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The Characterization Of True Pseudo Construction In Understanding Concept Of Limit Function

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Abstract: *This qualitative study was carried out in the seventh semester students of the Sulawesi Barat University, Majene, Indonesia. The goal is to assess the characteristics that arise when true pseudo construction in understanding concept of limit function. The results showed that in the process of understanding concept of limit function, there are five characteristics of true pseudo construction. These characteristics are disconnection, construction pit, non-holistic representation, partial miss-thinking and logical thinking.*
Keywords: *thinking process, construction concept, true pseudo construction, the concept of limit function*

I. Introduction

Learning mathematics is essentially a process of construction concepts and mathematical problem solving. Construction of the concept can succeed or fail. Construction failed to indicate a student's difficulties in constructing mathematical concepts. The difficulty is often reflected in the form of the students' mistake. The error may be a result of the construction process is not visible from the output of a real mental activity (Leron, 2005; Lithner, 2000; Pape, 2004; Subanji & Nusantara, 2013; Vinner, 1997). Such conditions are referred to as pseudo construction in this study.

Pseudo construction is a quasi construction. It is intended that the process of establishing the mathematical concept of "as if" in accordance with the scientific concept but once more explored deeply was not in accordance with the scientific concept (Subanji, 2016: 127). This pseudo construction is one type of error in constructing a mathematical concept (Subanji & Nusantara, T, 2013).

Mathematical concepts in this study are the concept of limit function because the students have difficulty in studying the concept of limit function (Cornu, 1992; Davis & Vinner, 1986; Juter, 2006; Li & Tall, 1993; Maharajh, Brijlall, & Govender, 2008; Monaghan, Sun, & Tall, 1994; Tall & Katz, 2014). In addition, the limits material in mathematics is an important matter that must be mastered students because the concept of limit is the basic concept of the calculus in the educational unit SMA / MA. Limit the material studied again at the college level, especially in the course of mathematics or mathematics education (catalog Department of Mathematics University, 2010). Material limit is a difficult matter and a major prerequisite in the calculus, especially for advanced mathematics study material, in particular with regard to the material continuity, differential and integral (Cornu, 2002).

Pseudo construction had been studied by many researchers using different terms. Subanji (2007, 2011) uses the term thinking pseudo reasoning co-variasional, Vinner (1997) use the term analytic and conceptual pseudo, Lithner (2000) used the term established experience (EE) versus plausible Reasoning (PR) in the context of problem solving non routine, Leron & Hazzan (2009) examines the Dual process Theory of Kahneman (process system 1 versus the system 2) in the context of solving algebra problems, and Pape (2004) uses the term direct Translation Approach (DTA) versus Meaning Based Approach (MBA) in context solving word problems.

Pseudo- analytic and pseudo-conceptual by Vinner (1997) was intended as a visible result of the settlement process and it is not the output of real mental activity. Further, he stated that the process of pseudo analytic thinking can produce the right or wrong answer. Its characteristic is the absence of control procedures (reflection), and identifying similarities of the problems with the other issues later using a mock procedure which does not match the problem (superficial similarities).

On the other hand, Vinner (1997) stated that the pseudo-conceptual intended as a condition where the behaviour looks like conceptual behaviour, but it is generated from a mental process that is not based on conceptual thinking. A conceptual framework is intended as a mental process that considers the concepts, relationships among concepts, ideas associated with the concept, logical relationships, and so on. Conceptual behaviour is the result of thinking conceptual, and pseudo-conceptual behaviour is the result of a pseudo-conceptual thought process (which is not based on conceptual thinking).

Lithner (2000) characterize the process of thinking in solving mathematical tasks into two parts, namely, plausible reasoning (PR) and established experience (EE). Further Lithner in describing the thinking of students when solving problems in four structures namely, (1) to understand the problem, (2) selecting strategies, (3) implement the strategy, and (4) conclusion (results). Structure 1-4 is the process of thinking PR if the components involved in reasoning contains mathematical properties. Whereas, if the structure is found 1-4 of understanding and procedures based on experience alone, then the structure of the thought processes of EE.

