) fairly creative, (3) creative, and (4) very creative. The Levels of Mathematical Creative Thinking (LMCT) are a stage of hierarchy thinking ability categorized based on fluency, flexibility, and novelty. Using LMCT in learning Mathematics, teachers can measure the levels of students' creative thinking. Furthermore, they can improve students' creative thinking skills. This study applied the Levels of Mathematical Creative Thinking (LMCT) s proposed by Siswono, comprising of level 4, level 3, level 2, level 1, level 0 as presented in table 2 below.

Table.2: Levels of Creative Thinking

Levels of Creative Thinking	Indicators		
	Fluency	Flexibility	Novelty
4 (very creative)	√	√	√
3 (creative)	-	√	√
	√	-	√
	√	√	-
2 (fairly creative)	-	√	-
	-	-	√

1 (hardly creative)	√	-	-
0 (not creative)	-	-	-

Based on the explanation above, this study deems necessary to conduct a study entitled "The Level of Students' Creative Thinking Skills in Solving Probability Problem through Scientific Approach".

II. METHODS

This study employed descriptive research with qualitative approach. The participants consisted of four students selected from each of creative group, creative group, hardly creative group, and non-creative group in Class VIII-B of SMPT Madinatul Ulum Jenggawah Jember. The participants were not selected randomly because the subjects were selected from each group level of creative thinking by testing the participants prior to conducting the study.

The tests were given to all students in class VIII-B who worked in groups available. Based on the test, the students were classified into four levels of creative thinking, namely LCT 0, LCT 1, LCT 2, and LCT 3. From these 9 (nine) groups, one group was chosen to be selected as research subject; therefore, there were four groups of research subject. The test included tasks deploying scientific approach. The tasks included open-ended questions that gave the students the opportunity to generate divergent solutions and answers. Afterward, four groups were classified based on the levels of creative thinking skills.

The task given to the students are presented as follows:

Sebuah dadu bersisi empat dilemparkan sebanyak 600 kali. T
muncul mata dadu 1 sebanyak 200 kali, mata dadu 2 sebanyak 150 ka
matu dadu 3 sebanyak 25 kali.

- Tentukan peluang teoritik muncul mata dadu 4 pada percobaan ter
- Tentukan peluang empirik muncul mata dadu 4 pada percobaan te
Berilah alternatif penyelesaian lebih dari satu.
- Bandingkan hasil (a) dan (b), kemudian buatlah kesimpulan
percobaan tersebut!

III. FINDINGS AND DISCUSSION

The results of test given to 36 students of the grade VIII-B are presented in the pie chart as follows.



Fig.1: The Data of Student's Creative Thinking Level in Class VIII-B

After grouping the levels of creative thinking, one group was selected respectively from each level of creative thinking as the research subject. The results of scientific approach test based on the levels of creative thinking are presented as follows.

1. The Level of Students' Creative Thinking of LCT 0
 - a. In the observing stage, group LCT 0 was not able to explain the task using their own sentences. The students understood the meaning of the task because they could write and mention what were known and asked in the questions.
 - b. In the stage of questioning, group LCT 0 did not write anything on their test sheet.
 - c. In the stage of trying/collecting the information, group LCT 0 answered only as requested, while in the process of doing the test, this group seemed to joke and did not put serious efforts on the task. Only one student seemed busy reading the question, even though this student could not solve it.
 - d. In the stage of reasoning, group LCT 0 answered questions as requested. Only one student were actively trying to solve the question. There was no interaction in this group.
 - e. In the stage of communicating, group LCT 0 wrote the result as requested. They spent more time on talking more than working on their task when the other groups were busy working on their test.

These findings showed that the process of scientific approach was not performed in detail and just simply dealt with answering the questions. Therefore, group LCT 0 was categorized on the non-creative level because in the stage of reasoning, the works of the group did not fulfil the creative thinking indicators.
2. The Level of Creative Thinking of LCT 1

- a. In the stage of observing, group LCT 1 wrote the initial information as requested without translating it into mathematical terms although they 1 comprehended the question purpose. They 1 could explain the meaning of the question using simple sentence.
- b. In the stage of questioning, group LCT 1 wrote down one question they had not understood and then given simple answers to the questions.
- c. In the stage of trying/collecting the information, group LCT 1 answered the questions correctly and they properly collected required information.
- d. In the stage of reasoning, group LCT 1 could solve the problems correctly, even though they were only able to write down one solution. They did not seem to be trying to find another idea to solve it while there was an instruction to generate more alternative solutions. Therefore, they only produced one way of completion.
- e. In the stage of communicating, group LCT 1 could conclude the discussion with simple sentence.

