

**THE PROFILE OF STUDENTS' LATERAL THINKING IN SOLVING  
MATHEMATICS OPEN-ENDED PROBLEM IN TERMS OF LEARNING STYLE  
DIFFERENCES**

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**Abstract**

In this globalization era, students as young generation of a country must be creative and innovative. As well as that, in solving mathematics problems, students should be able to find out several alternatives of questions or it is well-known as lateral thinking. Furthermore, open-ended problems provide an opportunity for students solve problem in several ways and seek several solutions. Besides, students learn according to their learning styles which influence students' thinking. There are three types of learning styles in this paper, namely visual, auditory, and kinesthetic. In conclusion, students with different learning styles have different ways of lateral thinking in solving mathematics open-ended problem as well.

**Keywords :** Lateral thinking, open-ended problem, learning style.

**INTRODUCTION**

**A. BACKGROUND**

One of the goals of national education according to the Undang-Undang Sistem Pendidikan Nasional by year 2003 is to develop creative thinking ability of students. The ability of creative thinking is necessary because in a line with the development of science, technology and global competition, the nation is expected to have an innovative human resources and have high creativities. Therefore, students who are candidates for the next generation are expected to have the ability of thinking out of the box.

To achieve the goals of national education, the learning process is required such as the learning of mathematics. Therefore, the ability to think out of the box is also expected to be developed in the mathematics learning. The ability of such thing is also known as lateral thinking.

According to De Bono (1977: 11), lateral thinking is closely related to creativity. But whereas creativity is too often only the description of a result, lateral thinking is the description of a process. Generally, people can only admire a result and take the process without granted. However, people can learn to use a process.

Lateral thinking is quite different from vertical thinking which is widely-known as traditional type of thinking. With vertical thinking a person may look for different approaches until he finds a promising one, whereas with lateral thinking a person goes on generating as many approaches as he can even after he has found a promising one. On the other words, with vertical thinking one is trying to select the best approaches but with lateral thinking one is generating different approaches for the sake of generating them.

The description of the profile of students' lateral thinking being necessary to be conducted in order to observe how far students develop their creativity in terms of developing their way of thinking in mathematics. To be more precise, how students find out several

alternatives of solutions become the objectives of the description as well. Since in lateral thinking students are intended to solve problem that requires thinking skill that is looking for many alternatives of solutions and has to be correct too.

Conventional learning methods which is usually applied by teachers in Indonesia is the traditional learning which makes students think traditionally as well. With such of learning process, students' thinking skills certainly can not develop maximally. Hence, teachers are required to facilitate the students to explore their lateral thinking.

Giving an open-ended question is one way that can be done by teacher in developing lateral thinking ability of students. Becker and Shimada (1997) state that open-ended problem is a problem that has several or many correct answers, and several ways to the correct answers. Therefore, by giving the open-ended problems to students, students might have chances to solve problem in many ways and looking for many alternatives. Consequently, students' lateral thinking ability could be explored through this kind of learning.

Another factor that influences the way student thinking is learning styles. Student has different way in learning and understanding the information each other. There are several approaches of learning style, one of them is the approach which is based on sensory modalities; determine the degree of dependence on particular senses. This approach was developed by Bandler and Grinder, Messick (Gunawan, 2007:140). This approach is based on sensory modality that is directly related to the use of certain senses within the meaning of learning so easily identified and found. Learning styles developed by Grinder on sensory modalities are divided into three types, namely visual, auditory and kinesthetic.

#### **B. FORMULATION OF PROBLEM**

Based on the background above then the formulation of the problem are as follows.

1. How is the profile of lateral thinking of visual learner in solving open-ended mathematics problem?
2. How is the profile of lateral thinking of auditory learner in solving open-ended mathematics problems?
3. How is the profile of lateral thinking of kinesthetic learner in solving open-ended mathematics problems?

#### **C. STUDY OBJECTIVES**

Based on the research questions above, the study objectives of this research are as follows.

1. To describe the profile of lateral thinking of visual learner in solving open-ended mathematics problem.
2. To describe the profile of lateral thinking of auditory learner in solving open-ended mathematics problems.
3. To describe the profile of lateral thinking of kinesthetic learner in solving open-ended mathematics problems.

#### **D. STUDY BENEFITS**

The significances of this study are as follows.

1. Provide information for teachers about the profile of students' lateral thinking in solving open-ended mathematics problems in terms of learning style differences.
2. As an input for other researchers as well as a reference for research on the students' lateral thinking in learning mathematics.