Process and behaviour in completing tasks in the Dual Process Theory of Kahneman (Leron & Hazzan, 2009) are grouped in two models namely, the process of the first system (S1) and the second system (S2). Characteristics S1 process is quick, automatic, without trying (effortless), involuntary (unconscious), and flexible (difficult to change). While the S2 process is slow, careful, hard efforts, calculations done, and relatively flexible. Both processes illustrate the difference in speed and ease of things comes to mind.

Based on the opinion above, we conclude that the pseudo construct examined in this study is more closely associated with pseudo thinking, and pseudo -analytic and pseudo- conceptual than the other terms mentioned previously. This happens because the researchers want to examine is the process of establishing the concept of limit function "as if" in accordance with the scientific concept but once explored more deeply was not in accordance with the scientific concept.

II. Research Methods

Type of the research is descriptive research. It is intended for the construction of this study describes the characterization of pseudo true in understanding concept limit function. The approach is qualitative approach, because this study examines the process or behaviour of students in solving mathematical problems.

This study was conducted on 18 students of seventh semester on Sulawesi Barat University, Majene regency, West Sulawesi Province, Indonesia Country. The procedure in determining the subject is done by researcher through conduct preliminary studies in advance at several universities. Determining the subject consider that candidates have studied the subject matter limit function, so the researcher observed fifth and seventh semester students. Furthermore, there will have students who experienced true pseudo construction, and students who have varied mistake in understanding the concept of limit function.
Assignment sheet instruments used in this study are as follows.

