

# THE ABSTRACTION PROCESS OF CONSTRUCTING RELATION OF TRIANGLES IN TERMS OF CONCEPTUAL COGNITIVE STYLE OF TEMPO TO THE STUDENTS GRADE VIII<sup>TH</sup> SMP NEGERI 1 BALIKPAPAN

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**Abstract** - Abstraction is an important process in mathematics education. Educators need to provide their cares and know the differences of students' characteristics in view of abstract mathematical objects; one of them is cognitive style. The objective of this research was to describe the abstraction process of constructing relation of triangles in terms of conceptual cognitive style of tempo. This research employed a descriptive research with qualitative approach, the research's subjects consisted of four students grade VIII at SMP Negeri 1 Balikpapan. The research's results obtained were subject of fast accurate gained 6 relation of triangles and in completing subject quickly without careful consideration and tend to write down everything which comes to mind on the answer sheet without thinking about it but the given solution tends to be precise. Subject of reflective gained 7 relation of triangles and in completing subject thought first before answering a question so it takes a long time but the answers are delivered based on the results of mature information processing and tend to be precise. Subjects of impulsive gained 5 relation of triangles and in completing subjects tend to respond quickly, short but not clear and write everything that comes to mind on the answer sheets but the given solutions tend to be less precise. Subject of slow inaccurate gained 5 relation of triangles and in completing subjects tend to be long in responding and less precise in giving conclusions and do not expose it in detail.

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**Keywords** - Process of abstraction, triangle, conceptual cognitive style of tempo

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## I. INTRODUCTION

Mathematics has strict structures; they are evident that to study mathematics, it must be done orderly in its concepts. Essentially, mathematics is all about learning the concepts, not only from the structures but also from the connection to one another. The main focus on learning mathematics is how students understand the concepts concretely. The series of modeling the abstract concepts is called as an abstracting.

Abstraction was defined by Halverscheid (2008), Hoyles (1996) "Abstraction is, in one sense, the transformation of events or objects in the external world into mental constructs and related to obtaining new information from these constructs. In other words, abstraction amounts to the appearance of new information through arrangement of information vertically (Halverscheid, 2008). Here the arrangement of information vertically means establishing relation of concepts. However, Noss and Hoyles (1996) addressed abstraction in the dimension of students' relating conceptual information which they have; according to this, when students perform activities successfully and progress, they learn to combine previous activities with new ones". [1]

The related research about the abstraction process is the research about spontaneous abstraction process within learning mathematics on Linear-line Equation topic [2]. In the research, William saw two ways of abstraction processes in two different countries (Australia and USA). Williams combined the theories

between Recognizing, Building With, Construction (RBC) and Mental Activity Krutetskii theory to solve problems and to make model which is able to identify the spontaneous abstraction process in learning mathematics in the class. The result of the research suggested that we have to give more space to students doing some activities for a glance, this means to trigger the spontaneous abstraction process. Yet, the research, which was done by Williams, did not explain more detail about characteristics of activities which stimulate the abstraction process.

Piaget proposed three kinds of abstraction; (1) Empirical Abstraction, which focuses on kids' way to construct the meaning of object's features. (2) Quasi-Empirical Abstraction, which focuses on the way of children to define the meaning of act characteristics in certain objects. (3) Reflective Abstraction, which concern about the way of student to construct the meaning of action and thematic operation on thoughts or assimilation, which related to mental-operation category and abstraction towards mental object. Basically, the three abstractions are related to another. The actions that lead to quasi-empirical and reflective abstraction are shaped by identification process towards object's features which are happening in the empirical one. Others, empirical abstraction only occurs through assimilation's schemes constructed by reflective abstraction. [3]

Generally, abstraction into two types: one is Empirical Abstraction which is defined as forming the meaning of an abstract object based on empirical experiences. Another is theoretical abstraction

derived from shaping the concepts and adjusted by several theories. [4]

There are three things happened in the abstraction process where students learn about empirical concept, mathematical object, and relation between empirical concept and mathematical object, or reversely. Although there is a different concept between empirical and theoretical abstraction, they are crucial and cannot be separated in a mathematics class. Some topics in mathematics can be easily taught by using empirical concept, like positive numbers, angle or flat shape. However, I will be more complex in irrational or complex number if empirical one is used in the class. [5]

Based on the definition, empirically or theoretically, indication of abstraction process can be seen a follows:

