

Learning Analysis based on Humanism Theory and Mathematics Creative Thinking Ability of Students

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ABSTRACT. Mathematics humanistic learning could provide students more flexibility to learn actively and challenged made creations that encourage creative thinking ability of students. In fact, many mathematics learning that has not applied humanism theory so mathematics creative thinking ability of students undeveloped. Therefore, this study aimed to know: (1) whether the mathematics learning device and process of solid geometry have already applied humanism theory and (2) how the mathematics creative thinking ability of students in solid geometry. The results of this study showed that the device and the process of mathematics learning in the subject of solid geometry didn't already applying the humanism theory. As a result, students have difficulty when doing mathematics creative thinking ability test. The average of mathematics creative thinking ability students in solid geometry included in almost not creative categories.

1. Introduction

Effective learning emphasizes the students are able to learn how to learn and through the creativity of teachers who produces joyful learning [5]. Skills developed through effective learning are problem solving, decision making, critical thinking, and creative thinking skills [6].

Creative thinking is one part of higher order thinking. Creative thinking is the process of generating ideas, which frequently emphasizes fluency, flexibility, originality, and elaboration in thinking [17]. According [3] creativity is the ability to see things in a new way, to see problems that no one else may even realize exist, and even develop new, unique, and effective solutions to these problems. Meanwhile, [13] states that creative thinking is a process used person in synthesizing (establishing) ideas, build new ideas, and apply them to produces new products are fluent and flexible. Based on some of the above opinion, the creative thinking is a thinking process in generating new ideas that emphasizes the aspects of fluency, flexibility, originality, and elaboration.

To show how is creative children's thinking can be when explored through their marks and representations on paper [8]. Besides that, measuring the ability of student's creative thinking can also be done by relying on what is communicated by students, verbally or in writing [3]. What is communicated by students may be the work related tasks of students, problem solving, or oral answer to teacher's questions.

Creative thinking ability of students is the ability of students to generate many possible solutions and ways of solving problems [14]. One of the important early developments of creativity research was a test devised by Torrance in the middle of last century, the Torrance Test of Creative Thinking (TTCT). This test is composed of four factors considered the constitution of the creative thinking

process, namely, fluency (many relevant responses), flexibility (different categories of relevant responses), elaboration (the amount of detail in the responses), and originality (novelty of the responses) (see, e.g., [1] and [15]). In this study used three indicators of creative thinking ability that usually used to measure creative thinking in mathematics by expert are fluency, flexibility, and originality to determine the characteristic of a student's creative thinking level (see, e.g., [4] and [16]).

As stated by [16], student in level 4 (very creative) if student is able to solve a problem with more than one solution and can represent another way to solve it, one solution fulfills originality (novelty); student in level 3 (creative) if student is able to solve a problem with more than one solution, but he/she cannot represent another way to solve it, one solution fulfills originality (novelty), an alternative characteristic, he/she can represent another way to solve a problem, but he/she cannot make a novelty solution; student in level 2 (quite creative) if student is able to solve a problem with one original solution however it does not fulfill fluency or not flexibility, or he/she can represent another way to solve a problem, however it is not novelty or not fluency; student in level 1 (almost not creative) if student is able to solve a problem with more than one solution but cannot represent another way to solve it, the solution does not fulfill originality (novelty); student in level 0 if student cannot solve a problem with more than one solution and cannot represent another way to solve it, solutions do not fulfill originality (novelty), fluency, and flexibility.

Creative thinking ability can also be established through mathematics learning in class that supports the establishment of this ability. One of the theories that support the learning process that can foster creative thinking abilities of students is humanism theory. According to this theory, learning must place students as the subject of learning. Through humanistic learning, students are invited to understand themselves and their surrounding environment, and make students as subjects who are free to find knowledge. Humanistic learning begins with preparing students and comfortable environment in order to learn. Comfortable environment will be easier for students to establish new knowledge that last longer and a key to the success of achieving the learning objectives to be achieved.