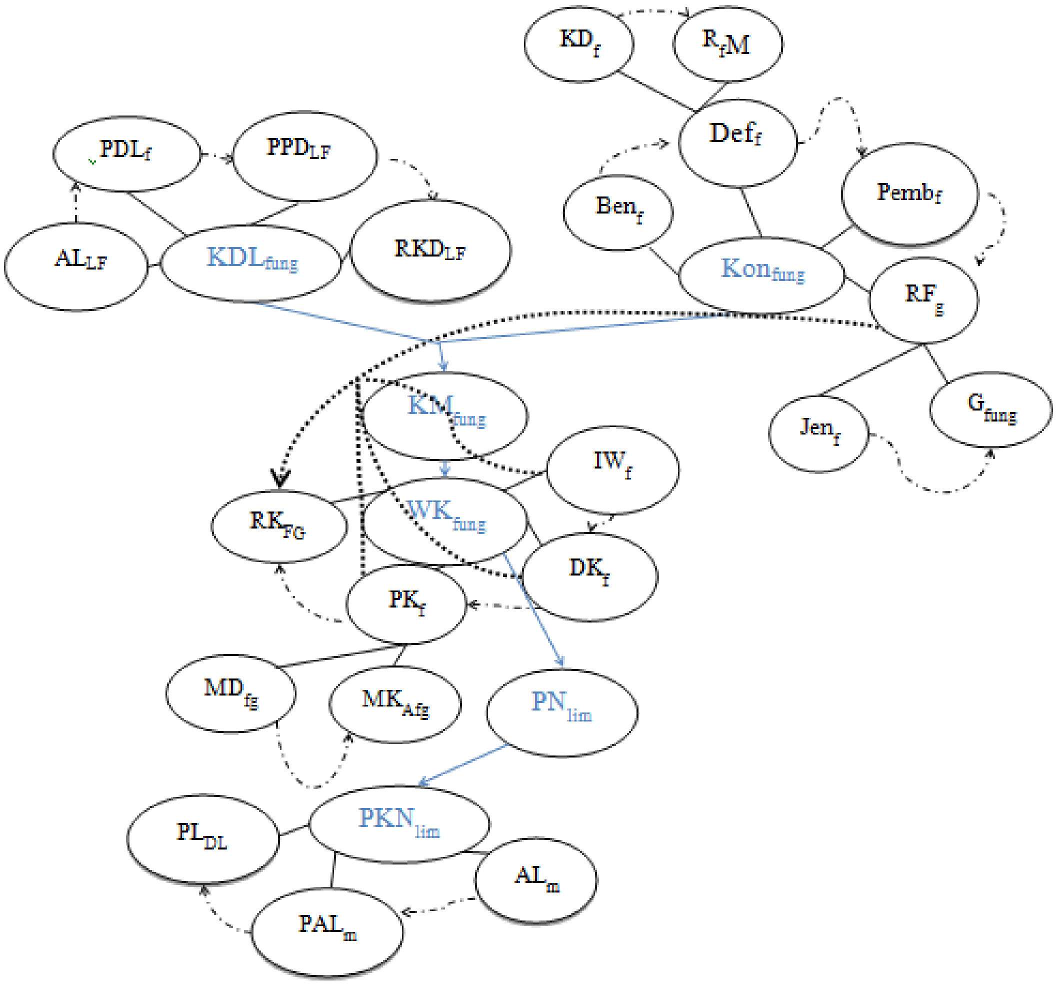

Figure 1. problem Structure of limit function

Remarks:

: A correct understanding
: Relationship indicates that the indicator compile/forming a concept
: A relationship which shows the flow of understanding of the concept of limit function
: Relationship showing the sequence of understanding to understand the components of the concept of limit functions.
: Relationship indicates that the connection concept to another concept.

KDL_{fung} : basic concepts of limit function
AL_{LF} : the meaning of the symbol and all symbols on $\lim_{x\to 1}\frac{x^2+3x-4}{x-1}$
PDL_f : basic understanding of $\lim_{x\to 1}\frac{x^2+3x-4}{x-1}$ is no limit if the limit value of the left and right there and the same.
PPD_{LF} : understanding the basic notions $\lim_{x\to 1}\frac{x^2+3x-4}{x-1}$
RKD_{LF} : basic concepts of representation limit function by using charts.
Kon_{fung} : the concept of function
Ben_f : form $f(x) = \frac{x^2+3x-4}{x-1}$) is a function if its domain is all real numbers except 1
Def_f : definition of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$
KD_f : basic concepts of function
R_fM : the representation of functions into mathematical algebraic form.
RF_g : graphic representation of the function f
Jen_f : the type of the function f is a rational function
G_{fung} : graph of the function f
$Pemb_f$: proof that $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ is a function
WK_{fung} : Being function and concept of similarity function
IW_f : identify and understand that the form of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ as $g(x) = x+4, x \neq 1$.
DK_f : function $f = g \Leftrightarrow \forall x \in D_{fungsi}$ apply $f(x) = g(x)$.
RK_{FG} : represent the same function through the charts
PK_f : proving the similarities between the functions f and g
MD_{fg} : demonstrate the applicability domain of the function f and g
MK_{Afg} : shows the similarity between the rule f (x) and g (x)
PN_{lim} : the determination that the value $\lim_{x\to 1}\frac{x^2+3x-4}{x-1} = \lim_{x\to 1} x+4 = 5$
$KL_{fung}M$: conceptual limit function is mathematically
AL_m : mathematical definition $\lim_{x\to 1}\frac{x^2+3x-4}{x-1} = 5$
PAL_m : understanding of every component of the definition $\lim_{x\to 1}\frac{x^2+3x-4}{x-1} = 5$
PL_{DL} : proof $\lim_{x\to 1}\frac{x^2+3x-4}{x-1} = 5$ with the definition of limit.

Techniques in collecting data are Think aloud and interview. Think aloud is done to get in process pseudo construction data that includes the data written, verbal, and behaviour (expression). While interview is to confirm that are not clear during collecting data by Think aloud.

The process of data analysis in this study conducted by the steps as follows: (1) transcribe verbal data and behaviour data (expression) collected, (2) explore all data available from various sources, namely from the data written, verbal data (results think out lauds, and interviews (if any)), and student's behaviour data (expression), (3) reduction of data by making abstractions. Abstraction is an attempt to make a summary of the core, process, and statements that need to be maintained to remain in it, (4) organize the units which further categorized by making the coding, (5) describe the structure of student thinking in solving the problem on the sheet task.