## DISCUSSION

### A. LATERAL THINKING

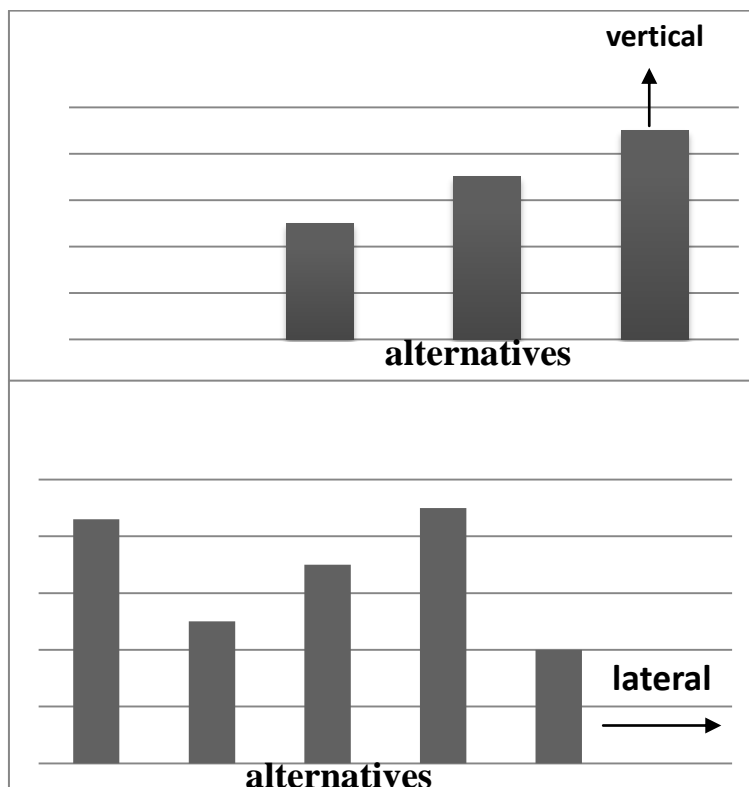
Lateral thinking is a very basic part of thinking and this skill can be developed (De Bono, 1977: 13). It is closely related to creativity. But whereas creativity is too often only the description of a result, lateral thinking is the description of a process. People can only admire the result but people can learn to use a process.

According to De Bono (1977: 11), lateral thinking is concerned with the generation of new idea and breaking out of the concept prisons of old ideas. This leads to changes in attitude and approach to looking in a different way at things which have always been looked at in the same way. Liberation from old ideas and the stimulation of new ones are twin aspects of lateral thinking.

The traditional type of thinking which is quite different from lateral thinking is vertical thinking. The distinction between these two kinds of thinking is sharp. In vertical thinking, one moves forward by sequential steps each of which must be justified. On the other hand, in lateral thinking, one may have to be wrong at some stages in order to achieve a correct solution. Another distinction of the two sorts is in lateral thinking, one may deliberately seek out irrelevant information, meanwhile in vertical thinking one selects out only what is relevant.

Rightness is what matters in vertical thinking whereas richness is what matters in lateral thinking. Vertical thinking selects a pathway by excluding other pathways. Lateral thinking does not select but seeks to open up other pathways. With vertical thinking one selects the most promising approach to a problem meanwhile with lateral thinking one generates many alternative as many as one can even after one has found a promising approach.

The diagram below illustrates the differences of vertical and lateral thinking.



The movement and change of lateral thinking is not an end in itself but a way bringing about repatterning (De Bono, 1977: 38). The lateral thinker is looking but he/she doesn't know what he/she is looking for until he/she has found it. On the contrary, the vertical thinker knows what he/she is looking for.

From the explanation above, it can be understood that those sorts of thinking are quite distinct and the differences are fundamental as well. However, lateral thinking is not a substitute for vertical thinking. Both are required and complementary. Once lateral thinking is generative, vertical thinking is selective. Precisely, lateral thinking enhances the effectiveness of vertical thinking and vertical thinking develops the ideas generated by lateral thinking. In the conclusion, the definition of lateral thinking in this study is thinking ability that is indicated by being able to look for various of alternative problem-solving

## **B. OPEN-ENDED PROBLEM**

Nowadays, many teachers facilitated their students to improve their ability in solving open-ended problems. Open-ended problems give opportunity for students to solve problem in several possible ways. According to Mahmudi (2009:7) open questions (open-ended problem) is a type of matter that can stimulate students to think flexibly. While flexible thinking is one aspect of creative thinking. In addition to this, through open-ended problem, students have a chance to explore many strategies or approaches to think flexibly in mathematics. What makes open-ended problems an attractive approach towards teaching and learning is their open nature that poses the challenge to engage the students' thinking.

Hancock (1995) argues that open-ended problem tasks are often thought of as tasks for which more than a single correct solution is possible, and that they offer students multiple approaches to the problems by placing little constraints on the students' methods of solution. Furthermore, Shimada (2007) states that open-ended problem is a problem that has several or many correct answers, and several ways to the correct answers.

