

# Problem Posing:

## A Learning Model to Improve Creative Thinking Skills in Mathematics

Rika Wulandari\*

Elementary Teacher Education Program

University of Trunojoyo

Madura, Indonesia

\*rikawoelandari87@gmail.com

**Abstract**—This study aims to determine how the steps of the problem posing learning model to improve the creative thinking skills of class XI IPS I at SMAN I Kamal, Bangkalan on Matrix concept. This research uses classroom action research with stages of plan, do, observe, and reflect. The subjects were students of class XI IPS I consist of 17 males and 13 females. The research instruments used included teacher observation sheets, student observations, interview guides, and creative thinking skills test questions. Based on the results, it can be concluded that the creative thinking skills of students using the problem posing model have increased. In the pre-cycle, the average students who were in the minimal creative category were 23.33%, (7 students). After the first cycle was implemented there was an increase in the number of students who were in the minimum creative category were 63.33% (19 students). These results have not yet reached the target of the success criteria set so that it is continued with the next cycle, namely cycle II. Increasing the results of tests of creative thinking skills of students who are in the minimal creative category reached 86.67% (26 students).

**Keywords**—problem posing, creative thinking skills, matrices

### I. INTRODUCTION

In accordance with the mandate of the law that the purpose of education is one of them to form a creative person. To be able to become a person who has creativity must be trained from an early age [1,2]. This creativity is not only in the form of hard skills, but also requires training in soft skills. Students' creative thinking skills are one of the abilities that children acquire after going through learning activities. Because learning is a process of someone trying to obtain a relatively permanent form of behaviour change. In learning activities, teachers usually set learning objectives. Children who are successful in learning are those who succeed in achieving learning goals.

Based on the results of interviews with class XI IPS I teachers, it is known that almost all students in class XI IPS I do not like mathematics. This is because mathematics seems difficult, many formulas are difficult to memorize [3]. Meanwhile, based on the results of filling in the questionnaire of interest in mathematics learning, it is known that, 83,33% of students said that the methods used by teachers in learning

mathematics rarely make use of learning media both from the internet and other ICT media. Even though, ICT can use for learning and it can make learning mathematics becomes fun [2,4]. Learning is still centred on the teacher (teacher centre learning) so students just sit to hear the explanation from the teacher in following the learning process. This is evidenced by the lack of enthusiasm of students in participating in learning. In addition, student interaction with the teacher has not been seen, students have not actively asked questions during the learning process. Students also experience difficulties in participating in mathematics learning. This can be seen when in doing the practice questions there are still many students who have not finished. The teacher is the most influential factor in increasing students' understanding of a learning material, because the teacher has a role to guide and facilitate students in the learning process. This is one of the causes of the low learning outcomes of mathematics in the matrix material.

In an effort to improve student learning outcomes in the material of adding and subtracting simple matrices, appropriate learning media are needed. One alternative learning media that can be used by teachers is Android-based media in the form of games [5,6]. Matrix game is an effective learning medium for learning mathematics basic competence matrix material. The characteristics of the matrix game media include: simple, easy to use, easy to store, smooth learning, durable, in accordance with the topic being taught, does not cause misinterpretation and leads to one understanding. In addition, the matrix game is one of the semi-concrete learning media so that it is in accordance with the characteristics of students who are at the stage of concrete operational cognitive development. Boy Matrix Game Media is a learning medium used to assist teachers in explaining the concept of the matrix through gadget. The advantages of gadgets are positive if they are used efficiently such as for creating mathematics skills [7].

In addition to the use of learning media, the selection of an appropriate learning strategy is also needed. Strategies in relation to learning are tactics or tips that are deliberately planned by the teacher, with regard to all learning preparation so that the learning process can run smoothly and the goal in the form of learning outcomes can be achieved optimally. Meanwhile, the Ministry of National Education defines a

learning strategy as a plan of action (a series of activities) including the use of methods and the use of various resources or strengths in learning that are structured to achieve learning objectives. One learning model that can trigger students' creative thinking skills to develop is the problem posing model [8]. Learning by applying the Problem Posing Model coupled with games, praise, and rewards is expected to increase student learning motivation. Mentions that one alternative that can be used to make mathematics learning more interesting is by holding frequent discussions / collaborations to find the stages of solving problems quickly, accurately, and easily to understand, as well as exchanging quizzes. made yourself with quizzes that have been made by friends, answer them, then the quiz answers are checked by each quiz maker.

