An initial observation of learning devices development based on discovery learning to increase students’ creativity

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Abstract. Creativity is a combination of logical and divergent thinking that is used to bring up a new idea. The type of research was a descriptive research by using qualitative approach. An initial observation of learning devices development based on discovery learning aims to (1) to know an initial conditions of mathematical planning and learning that are developed by the teacher (2) to know and review how creativity of senior high school students in mathematics learning (3) whether it is necessary to continue research development based on discovery learning to improve creativity of senior high school students. The results of preliminary observations indicate that: (a) mathematics planning and learning that are developed by teachers is still general. (b) So that the creativity of high school students in mathematics learning is still low. (c) Based on this, follow-up action is needed in the form of research on development based on discovery learning to increase creativity of senior high school students (SMA N 5 Padang on 2018/ 2019).

1. Introduction

The existence of science is the result of the research, without scientific research it will not develop well. With an initial conducted observation, new ideas can be found, and to improve things. Something here can be in the form of science or products. The initial observation is conducted using certain steps and procedures. Whatever the type of research is, it always starts with the existence of the problem that is a challenge for the researcher. This challenge is caused by some reasons, factors, and problems. With that problem in mind, the researcher tries to find the solution from those difficulties that are felt by the researcher by conducting research that starts from initial observation and supported by appropriate theory [1].

To conduct research requires some steps and procedures that should be done. One of them is the initial observation. This step is the second step after finding a problem. Therefore, in this journal explains how the process of initial observation of learning instrument development based on discovery learning to improve the creativity of high school students.

The ideal condition that the teacher wants to achieve is to produce a creative student. The criteria of creative student are: (1) Critical and analytical student; which a learning process or information is taken blindly by the student, but to consider deliberately so that the information is valid. (2) Self-motivated creativity; without being asked the student is proactively do it. (3) sharing; share the knowledge that he or she understands [2]. The next ideal condition that the teacher wants to achieve is to raise the motivation of the student to study mathematics. Without being asked, the student will do the assignments in the book, learning media and other learning sources.
If the teacher doesn’t improve themselves, the impact that will be felt by the students are: (1) the student will not achieve the intended goal or the result is not satisfying. (2) the student will not enhance themselves, because lacking in gaining the proper information. (3) low result of students’ learning achievement.

Because of the limited ability, this initial observation is centered the problem is limited to the creativity of students. I choose Discovery Learning model because it is suitable in my opinion, it is the most appropriate model to apply in learning media development so that it can be function as a guidance for a teacher and student in the learning process of improving high-school student’s creativity. Therefore, the initial observation is conducted to check the on-going mathematics in the learning process at SMA N 5 Padang.

Theories that Support this Initial Observation are as follows: (1) Learning Devices observed in SMA N 5 Padang were Lesson Plan (LP) and Student Worksheets (SW). (2) The Lesson Plan (LP) is the most important component in planning before the implementation of learning. LP is the 2014 Republic of Indonesia Minister of Education and Culture Regulation number 103 concerning Learning in Primary and Secondary Education stated that lesson plans are learning plans that developed in detail referring to syllabi, textbooks, and teacher guide book. Every teacher in each education unit is obliged to prepare lesson plans [3]. (3) Student Worksheets (SW) are one kind of teaching material that helps students in the learning process. SW contains steps for activities that must be done by students to find the concepts of learning and exercises [4]. (4) Discovery is a learning model that developed based on constructivism [5]. This model emphasizes the importance of understanding the structure or important ideas of a scientific discipline, through the active involvement of students in the learning process [6][7][8] (5) Creativity is a product of one's creative thinking. Research on mathematical creativity has been carried out [9] and one field sees the ability to submit problems as an ability to think creatively [10][11][12][13]. This creative thinking or creativity can be seen through the task of submitting problems The behavior of students related to creativity or high-level thinking includes: (a) Fluency (b) Flexibility (c) Originality (d) Elaboration, (e) Complexity (f) Curiosity [14].