One of the important ideas in mathematics humanistic is that learners can construct their own understanding in learning [12]. This is supported by [2], he finds that there are three major aspects in mathematics humanistic learning, namely (1) a mathematical concept with a "human face", (2) what kinds of mathematics is good and why, (3) the ways in which someone introduced to mathematics and learning mathematics. Humanistic learning stressed the importance of emotions or feelings, open communication, and values which is owned by each learner.

Creativity is one of common characteristics in mathematics humanistic learning, namely mathematics learning that humanize human beings. Creativity is realized by providing solids for students to solve problems in different ways, using the challenging problems and open ended questions that puts students as an inventor. In other words, students are not only placed as the receiver the facts and procedures [15].

That opinion in accordance with the learning principles of humanism learning reported by Rodgers (see [7]) which state: (1) learning is facilitated when the student participates responsibility in the learning process; (2) self-initiated learning, which involves the whole person of the learner, feelings as well as intellect, is the most lasting and pervasive; (3) independence, creativity and self-reliance are all facilitated when self criticism, and (4) self-evaluation is basic and evaluation by others is of secondary importance.

Based on the above explanation, researchers interested in conducting further research wether the mathematics learning in the subject of solid geometry that is currently implemented are applying the humanism theory and how the creative thinking ability of students in that learning. The purpose of this research as follows.

1. Find out wether the mathematics learning device and pocess on solid geometry already apply humanism theory.
2. Find out how the creative thinking ability of students in the subject of solid geometry.

2. Methodology

This study used descriptive method with qualitative approach. Data collection techniques that used were documentation, observation, interview, and test. Documentation used to analyze data of learning devices that is syllabus and lesson plan based on humanism theory. Observation used to analyze data of learning process based on humanism theory. Interview used to analyze learning process and mathematics creative thinking ability of students. Test used to analyze mathematics creative thinking ability of students on solid geometry.

Subject in this study was students in mathematics education program study at Sultan Agung Islamic University who taken courses solid geometry, consist of 26 students. Samples were selected for interview by using snowball sampling amounted to 6 students. Sixth selected subject were a representation of the three categories of mathematic abilities that were upper, middle, and lower category. While the material to be interviewed based learning courses conducted lecturer at solid geometry and the works of students in doing mathematics creative thinking ability test.

Data analysis was in qualitative research. The data analysis began with formulate and explain the problems, before going into the field and continue until the writing of the results of research. Analysis done before in the field of data results of preliminary studies, or secondary data was used to determine the focus of research. In this study conducted a preliminary study by interviewing a lecturer in solid geometry on mathematics learning device, while also conducted a literature reviews and the results of previous studies. Data analysis in field using an interactive model of Miles and Huberman which included activities in data analysis, that are data reduction, data display, and conclusions drawing/verification.

3. Results and Discussion

Syllabus assessment results reviewed of humanism theory score was 1.75 on a scale of 5 was included in the low category. The results was low category because the lecturer written learning activities provide explanations and examples, while students just pay attention and observes, then practice drawing and concluded. It is not clear in detail steps that will be implemented in the learning activities, so it is not visible syllabus in accordance with humanism theory.

Based on interviews with solid geometry's lecturer appeared that the syllabus had been compiled by lecturer, but lecturer have not developed the syllabus according to student abilities. One of the constraints in the preparation of the syllabus was a load of material that must be learned was not in accordance with the allocation of available time. Consequently lecturer of the solid geometry course more pleased using the expository method, because by using this method the material can be accomplished.

The average results of lesson plan assessment score was 2.08 on a scale of 5 was included in enough category. The average score each indicators in terms of humanism theory can be seen in Graphic 1.