According Suherman (2003: 123), the problem which is formulated to have a many right answers is called the incomplete problem or also called open-ended problems. The main goal of open-ended problem which is given to student is not to get the solution, yet how the way to get the solution. Besides, Becker and Shimada (1997 : 1) said that open-ended approach, an 'Incomplete' problem is presented first. The lesson then proceeds by using many correct answers to the given problem to provide experience in finding something now in the process. This can be done through combining student own knowledge, skills, or ways of thinking that have previously been learned."

Based on several arguments above, open-ended problem is a problem that has several or many possible correct answers, and several ways to the correct answers. On the other words, open-ended problem can be stated as a problem with one way to find many possible correct answers, a problem with many ways to find one correct answer, or a problem with many ways to find many possible correct answers.

## **C. LEARNING STYLES**

Each student has different interests in the way of learning. Some students prefer to pay a lot of attention to the teachers' explanation on the board, the others are easy feeling bored while they should sit down on their seat during lesson, and another loath to read a lot without any discussion. In a line with that statement, Gunawan (2007: 138) argues that kinds of different ways to think, process and understand the information is referred to the learning styles.

In addition to this, Felder and Hendriques (in Sabatova, 2008: 17) define learning style as the ways in which an individual characteristically acquires, retains and retrieves

information. From that definition, it is clear that each student has distinct way to understand subject so that the subject that is learnt could be mastered well.

Based on the definitions above, it can be concluded that learning styles are different ways for each individual to process, explore and learn the information easily. Actually, there are several kinds of learning styles approaches, such as:

1. The Myers-Briggs type indicator(MBTI)

This model classifies students according to their preferences on scales derived from psychologist Carl Jung's theory of psychological types. Felder and Henriques (in Sabatova, 2008: 20) address that Jung introduced sensation and intuition as two ways in which people tend to perceive the world. The different ways in which sensors and intuitors approach learning have been characterized in MBTI.

2. The approach which is based on intelligence; specify different talents. This approach was developed by Gardner, Handy (Gunawan, 2007:140)

3. The approach which is based on sensory modalities; determine the degree of dependence on particular senses. This approach was developed by Bandler and Grinder, Messick (Gunawan, 2007:140).

In this study, researchers restrict the learning style approach to be used is the approach to learning styles with sensory modality developed by Bandler and Grinder. Researchers chose the approach of learning styles with sensory modality because the approach is based on sensory modality that is directly related to the use of certain senses within the meaning of learning so easily identified and found. Learning styles developed by Grinder on sensory modalities are divided into three types, namely visual, auditory and kinesthetic.

#### D. RELEVANT RESEARCH

There were several research that explored about lateral thinking. Firstly, the research that has been done by R. Rosnawati (2011) from Universitas Negeri Yogyakarta and the title is "Lateral Thinking in Mathematics Learning". The research explore the lateral thinking as students' thinking ability that should be owned. In lateral thinking students do not have to be 'right' at every step and do not use categories, classifications or labels that remain in solving the problem. In order to facilitate students to be able to have the lateral thinking abilities, mathematics learning is done through learning activities that may provide opportunities for students to do free thinking, and creating connections. The result of this research is each student has different perspective in solving problem. Lateral thinking processes challenge students and allows the 'mistakes' will produce something creative.

The other research was conducted by Ilmiyah (2012) from Universitas Negeri Surabaya discussed about the profile of students' problem solving in terms of learning style differences. First, visual learner understands problem by underlining keywords and drawing diagrams to solve the problem. He is pretty sure of his answer and reviewing it by reading keywords and the way of problem solving several times. Second, auditory learner understands problem by reading aloud the question and rewrite the keywords in his own way. Auditory learner talks to himself and pays attention the each steps in solving problem to ensure his answer. He reviews his answer by applying reverse operations. Third, kinesthetic learner understands the problem by pointing keywords by his finger and tapping pencil on the table. He makes sure that his answer is true by reviewing each steps in solving problem.

## CONCLUSION AND SUGGESTION

Based on the discussion above, it is clear that each learner from different learning styles has his own way in understanding problem and reviewing his work. First, visual learner understands problem by underlining keywords and drawing diagrams to solve the problem. He is pretty sure of his answer and reviewing it by reading keywords and the way of problem solving several times. Second, auditory learner understands problem by reading aloud the question and rewrite the keywords in his own way. Auditory learner talks to himself and pays attention the each steps in solving problem to ensure his answer. He reviews his answer by applying reverse operations. Third, kinesthetic learner understands the problem by pointing keywords by his finger and tapping pencil on the table. He makes sure that his answer is true by reviewing each steps in solving problem. It seems that they have the ability of lateral thinking as well as in solving open-ended problem.

As a suggestion, since each student has own learning styles that can affect on their thinking process, teacher should design appropriate learning method in facilitating their learning styles differences.

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