**Table 1. Indicator of Abstraction Activity**

Abstraction Activities	Type of Abstraction
Identifying object's features through direct experiences	Empirical
Identifying a manipulated or imagined object's features	Empirical
Generalizing	Theoretical
Presenting the mathematical idea into mathematics' words and symbols	Theoretical
Making relation between process or concept to generate a new understanding.	Theoretical

**Source: Nurhasanah, 2010**

Thus, the researcher was interested in studying the abstraction process on constructing similarities of triangles seen by conceptual-cognitive tempo by put forward these questions: (1) How does abstraction process' description in constructing the relation of triangles done by a fast accurate's student?, (2) How does abstraction process' description in constructing the relation of triangles done by a reflective-cognitive's student?, (3) How does abstraction process' description in constructing the relation of triangles done by a impulsive-cognitive's student?, (4) How does abstraction process' description in constructing the relation of triangles done by a slow inaccurate cognitive's student?. The research aim to discover how the abstraction process in constructing the relationship amongst triangles taken from a tempo-conceptual cognitive's student (fast accurate, reflective, impulsive, and slow accurate cognitive).

## II. RESEARCH METHOD

This is a descriptive research by using qualitative approach. This research illustrates qualitative data and depicts more detail about the abstraction in constructing the connection amongst triangles viewed by tempo-conceptual cognitive. The data was collected by the test of abstraction and interview transcript. Subject was grade 8 of SMPN 1 Balikpapan year 2017/2018. Subjects were selected based on cognitive behaviors (reflective, impulsive, fast accurate, and slow accurate). Selecting subject was done by using MFFT (Matching Family Figure Test) which was made by Jerome Kagan and modified by Warli that its validity, reliability, and advisability has been tested [6]. Data collected by giving the test of abstraction was based on indicators of abstraction activities, next was interviewing subjects in the manner of task which they can write what they think and imagine when they try to understand and solve the problems. Time triangulation was used to test the data's validity by checking and comparing data from each subject in the different time. The data which was the result of solved written-test and the interview towards problem M1 were validated obtaining the solved written-test and the interview towards M2, where M2 and M1 were parallel.

## III. RESULT AND DISCUSSION

The data of students' cognitive behavior was gained from grade 8 SMP Negeri 1 Balikpapan year 2017/2018. The candidates were selected from 8.1 and 8.2 (66 students). Based on the MFFT test, there were 32% of students categorized as reflective cognitive, 30% as impulsive cognitive, 20% as fast accurate cognitive, and 18% as slow inaccurate cognitive. The data was used to pick out 4 students as representative from each cognitive behavior.

### 3.1 The Abstraction Process of A Fast Accurate's Subject in Constructing the Relation of Triangles

Subject elaborating the relation of triangles based on their length and angle was able to answer the problem fast because he could correlate his prior knowledge. Subject utilized the presented examples which grouped into two types of triangle. One was from the length and another was from the angle, and afterwards he explained the properties of triangles. Subject focused on the same parts of triangle (the same degree of the angle) to construct the relation. The student used the data to opt triangles based on its length and its degree. New information was gained, and presented as follow:

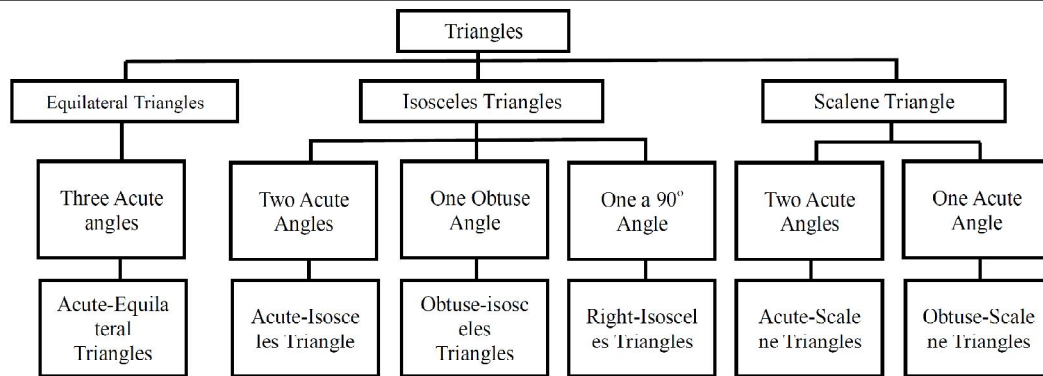


Figure1. Scheme of relation of triangles based on their length and angle which presented by a fastaccurate'sstudent

In this case, subject with a fastaccurate cognitive behavior tend to write what he thinks without considering it first, however, it comes with a precise solution.