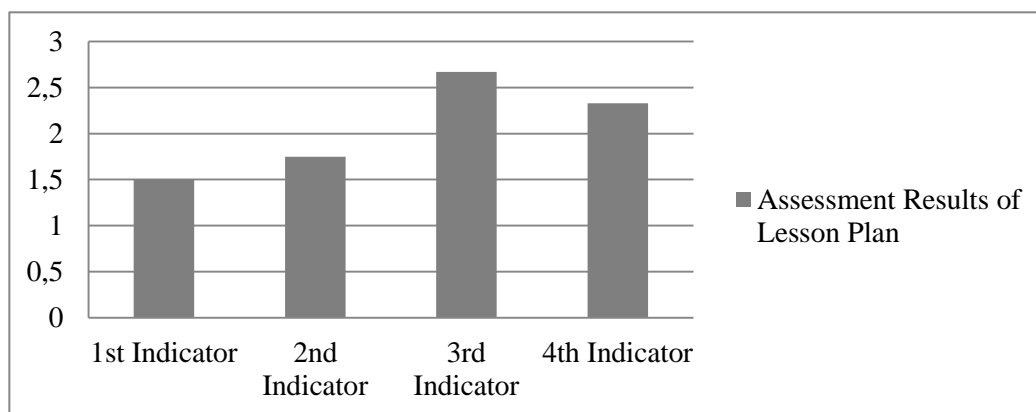
Analysis of observation on each indicator reviewed of humanism theory as follows.

1. Students as learning center
Learning activities in lesson plan focusing more lecturer as a center of learning. Students were not actively involved in learning. This was not appropriate with [7] which states that humanistic learning involve students intensively.
2. Learning environment support the successful of all student's potential achievement.
Learning activities were planned in lesson plan did not adapt to the potential of every student, so it did not support the achievement of all student's potential achievement.
3. Independence, creativity, and self-reliance
The task given in lesson plan contains only a few exercises. From the problems that exist seems were not open ended problems, so that students can't be answered in various ways. As a result students were not developing creativity. The positive thing that can be seen in lesson plan was students were given freedom to express opinions and lecturer use teaching aids that allow students to develop their self-reliance.

4. Self-evaluation

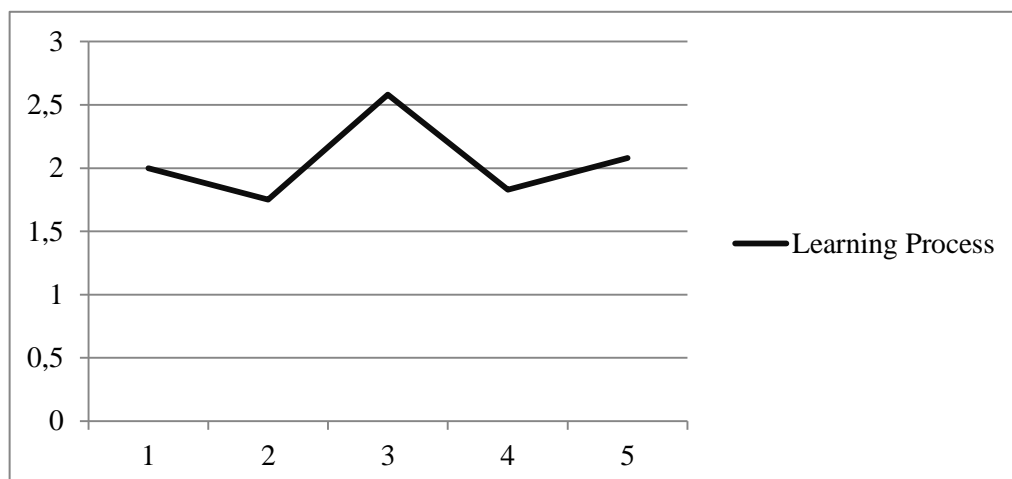
Lesson plan contained assessment, unfortunately still limited of cognitive assessment, have not contains the affective and psychomotor aspects, lesson plan also not attach instruments of assessment.

Graphic 1 Assessment Results of Lesson Plan based on Humanism Theory



Observation of the learning process in this study performed a total of five meetings with each of meeting was 100 minutes. Observation of learning process in this study based on humanism theory. The average score of learning observation was 2.05 or included in medium category. Score observation of learning process in 1st meeting until 5th meeting can be seen in Graphic 2.