III. Results And Discussion

Researcher conducted a preliminary study at several universities before making the determination of the subject, including the University of Malang (UM) in fifth and seventh semesters, the Sulawesi Barat University (UNSULBAR) in fifth and seventh semesters, and Makassar State University (UNM) in fifth and seventh semesters. UM students were 28 students in the fifth semester and 27 in the seventh semester. Students

UNSULBAR were 30 students in the fifth semester and 35 in the seventh semester. Students UNM used were 25 students in the fifth semester and 29 in the seventh semester. The following is the results of their work.

Table 1. Categories of Student Job Results

Category Student Job Results	**Students UNSULBAR (person/semesters)**		**Students UM(person/semesters)**		**Students UNM (person/semesters)**	
	V	**VII**	**V**	**VII**	**V**	**VII**
True pseudo construction	11	18	19	17	20	23
true real	-	-	-	3	2	3
False real	19	17	9	7	3	3

Based on the table above, each college have students who experienced a true pseudo construction in understanding the concept of limit function. Students experience the true pseudo construction of each of the colleges mentioned above have the same characteristics corresponding to each semester. Students in semester V have done true pseudo construction but the characteristics of their mistakes are similar. They are all constrained in all components of the concept of limit function so that the characteristics are not varied. While the students in seventh semester have done true pseudo construction, besides they represent the characteristics of the fifth semester students' mistake, there are also other characteristics of a mistake in understanding the components of the concept of limit function. The characteristics such as, there have mistake in the component concepts of function and limit conceptual mathematical functions, and they have to understand the basic concept of all components of the concept of limit function even though they are not understanding. so, their mistakes are more varied, because of the characteristics of the students at each university, the researcher decided to use students at the Sulawesi Barat University in seventh semester as subjects in this study. More precisely, the researcher used 18 students were undergoing true pseudo construction as the subject.

The students work in completing the assignment sheet instruments are divided into two groups based on student answers. The groups are the right answer and wrong answer. Students will be used in this study were students from groups that experienced a true pseudo construction. Students who have to be pseudo construction conditions is true if the student answers correctly in completing the assignment sheet, but are not able to understand properly the components making up the concept of limit function. The components of the limit function consists of four components namely, the basic concept of limit function, the concept of function, form and concept of similarity of function, as well as conceptual limit function mathematically.

The true pseudo construction process on the student occurs when students understand the concept of limit function. This is indicated by the students answered correctly assignment sheet instruments as seen in Figure 2 but think aloud and interview results showed that the subjects had difficulty in understanding the concept of component of limit function as shown in dialogue 1.

$$\lim_{x \to 1} \frac{x^2+3x-4}{x-1} = \lim_{x \to 1} \frac{(x+4)\cancel{(x-1)}}{\cancel{(x-1)}} = \lim_{x \to 1} x+4 = 1+4 = 5$$

Figure 2. subject Determining the value of $\lim_{x\to 1} \frac{x^2+3x-4}{x-1}$

Researcher: Could you explain the definition of $f(x) = \frac{x^2+3x-4}{x-1}$, for x is not equal to 1?

Subject : Ok, so for each x element of real numbers, then$f(x) = \frac{x^2+3x-4}{x-1}$, but there is the condition x is not equal to 1 then f (x) is defined, it shows that x pairs. If it means, suppose there's any element of R is not a 1, for every b element $\mathbb{R}$ is not 1, if suppose f (a) = f (b) then a = b.

Dialog 1. Understanding subject to the definition of the function f

We will describe students' mistakes regarding the clarification of their work. From the mistakes that have been identified, the author categorized these mistakes into five components. These components are disconnection, construction pit, non-holistic representation, partial thinking and miss logical thinking. The following is description of the mistakes.

Disconnection

Disconnection meant that the understanding of the concept of limit functions of wrong student because it is not doing attribution among the components making up the concept of limit function. The following is exposure to disconnection when students have true pseudo construction in the process understanding the concept of limit function.