2. Research Method
To find out the quality the process of learning activities, observations were carried out to determine the level of the teacher's active role during the learning activity process and also to see how the devices used by the teacher especially the Lesson Plan (LP) and Student Worksheet (SW). Researchers conducted observations at SMA N 5 Padang with the steps taken to collect data and information needed in the form of interviews with at the teacher. The type of research was descriptive research by using qualitative approach. The researcher used two main components in the analysis phase, namely data reduction and data decomposition. Data reduction is a focus selection process that is part of the analysis that reinforces, shortens, and discards things that are not important. Furthermore, at the data decomposition stage the researcher described the problem so that conclusions can be obtained [15].

3. Results and Discussion
In general, initial observation at SMA N 5 Padang on 2019/2020 shows: (a) Teachers have not been able to develop students’ learning activities optimally; When the initial observation was carried out, it can be seen that students were still passive in learning activities and lacking in enthusiasm in mathematics learning. (b) Teachers have not been able to engage students’ curiosity optimally; It can be seen that there were still some students who lack focus in learning, less attention to learning, and less enthusiastic in giving questions. (c) Students who were not able to achieve the objectives of mathematics learning; It appears that some students do not succeed in achieving the learning objectives targeted by the teacher. It can be seen from some students that they have not been able and completed the questions and questions raised by the teacher and some students cannot provide conclusions in learning. (d) Some students lack motivation in learning; It can be seen that some students do not follow the maximum learning activities carefully from the beginning to the end. It is seen that some students are still trying to shift their focus to other things, besides learning mathematics. (e) Some students do not follow the
mathematics learning process; it can be seen that some students have permission when learning begins, and it can be seen from lack of discipline when students participate in learning activities. (f) Teachers have not been able to grow optimally the creativity of students it is seen that the lack of students produces ideas in learning, gives ideas in learning, develops ideas in learning, provide solutions in learning. (g) Teachers have not optimized the application of model/approach/strategy/method/techniques; the devices used by the teacher are still general. The lack of a combination of the application of the model/approach/strategy/method/technique in learning that is applied by the teacher especially in the Lesson Plan (LP) and the unavailability of Student Worksheets (SW) in the implementation of learning.

The observer used 2 questions on this observation and it was analyzed descriptively with the criteria for assessing the ability to think creatively in mathematics according to [16] and then described the creativity indicators as follows:

| Table 1. The criteria for evaluating creative thinking skills in mathematics |
|---------------------------------------------------------------|
| Score | Criteria |
|-------|----------|
| 4     | The students can answer all completely and correctly, students can describe the problem solving,, reasoning along with communication skills, students can get results that are described in full. |
| 3     | The Students can answer all correctly, students can describe the problem solving,, reasoning along with communication skills, students almost all answer correctly, and the results of students are explained. |
| 2     | One of the answers from students illustrates problem solving, reasoning along with communication skills did not exist, the lack of students thinking level, the conclusions of students are inaccurate, and some concepts from students are described incompletely. |
| 1     | Two components of the students' answers that illustrate the problem solving, reasoning along with communication skills do not exist, some calculations from students are wrong, and only a few descriptions of understanding. |
| 0     | The answers of all students are incorrect, no one of the students put forward answers. |

Furthermore, tested the questions were assessed by indicators of creativity. The questions that are tested are: (1) Pay attention to the sequence 4,7,1,8,9,7,6,3 for n > 2 n\(^{th}\) term is the number of units of the 2 terms previously, if \(S_n\) states the number n the first term of this sequence, then the smallest value so that \(S_n > 1000\) is?. (2) Three real numbers 2, a, and b form an arithmetic sequence, if the sequence 2, a + 2, b + 12 are geometric sequences, then the largest possible value for a is?