Graphic 2 Score of Learning Process based on Humanism Theory



Graphic 2 showed that the learning process take place in fluctuating. At the third meeting have the highest results because lecturer used teaching aids in explaining the material. Students were asked to use the teaching aids in front of class and lecturer give question to the students. It has been appeared that there was a good interaction between lecture and students and also among students. Lecturer also have been tried to show the self-reliance of students. Unfortunately, learning that involves a discussion like this was rarely done by lecturer. This is consistent with the results of interviews with lecturer.

Researcher : Why did you rarely uses the methods of discussion in teaching solid geometry?

Lecturer : Because of the time available to teach the solid geometry was limited, but there were times when I gave questions to students that encourage them to think.

Based on the interview appears that students feel comfortable and happy to be learn by lecturer. Students did not have a feeling of fear or depressed when learning takes place.

Researcher : How did you think taught by solid geometry's lecturer?

Lecturer : The solid geometry's lecturer was enjoyable in teaching.

Researcher : How the interactions of solid geometry's lecturer with students?

Lecturer : Good, lecturer always to be open with students.

Analysis of the learning process based on humanism theory as follows.

1. Students as learning center

Learning is facilitated when the students participates responsibility in the learning process [7]. This means that learning should make the student as a center of learning. Based on observations of the learning process overall were dominated by lecturer than student's activities. This is evident in exploration activities in which the lecturer explains the material with expository method. Student activities that appear in every meeting when students were asked to demonstrate teaching aids or write their work in front of class and then explain it.

2. Learning environment support the successful of all student's potential achievement.

The learning process was not fully support the achievement of the full potential of student success. It can be seen from the learning activities that were dominated by the lecturer. As a result, students were only receiving material without involving their potential in construction process. Use expository method was also less support for students to interact with other students. This was not in accordance with [9] that state one of the principles of humanistic education was there are a good relationship with classmates. The positive thing that can be seen in the study was the interaction between lecturer and students took place in atmosphere of familiarity, so it appears that lecturer could create a good relationship with students. At the time of responding to questions from students, lecturer also responded well. This showed that lecturer understand the difference of student's ability.

3. Independence, creativity, and self-reliance

At each meeting, lecturer explained the material with expository method. Lecturer gave definition, theorem, and example directly after that lecturer gave exercises to be done. Task that was given by lecturer were also less encouraging creativity students, simple and not too complicated. The task given still limited to work on the problems that the settlement was similar to what was explained. The positive thing that can be seen in this study was after completion did the task, students were asked to present the results in fornt of class, then a lecturer giving feedback and reinforcement to student's work. These activities could foster self-reliance of students.

4. Self-evaluation

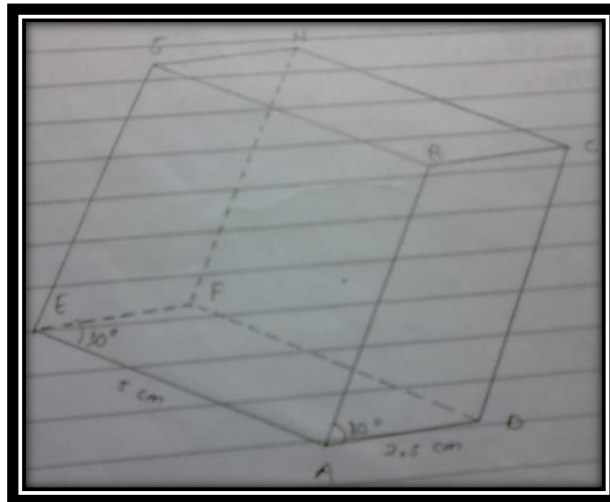
Based on observations, lecturer encourages students to evaluate themselves only at the time confirmed the results of student's work by giving comments or feedback on the results of sudent's work. At the end of the lesson, the lecturer also did not do reflection.

