Concreteness fading process of elementary school students based on mathematical ability

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Abstract. First grade students generally have difficulty in converting concrete to abstract thinking. This qualitative research that is concerned with concreteness fading process of students. The study aimed at describing the concreteness fading process of 1st grade elementary school students. In order to find out the concreteness fading process students can be seen based on enactive, iconic, and symbolic stages are known through learning, tasks and task-based interviews. The results generally show that students are still having difficulty solving mathematical equivalence problems in a symbolic stage objects. In general, first year students still have difficulty. Difficulties experienced that solve problems related to the sum of the natural numbers more precisely in a problems of mathematical equality.

1. Introduction

Mathematics is the study of abstract objects [1]. Abstract mathematical objects that have become one of the causes of students having difficulties. Mathematical concepts that are abstract will be more easily understood if it is converted into a more concrete form. Understanding the concept of mathematics is a necessary basis for thinking in solving mathematical problems and problems of everyday. To facilitate understanding of abstract concepts required a manipulative materials that can be used to improve motor skills and abstract understanding in mathematics [2].

According to Nursalim states that students in 1st grade are at the concrete operational stage which requires a real media in learning [3]. At this stage the children are able to understand simple mathematical concepts that are still influenced by real objects. This opinion is supported by the Piaget's psychological theory [4] that is elementary school students between the ages of 7-11 years are still at the stage of concrete operational. Based on observations by researchers, showed that students in 1st grade are still having difficulties. The difficulty is solving problems related to mathematical equality, so it takes a thing that is used to transfer the thinking from concrete to abstract.

Concreteness fading is one that can help change that thinking. This concreteness fading appears in the beginning with a concrete format and then connected with abstract symbols [5]. Specifically refers to the progress of the three steps in which the physical object (real) of a concept over time becomes abstract. “Concreteness fading are theorized to benefit learning by activating real world knowledge, inducing physical or imagined action and enabling students to construct their own knowledge of abstract concepts” [6]. Based on these opinions can be said that the concreteness fading can provide benefits in
learning by activating the real-world knowledge, encouraging students to act with real, and allowing students to build their knowledge of abstract concepts. Mathematical ability is a skill every individual to be able to perform a variety of tasks ranging from a concrete object to the use of abstract symbols, the use of a mind or logical reasoning can be measured through mathematical ability tests.

Therefore, this study aims to investigate and describe the concreteness fading process of elementary students on natural numbers based on mathematical ability. Task sheet given to students was analyzed based on Bruner's theory about enactive, iconic, and symbolic.

2. Method

This descriptive qualitative study was conducted on 34 first grade elementary school students in Gresik, Indonesia. In which 3 students that consist of highest, middle, and lowest student’s ability. Students are learning first and then given instrument. The instrument used is a task sheet that focuses on the concept of addition and mathematics equality and given an interview based on semi-structured task-based interviews. Data collection used tests and interviews.

After they complete the task, they are given an interview based on semi-structured interviews. Then the work sheet and interview results were analyzed based on the stages of Bruner's theory of the enactive, iconic, and symbolic stages.

3. Results and discussion

Based on learning, students task sheet and interview based on task results are analyzed based on concreteness fading process. Here are the results and interviews of selected students.

3.1. Concreteness fading process of student with highest mathematical ability

Student in highest mathematical ability shows answer in figure 1.

![Figure 1. Student in highest mathematical ability answer.](image)

In the learning process student are able to answer the problem on task sheet be avowed in concrete form that is represented by the form of eraser which is the enactive stage. As Soviawati points out that mathematics must be related to reality and relevant to everyday life [7]. After the use of the concrete form is changed to a similar in the picture form, the student also can still answer the problem which in this situation includes the iconic stage. Furthermore, at the symbolic stage when given numbers problem then asked to add and equalize the sum student is still having difficulties. This is shown in the student work as follows. At number 1 the student can equalize properly. At number 2 student write the number 9 which means that the number is the same as on the left without counting the number 11. At number 3 student also directly add numbers 12 and 3 regardless of the number 11, and at number 4 student answered correctly.
3.2. Concreteness fading process of student with middle mathematical ability

Student in middle mathematical ability shows answer in figure 2.

![Figure 2. Student in middle mathematical ability answer.](image)

In the learning process, student can solve the problem when the question on task sheet be avowed in concrete form of eraser, which at this stage is an enactive stage. As Soviawati points out that mathematics must be related to reality and relevant to everyday life [7]. After concrete is converted into image form. Student begin to have difficulty answering the problem, in this situation student is in iconic stage. Furthermore, at the symbolic stage when problem is converted into a numeric symbol, student can only summing without equalizing the sum. This is shown in the numbers 1 to 3 that student can only sum and don’t know when to be equalized, while at number 4 student answer 2 choices, This is because student have difficulty understanding the meaning of the problem or it can be said that the student difficulties when given the story. As Hadi argues that the first grade students of primary school have difficulty solving the story problem because it does not have a clear enough picture to make it into a mathematical sentence [8].

3.3. Concreteness fading process of student with lowest mathematical ability

Student in lowest mathematical ability shows answer in figure 3.

![Figure 3. Student in lowest mathematical ability answer.](image)
In the learning process, student can solve the problem when the question on the task sheet is expressed in the concrete form of eraser, which at this stage is an enactive stage. As Soviawati points out that mathematics must be related to reality and relevant to everyday life [7]. After concrete is converted into image form, student begin to have difficulty answering the problem. In this situation student at an iconic stage, where there is a change from concrete to image form. Furthermore, at the symbolic stage, when the problem is converted into a number symbol, student can only summing without equalizing the sum. This is shown from the numbers 1 to 4, student just summing any numbers on the question and do not equate it. At number 4 student choose option b but still summing the available options.

Concreteness fading is one of the tasks used in learning can begin by representing a thing in the learning [9]. The representation begins with a concrete representation which will then continue and be replaced by more abstract representations. It supports the results of this research that concreteness fading is one of the things used to change students' thinking about a problem. First it represents the problem in concrete (real) form then transforms it gradually into a more abstract form.

4. Conclusions
Based on the results, we conclude that students with high mathematical ability during the concreteness fading process have been able to solve the problem at the symbolic stage, but still can’t solve the concept of summation on mathematics equality. In other words, students with high ability have almost reached the symbolic stage. While students with middle and lowest math ability generally still can’t solve the problem when a concrete object is changed to image form, or in other words only until the iconic stage.

In general, first year students still have difficulty. Difficulties experienced that solve problems related to the sum of the natural numbers more precisely in a matter of mathematical equality.

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