By building student's interest in learning, it is hoped that it can improve understanding of concepts and student learning outcomes. This strategy also provides experience for students to be able to teach the understanding they have gained to their peers. On the one hand, they can help each other to understand each other, on the other hand, they are basically increasingly sticking to their understanding of themselves, so that they can master the material. This is in accordance with the theory of active learning according to Silberman, especially on the last point "what I hear, I forget. What I hear and see, I remember a little. What I hear, see, and ask questions about or discuss with someone else, I begin to understand. What I hear, see, discuss, and do, I acquire knowledge and skills. What I teach to another, I master".

The steps of the Problem Posing Model are: a) Distributing papers to students and asking students to write questions about the material or learning outcomes that should be discussed or studied, b) Collect the papers, shuffle, and distribute back to students randomly, c) Invite volunteers to come forward and read the questions, and provide answers / responses to the questions, d) Developing a discussion starting from the question, e) Clarify the material / learning outcomes of each question discussed so that all students gain an understanding of the material / learning outcomes.

**II. METHODS**

This study uses classroom action research especially Kemmis and Mc. Taggart models, which each cycle consists of four stages of action, namely planning (plan), implementing action (act), observing (observing) and reflecting (reflecting) in an interrelated spiral. This research was conducted using a research model from Kemmis and Mc. Taggart because the model fits the research plan that will be carried out. The research plan is to begin with the observation of learning problems that occur in class XI IPS I of SMAN I Kamal and continue with planning actions to be taken to deal with these problems. The action plan is continued by implementing the planned actions and observing the action plans that have been implemented. Each cycle ends with a reflection.

The subjects of this study were students of class XI IPS I of SMAN I Kamal with 24 students consisting of 10 male students and 14 female students. Sampling technique used purposive sampling. Data obtained through the technique of giving written tests, interviews, observation, and

documentation. The test results that have been obtained from the students were analysed descriptively quantitatively. While the data obtained through interview techniques, observation, and documentation were analysed qualitatively descriptively. The stages in analysing qualitative descriptive data include three steps, namely: data reduction, data presentation and conclusion or verification.

**III. RESULTS**

Based on the data from the pretest student's creative thinking ability (Figure 1), it can be seen that the mathematics learning outcomes of the matrix material are still low. The cause of the low learning outcomes is that students do not understand the concept of the matrix well. Therefore, it is necessary to take action to improve mathematics learning outcomes by adding and subtracting, multiplying, and finding the determinants of a matrix. The following is the data on the pretest results of student's creative thinking skills in class XI IPS I on the matrix material.

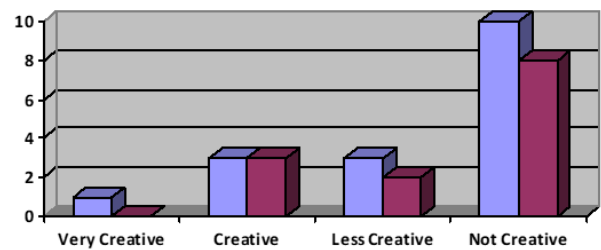


Fig. 1. Pretest results of creative thinking skills in XI IPS I grade students about matrix.

Each cycle consists of four stages, namely: planning, implementing, observing, and reflecting.

**A. Cycle I**

1) *Planning*: Learning in the first cycle, the concept presented was the concept of adding and subtracting matrices with the basic competence of adding and subtracting various forms of matrices. The plans made are:

- Prepare a lesson plan in accordance with the concept to be delivered
- Compile and prepare observation sheets regarding the learning process carried out using the Game matrix media
- Preparing the Game matrix media to be used, and
- Arrange post test questions that will be used to measure the improvement of student's mathematics learning outcomes

2) *Action*: The research in cycle I was carried out in 1 meeting with the time allocation for each meeting was 2 x 45 minutes. The initial activity gives apperception. In addition, researchers also motivate students to actively participate in the learning process. The core activity of the researcher was conveying material on how to operate matrix addition and subtraction using a problem posing model assisted by boy

matrix media. The boy matrix Game Media is used by students to practice independently on each student's android so that they don't easily forget the material that has been learned. The researcher explains the rules of the boy matrix game and divides the students into small groups to play the matrix game. When playing the matrix game, the teacher always guides students when there are students who have difficulty. In addition, researchers and students always discuss the results of the answers to the game. There was active interaction between teachers and students.