According to the explanation above, the process of scientific approach was in performed in its entirety, although they just provided simple answers. In the stage of reasoning, this group had written down one alternative solution correctly; thus, they had fulfilled the fluency indicator. Therefore, theywere categorized into the *hardly creative* level.

3. The Level of Creative Thinking of LCT 2.
 - a. In the stage of observing, group LCT 2 wrote down the initial information as requested, even though they could explain the initial information using their own sentences fluently.
 - b. In the stage of asking, group LCT 2 could answer the teacher question correctly and wrote down one question they had not understood.

- c. In the stage of trying/collecting the information, group LCT 2 did it correctly but their work was still imperfect.
- d. In the stage of reasoning, group LCT 2 could solve the problem with two alternative solutions, one of which was finished correctly and completely and the other of which was made with imperfect answer.
- e. In the stage or communication, group LCT 2 wrote down the answers well and correctly. In addition, the results of their discussion were correct.

These findings revealed that the process of scientific approach was performed in detail, regardless of incomplete stage. In this reasoning stage, the group had written down two alternative solutions even though the second solution was not complete. This group fulfilled the flexibility indicator because they could write more than one solution. Therefore, group LCT 2 was categorized as the *fairly creative* level.

4. The Level of Creative Thinking of LCT 3
- a. In the stage of observing, group LCT 3 could explain the question using their own sentences and they could write down and mention what was known and asked in the question.
 - b. In the stage of asking, group LCT 3 wrote one question they had not understood and solved the questions well and correctly.
 - c. In the stage or trying/gathering the information, group LCT 3 could finish the tasks well and correctly.
 - d. In the stage of reasoning, group LCT 3 could solve the problem well and completely. LCT 3 was able to generate more than one alternative solution.
 - e. In the stage of communicating, group LCT 3 wrote the discussion result well and fluently.

From the explanation above, the process of scientific approach was performed in detail. In the stage or reasoning, this group had written down two alternative solutions well and correctly. Thus, this group fulfilled the indicator of fluency and flexibility because they could write more than one solution. Therefore, group LCT 3 was categorized in the *creative* level.

IV. CONCLUSION

The study has concluded that LCT 0 group in the stage of observing could not explain the task using their own sentences even though the students in LCT 0 understood the purpose in the questions because they could write down and mention what was known and asked in the question. In the stage or trying/gathering the

information and reasoning, group LCT 0 just answered as requested. Upon doing the test, the group seemed to be cracking jokes quite often and did not put serious efforts on their task. Only one student seemed busy reading the question even though the student could not solve it. Therefore, group LCT 0 was categorized on the *non-creative* level because the group work did not fulfil the creative indicators. In the stage of reasoning,

Group LCT 1, In the stage of observing wrote down the initial information as requested without translating it using mathematical terms even though these students comprehended the purpose of the question. LCT 1 could explain the task purpose using simple sentences. In the stage of questioning, trying, and reasoning, group LCT 1 wrote one unintelligible question and then they answered the available questions using simple responses. In the stage of reasoning, this group had written one correct solution. Thus, this group met the indicator of fluency. It could be concluded that LCT 1 was in the *hardly creative* level.

Group LCT 2, in the stage or observing, wrote down the initial information as requested, although LCT2 could explain the initial information using their own sentences fluently. In the stage of trying/collecting the information, group LCT 2 utilized the collected information correctly but it was incomplete. In the stage of reasoning, LCT2 could elaborate the problems and provided two alternative solutions, one of which was finished correctly and completely. Another solution was written incompletely. Therefore, this group fulfilled the indicator of flexibility because they could write down more than one solution. In conclusion, group LCT 2 was categorized in the *creative enough* level.

Group LCT 3, in the stage of observing could provide elaborate responses to the task using their own sentences. They could write down and mention what was known and asked in the questions. In the stage of trying/collecting the information, reasoning and communicating. In addition, group LCT3 could finish the task properly, correctly, and fluently. The explanation indicated that the process of scientific approach was performed in detail. In the stage or reasoning, this group had written two alternative solutions well and correctly. This group fulfilled the indicator of fluency and flexibility because they could write down more than one solution. Therefore, group LCT 3 was in the *creative* level.

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