Sample of the students answers:

![Figure 1. An example of the student answer for question number 1](image)
Figure 2. An example of the student answer for question number 1

Figure 3. An example of the student answer for question number 2
Figure 4. An example of the student answer for question number 2

The analysis of figure 1 is as follows:

| Indicators | 0 | 1 | 2 | 3 | 4 | Information |
|------------|---|---|---|---|---|-------------|
| Fluency    |   |   |   |   | ✔ | The process carried out by student is almost close to true results. In the process, he should continue the calculation, not stop at the results of 60 |
| Flexibility|   |   |   |   | ✔ |            |
| Originality|   |   |   |   |   |            |
| Elaboration|   |   |   |   |   |            |
| Complexity |   |   |   |   |   |            |
| Curiosity  |   |   |   |   |   |            |

Analysis of figure 2 is as follows:

| Indicators | 0 | 1 | 2 | 3 | 4 | Information |
|------------|---|---|---|---|---|-------------|
| Fluency    |   |   |   |   | ✔ | The process carried out by student is almost right. In the process, she should continue the calculation, not stop at result 16 |
| Flexibility|   |   |   |   | ✔ |            |
| Originality|   |   |   |   |   |            |
| Elaboration|   |   |   |   |   |            |
| Complexity |   |   |   |   |   |            |
| Curiosity  |   |   |   |   |   |            |
Analysis of figure 3 is as follows:

| Indicators | 0 | 1 | 2 | 3 | 4 | Information |
|------------|---|---|---|---|---|-------------|
| Fluency    | ✓ |   |   |   |   | The process carried out by the student is almost right, he should continue the factoring process |
| Flexibility| ✓ |   |   |   |   |             |
| Originality| ✓ |   |   |   |   |             |
| Elaboration| ✓ |   |   |   |   |             |
| Complexity | ✓ |   |   |   |   |             |
| Curiosity  | ✓ |   |   |   |   |             |

Analysis of figure 4 is as follows:

| Indicators | 0 | 1 | 2 | 3 | 4 | Information |
|------------|---|---|---|---|---|-------------|
| Fluency    | ✓ |   |   |   |   | The process carried out by student is almost close to true results. But in substitution, he is wrong to count in value and so that he is wrong to eliminate |
| Flexibility| ✓ |   |   |   |   |             |
| Originality| ✓ |   |   |   |   |             |
| Elaboration| ✓ |   |   |   |   |             |
| Complexity | ✓ |   |   |   |   |             |
| Curiosity  | ✓ |   |   |   |   |             |

The things that are often done are: students only focus on the part of the solution obtained after the division of tasks. After completing the part, the new one is combined into one So that what happens is the majority of students who are only part of the task. This habit still needs further efforts to be improved. Students have a tendency to be reluctant or do not feel the need to collaborate between groups. Habits are reluctant to cooperate with people outside the group triggered by the urge to compete between groups so students should not close the space for collaboration between groups so that participants do not fall into the narrow view that belongs to the group regardless of the views or ideas of other groups. Instead, it needs to be developed in the students' habit of sharing ideas, ideas or solutions in conveying problems between groups so that ideas or solutions are more comprehensive. The use of conventional learning models tends to confine the involvement of students actively and creatively. And everything is illustrated inside lesson plans.

The use of these models has an impact on learning outcomes that are more often ineffective and students feel bored with the material that refers to the involvement of students and teachers actively and creatively must be carried out to improve the results of the learning done. Learning mathematics using the discovery learning model requires the involvement of students actively and creatively. Because later this research is focused on creativity, the researcher focuses on discussion only on creativity. The results of preliminary observations indicate that: mathematics planning and learning developed by teachers is still general. So that the creativity of high school students in mathematics learning is still low. Based on this, the need for follow-up research on the development of discovery learning-based learning devices to improve the creativity of senior high school students.

4. Conclusion
The results of the preliminary observations indicate that: (1) mathematics planning and learning developed by teachers is still general. (2) So that the creativity of high school students in mathematics learning is still low. (3) Based on this, the need for follow-up research on the development of discovery learning-based learning devices to improve the creativity of senior high school students.
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