Results of mathematics creative thinking ability test of students on solid geometry showed that the average students were included in almost not creative (level 1) category. From 26 students, 6 students (23.08%) were quite quite creative, 16 students (61.54%) were almost not creative, 4 students (15.38%) were not creative, and no students in creative or very creative. Based on the test results, the mathematics creative thinking ability students group upper, middle, and lower still low because all of students at each capability only in the quite creative, almost not creative, and not creative category. This is not consistent with the results of [11] which stated that creative thinking ability of students according to their level achievement of students.

Students who were in quite creative category means that students were only able to fulfill flexibility or originality, that was students able to solve a problem with one original solution however

it did not fulfill fluency or not flexibility, or he/she can represent another way to solve a problem, however it was not novelty or not fluency. Student in upper category (M1) was able to solve a problem with one original solution however it did not fulfill fluency or not flexibility as shown at Picture 1.

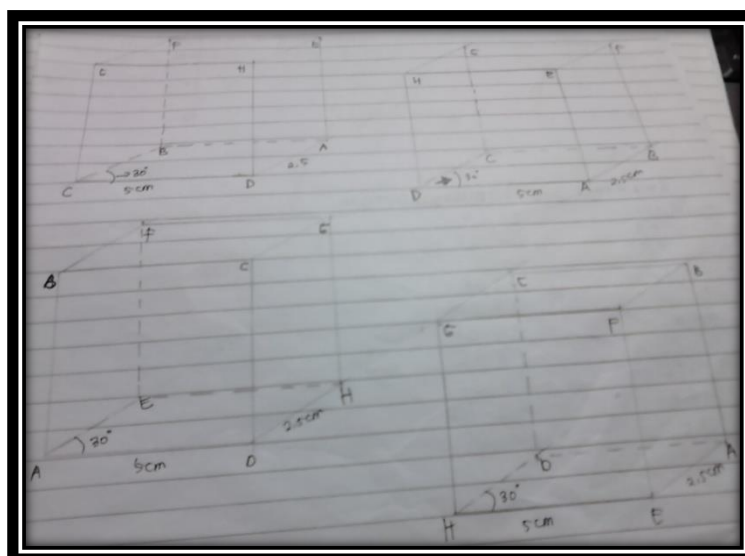
Picture 1 Example Student's Work in Upper Category (M1)



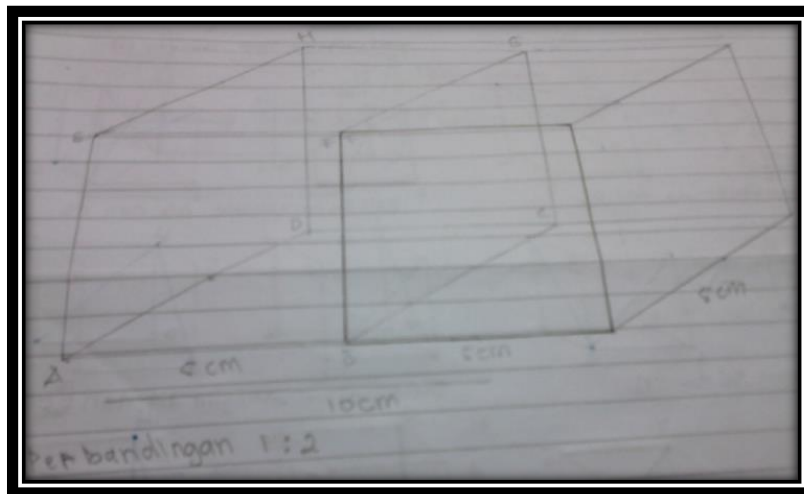
Students who were in almost not creative category means that students were only able to fulfill fluency, that was students able solve a problem with more than one solutions but cannot represent another way to solve it, the solutions did not fulfill originality. Student in middle category (M3) was able to solve a problem with more than one solution but cannot represent another way to solve it. The solution did not fulfill originality as shown at Picture 2.