### 3.2 The Abstraction Process of AReflective's Subject in Constructing the Relation of Triangles

Subject revealed the relation of triangles based on the length and angle. No hurry did he decided to answer the question, but he considered the answers. Once he made a mistake, consciously, he corrected it right

away. Subject found the relation by studying the discovered example from the picture in the problems. Subject divided triangles into two categories; (1) the length, (2) the angle. Then, each category was explained its features. In deduction, subject paid attention to the same features which are the same size of angle. Constructed the relation of triangles based on their characteristics and the size of the angle by focusing on the same parts, subject come up with this scheme below:

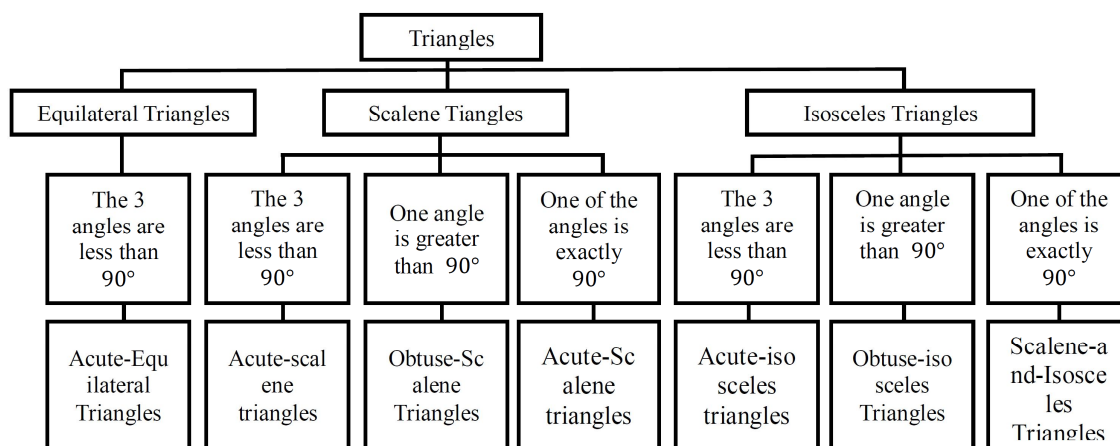


Figure 2. Scheme of relation of triangles based on their length and angle which presented by a reflective'ssubject

The abstraction process of a reflective subject of who constructed the relation within triangles, which confirmed by interviewing, was gained from preconceiving the answer. Subject used more time to solve the problem, but the given answered was from a considerable answer. In doing the test, subject thought firstly about the coming-up ideas and considered the answer before writing it down.

### 3.3 The Abstraction Process of Animpulsive's Subject in Constructing the Relation of Triangles

Subject in revealing the relation of triangles was based on the length of the sides and the angle by

observing the angle, the length of the sides and the shape of the triangle and giving an explanation by using the example of a triangle that has been found previously. Subject was still limited in to look at triangle based on the shape of the triangle that has been studied. In constructing the relation of triangles based on the length of the sides and the angle, subject took into account the shape's characteristics and the angular lengths held by the triangle based on the length of the sides. The result of constructing inter-continents relationships based on the length of the sides and the angle is presented in the following scheme below:

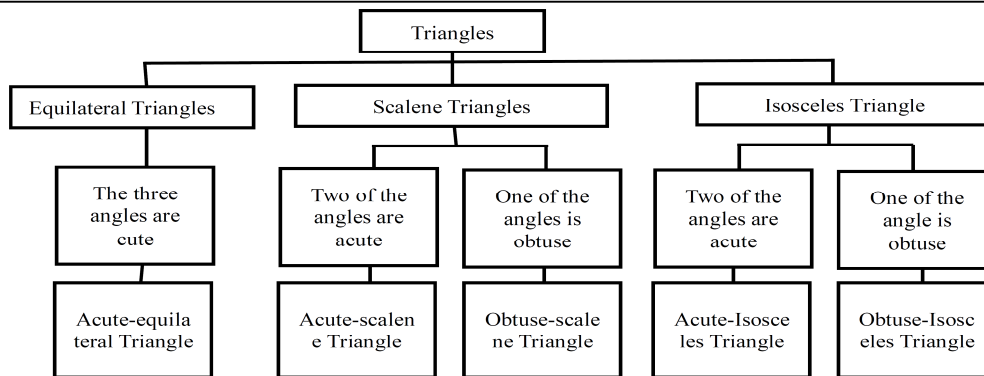


Figure 3. Inter Triangles Relationship Scheme Based on Length of Side and Large Angle on Impulsive's Subject