TABLE 1. PERCENTAGE OF STUDENT'S CREATIVE THINKING TEST RESULTS ON CYCLE I

No	Interval	Amount	Percentage
1	90-100	4	16,67%
2	80-89	4	16,67%
3	70-70	5	20,83%
4	60-69	6	25%
5	<59	5	20,83%

Based on the Table 1, the comparison of pre-action students' mathematics learning outcomes that have been completed is as many as 8 students (33.3%) while those who have not completed are 16 students (66.7%). In the first cycle, there were 13 students (54.17%) who had not completed which were 11 students (45.83%). With an average score of mathematics learning outcomes of class XI IPS I in pre-action amounted to 59.8 while in cycle I was 68.3.

3) *Observation*: In this study the researcher acts as a teacher. At the beginning of learning, students seemed enthusiastic in participating in learning activities. The student's enthusiasm increased compared to the enthusiasm of the students during the pre-action. The student's enthusiasm begins with the teacher motivating the students to use songs and yells that make students look even more enthusiastic about the learning process. The use of game matrix media besides being able to increase students' enthusiasm can also increase student interest in participating in the learning process. This is evidenced by student activities when playing the matrix game. In addition, the matrix Game media can also increase the feeling of pleasure in students because they learn while playing.

When apperception, the majority of students seemed to focus on listening to the teacher's explanation. But when the teacher explains the rules of the game matrix game, there are still many students who experience confusion. This is because when explaining the rules of the game there are some students who are busy alone and do not focus on paying attention to the game rules described. At the time of group selection, students appeared to be less conditioned so that they were less effective because they took up a lot of time. But in the implementation of the matrix game, the majority of the group is still wrong in doing the matrix game. In addition, students have not been able to work well together in their groups because there are still students who have not been able to convey their opinions well. Some students still look confused in playing the matrix game. Thus the classroom atmosphere does not appear conducive. Even so, this can make some students actively ask the teacher

and actively discuss with the teacher about the rules of the matrix game.

During the student learning process most of the students were able to follow the learning well. In addition, the teacher always accompanies the activities carried out by students. The teacher also always helps students if there are any difficulties during the learning process. At the end of the lesson the teacher also guides students in concluding the learning activities that have been carried out. The teacher also provides clarification of the problems faced by students during the learning process.

Students look enthusiastic in playing the matrix game. Students also appear to be more active and conducive in playing the matrix game. In addition, students can also show fairness, cooperation, and tolerance. This fair attitude was shown by the students when dividing the matrix game into their groups. The cooperative attitude shown by the students when playing the game matrix in groups. Meanwhile, the attitude of tolerance is shown by students when they are able to give appreciation to students who win the matrix game in their group.

4) *Reflection*: The obstacles experienced during the implementation of cycle I include:

- Students still do not understand the rules of the game matrix.
- There are still many students who are confused when completing the addition and subtraction matrix operations material with different denominators.
- There are several groups who are still wrong in writing the answers to the matrix game.
- Students are still scrambling to select groups.
- In working on evaluation questions, there are still some students who find it difficult.

#### B. Cycle II

1) *Planning*: In the second cycle improvement plan, the researcher identifies the problem and formulates the problem based on the results of cycle I. The researcher also prepares the game matrix learning media to be used. Planning is prepared by developing learning instruments, and providing explanation regarding the rules of the game (Game matrix) which will be played by providing motivation and emphasis to students so that they are not afraid or embarrassed when there are things that are less understood to be asked of the teacher immediately.

2) *Action*: The learning process was carried out in stages, starting with apperception and ending with giving tests. The test results will be analyzed to determine whether the learning improvement efforts have been successful or not. Based on the data analysis of the learning outcomes achieved by students in the improvement of learning cycle II, the values obtained in Table 2 are as follows.

TABLE II. PERCENTAGE OF STUDENT'S CREATIVE THINKING TEST RESULTS ON CYCLE I

No	Interval	Amount	Percentage
1	90-100	6	25%
2	80-89	10	41,67%
3	70-70	6	20,83%
4	60-69	4	4,17%
5	<59	4	4,17%

3) *Observation:* The results of observations in cycle II note that the learning material has been conveyed well using the Problem Posing Model combined with the Game matrix media. Learning has been carried out effectively using semiconcrete learning media through media and providing adequate training and evaluation by paying attention to the time allocation. So that it is obtained an increase in student learning outcomes, especially in the matter of addition and subtraction of the matrix.