Students who were in not creative category means that students were not able to fulfill fluency, flexibility, and originality, that was students cannot solve a problem with more than one solution and cannot represent another way to solve it. Student in lower category (M5) cannot solve a problem with more than one solution and cannot represent another way to solve it, the solution that given by M5 was not correct as shown at Picture 3. Another student in lower category (M6) cannot answer the problem. She only rewrote the given problem.

Picture 2 Example Student's Work in Middle Category (M3)

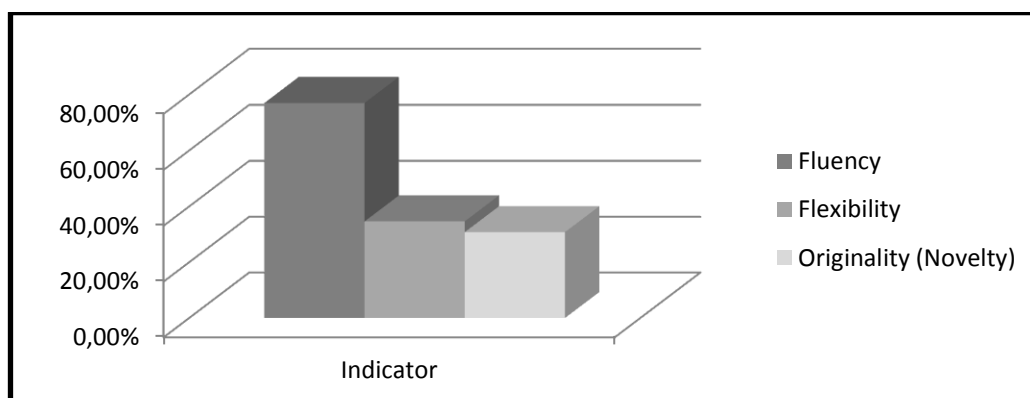


Picture 3 Example Student's Work in Lower Category (M5)



Based on the student's work it could be seen that mathematics creative thinking of students still less or did not learn by lecturer. It was appropriate with lecturer's interview, lecturer rarely give problems that measure creative thinking ability of students because it would be have much times in learning. Lecturer in learning more focused in transferring the material accordance in curricula, students just learn in convergent thinking where students solve the problems in one way without learn how to make another way to solve the problems. If lecturer tried to learn divergent thinking for students in learning, it could be encourage creative thinking ability of students.

Graphic 3 Results of Mathematics Creative Thinking Ability Viewed of Each Indicator



Graphic 3 shown that mathematics creative thinking ability of students have not fully satisfied all the indicators of fluency, flexibility, and originality. Majority of students have fulfill fluency indicator, but many students have not fulfill flexibility and originality. This was because students were not familiar to solve a problems using variety of ways and they familiar to solve a problems using one way that has been taught by lecturer. So, they were not familiar to make a new idea to answer the problems. As a result, they have difficulty when doing creative thinking ability test.

4. Conclusions

In general, the device and the process of mathematics learning in the subject of solid geometry did not already applying the humanism theory. One of lecturer's factors did not use humanism theory because the material that must be learned was not in accordance with the allocation of available time. Lecturer

rarely give problems or tasks that measure creative thinking ability of students because it would be have much times in learning. As a result, they have difficulty when doing mathematics creative thinking ability test. Results of mathematics creative thinking ability test of students on solid geometry showed that the average students were included in almost not creative (level 1) category. From 26 students, 6 students (23.08%) were quite creative, 16 students (61.54%) were almost not creative, 4 students (15.38%) were not creative, and no students in creative or very creative. The results from this study indeed that lecturer need to create and implement the device and the process of mathematics learning that can develop creative thinking ability's students, such as implement humanism theory. In determining the level of creative thinking ability in this study still used three indicators that were fluency, flexibility, and originality. It is necessary to develop level of student's creative thinking ability that contains all indicator of creative thinking that is fluency, flexibility, originality, and elaboration. So it can measure this ability accurately.

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