Subjects with impulsive cognitive style in the process of abstraction in constructing relation of triangles through abstraction activities related to the interview process, subjects tend to respond quickly, briefly, but less clearly. In the test, subject tends to immediately write down everything on his mind onto the answer sheet without any consideration and subject could not provide a clear reason.

### 3.4 The Abstraction Process of AnSlow Inaccurate's Subject in Constructing the Relation of Triangles

In revealing the relation of triangles based on the length of the sides and the angle, subject considered

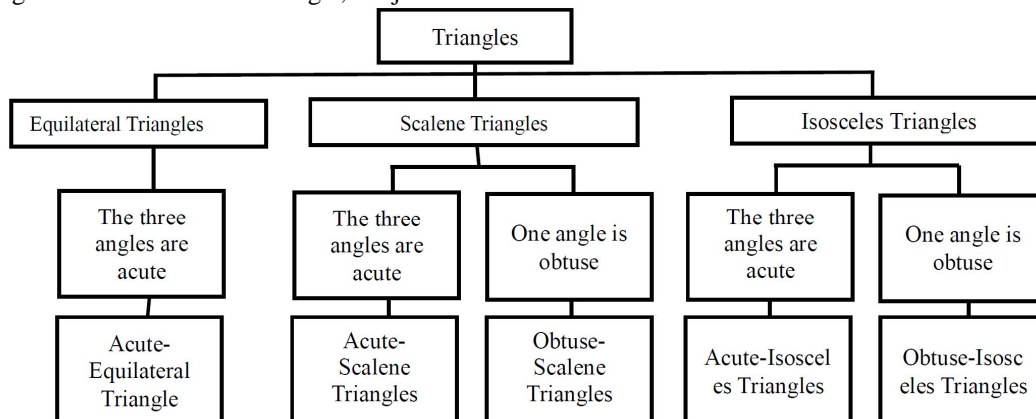


Figure 4. Inter Triangle Relationship Scheme Based on Length of Side and Angle on SlowInaccurate's Subject

A slowinaccurate's subject with slow, in the abstraction process, constructed the relation of triangles which were related to the interview process, subjects tended giving a late response; the answers were delivered less precise. In the abstracting tests, subjects did not re-investigate them and subjects concluded the information unclearly.

## CONCLUSION

Based on the results of data analysis that refers to research questions, the conclusions obtained in this study are: 1) The abstraction process on the fastaccurate's subject in constructing relation of triangles based on the length of the sides and the angle is to consider the same parts of the triangle. The relationship scheme presented 6 relation of triangles.

the shape of the triangles. In explaining the relation of triangles, subject also gave examples related to the relationship of side length and the angle. Subjects tended to provide a less clear explanations and relationships based on length and angle of triangles were incomplete. In constructing the relation of triangles based on the length of the sides and the angle, subject focused the shape's characteristics and the angle of the triangle by the length of the side. The results of constructing between triangles relationships based on the length of the sides and the angles are presented in the following scheme below:

Subject, in solving the problem, tended to respond quickly and give right solutions/answers. 2) The abstraction process on the reflective's subject in constructing the relation of triangles based on the length of the sides and the angle is to consider the same parts of the triangle. The relationship scheme presented 7 relation of triangles. Subjects, in solving the problem, tended to take more time but the answers are submitted based on the results of mature information processing. 3) The abstraction process on the impulsive's subject in constructing the relation of triangles based on the length of the sides and the angle is to consider the angle possessed by the type of triangle based on the length of the side. The relationship scheme presented 5 relation of triangles. Subjects, in solving the problem, tended to provide a quick response, short, but less clear and did not make

a careful consideration and not in provide a clear reason. 4) The abstraction process on the slowinaccurate's subject, in constructing the relation of triangles based on the length of the sides and the angle, is the angle seen from the angle of the triangle which is based on the length of the side. The relationship scheme presented 5 relation of triangles. Subjects responded to the problems long in the meaning of giving the solution, moreover subject answered it less precisely and deducted it less clearly by not posing it in detail.

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