4) *Reflection:* After carrying out the learning improvement process in cycle II, the following reflections were obtained. (a) Students have begun to understand the rules of the game to use so that the learning process is not hampered, (b) The media has been effectively used in learning, (c) The time used for learning the multiplication and determinant material of the Matrix is quite effective, (d) Problem Posing Model combined with the matrix Game media is able to make students learn mathematics in a fun way. Based on the data above, it can be seen that the improvement of learning in cycle II has been successful. This can be seen from the learning outcomes test in cycle II, from 24 students, 22 students have achieved classical learning completeness which is 91.67%. The success of improving learning in cycle II is influenced by several things, including (a) The explanation given by the teacher at the beginning of the lesson regarding the use of media is sufficiently understood by students, (b) The use of media in the form of games or group competitions makes students motivated to learn and can improve student learning outcomes, (c) The time given to complete the learning outcome test questions is sufficient, (d) The Problem Posing Model used is quite cooperative and fun for students.

#### IV. DISCUSSION

Based on the results of research conducted in class XI IPS I of SMAN I Kamal, it can be seen that learning mathematics, the operation material of addition and subtraction of the basic competency matrix numbers adding and subtracting various forms of matrices using the Game matrix media can improve student learning outcomes. Students find it easier to understand the material comparing simple matrices through games using the Game matrix media. Learning is more interesting and fun because students can learn while playing. Learning is more meaningful because students indirectly learn to operate matrix numbers in groups through a game so that all students actively participate in learning. In addition, in this lesson, it trains students to have thinking skills and social skills such as the skills to operate the matrix quickly, cooperate, and be able to give appreciation to other students. The above is in accordance with the theory put forward that learning mathematics is a

process to create a learning environment for students to be conditioned in learning mathematics. Mathematics learning also uses a design that optimizes students in learning mathematics so that optimal mathematics learning can be created and can get optimal learning outcomes.

Learning design in optimizing students through a learning medium. This is regarding the benefits of learning media. These benefits include: the learning material will have a clearer meaning, so that it can be better understood by students and allows students to master and achieve learning goals. Matrix media game is useful for providing students' understanding of the matter of adding and subtracting matrices. This study provides optimal results for student learning outcomes. Mathematics learning outcomes of class XI IPS I SMAN I Kamal increased after mathematics learning was implemented using the Problem Posing Model assisted by the matrix Game media that had never been implemented before.

The increase in mathematics learning outcomes of students of class XI IPS I in cycle I to cycle II to 91.67% indicates that the application of the Problem Posing Model assisted by the matrix Game media can help improve the mathematics learning outcomes of class XI IPS I of SMAN I Kamal Kamal, especially in the material using operations addition and subtraction matrices with different denominators. Even though in cycle I some students still experienced difficulties in playing the matrix game because they still did not really understand the game rules of using the matrix game learning media and students were embarrassed to ask directly to the teacher so that in cycle I, some students still experienced difficulties. In this study, students' motivation to learn mathematics has increased. This is because students are increasingly interested in learning. This interest is due to the fact that mathematics learning is carried out using the matrix Game media. Media Game matrix is used through a game.

In this study, student's mathematics learning outcomes on the subject matter of adding and subtracting matrices experienced an increase in classical completeness of students' mathematics learning outcomes by 20.87% from pre-cycle to cycle 1, while the increase in classical completeness of mathematics learning outcomes from cycle I and cycle II by 37.5%. Student response to learning mathematics using this matrix game media is very good, seen from the increase in student enthusiasm and student involvement in the learning process.

#### V. CONCLUSION

Based on the results of research and discussion, it can be concluded that learning mathematics matrix material using the matrix game media in class XI IPS I SMAN I Kamal can improve learning outcomes. This increase was due to the matrix Game media used by the teacher as a tool. The teacher in explaining the rules of the game is very clear and accompanied by examples of the implementation of the game so that students can play the matrix game according to the rules of the game. The increase in student learning outcomes from the pre-cycle / pre-test student achievement was still low because under the KKM, the class average reached a value of 59.8. In the first cycle after the application of mathematics

learning using the Game matrix media, it shows that the result of learning mathematics from the class average has increased to 68.3, it has reached the KKM but is still at moderate criteria and learning completeness is still 56.5% not yet reaching 70%, it is necessary to continue to cycle II. From the second cycle there was an increase in student learning outcomes by 37.5% so that the classical completeness of the students of SMAN I Kamal for addition and subtraction matrix material had been achieved.

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