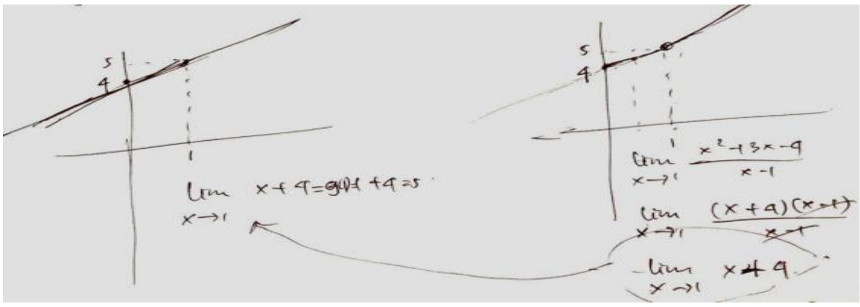

Figure 3. Understanding subject to RK_{FG}

The above picture shows that the graph on the right is a graph of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ and on the left is a graph of the function$g(x) = x + 4, x \neq 1$.. Further, it is demonstrated that the graph of the function f-shaped curve for a quadratic function, while the graph of the function g in the form of a straight line as a linear function. Nevertheless, it appears that the subject tried to make the second graph has the same points namely at the point (0, 4) and a hole at the point (1, 5). This is supported by the following dialogue.

Researcher : This is what the connection between the function f with the function g?
Subject : The relationship, the difference is actually much different, g (x) is linear, that is f (x) is slightly curved, is not it, what is it called, it was not,, not really straight.
Researcher : Cannot you represent!
Subject : What is yes, a moment (while graphing g (x)), if that is the value, 4 (while writing the number 4 on the y-axis in graph 4), here one on the x axis paired with a 5 on the y axis (while making point (1,5) on the graph g (x)), then made a straight line through 4 and the point of this (pointing at the point (1,5) on the graph g (x)), like this anyway. Well, while that which is (while making the graph f (x)), this 4 (while writing the number 4 on the y-axis on the graph f (x)), here one on the x axis paired with a 5 on the y axis (while making an image circle perforated at the point (1,5) on the graph f (x)), then what is it (pulling slightly curved line through the point (0,4) and the point (1,5)), the value of it, he does not really straight, not straight line, like ,, such as curves, curves.

Dialog 2. Understanding subject to RK_{FG}

Subjects can identify that the form of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ is $g(x) = x + 4, x \neq 1$ (IWF), can understand the definition function f = g (DKF) well, but he can not represent the same function through the charts (RKFG). It is shown in Figure 3 where the subject to draw graph of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq$ and $g(x) = x + 4, x \neq 1$ is different. This indicates that the subject does not perform the function of attribution form and definition to the concept similarity function graphing functions. As a result, the subject can not understand that if a function g is a form of function f when x ≠ 1, which means$\forall x \in \mathbb{R} - \{1\}, f(x) = \frac{x^2+3x-4}{x-1} = x + 4 = g(x)$, the graph of f and g are the same.

The above statement shows that the disconnection occurs when subject attempt to represent the similarity between the functions f and g through the charts, causing a subject cannot represent those similarities correctly. This is consistent with the concept of miss-connection as a characteristic error in constructing mathematical concepts by (Subanji, 2016; Subanji & Nusantara, T, 2013).

Here is a picture of a subject thought structure that indicates the occurrence of disconnection in understanding the concept of limit function.

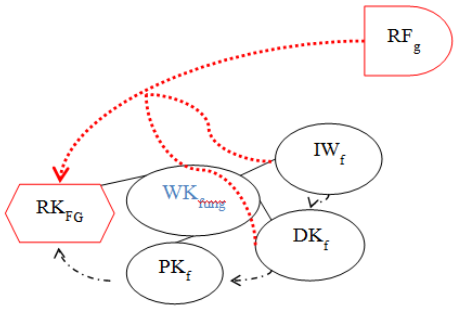

Figure 4. Structure of Thinking in Understanding subject RK_{FG}

Remarks :

: Understanding of fault indicators for disconnection
: Think partially (partial thinking)
: Relationship shows disconnection

Construction Hole

Construction hole meant that occur holes in students' understanding of the concept of limit function for errors or disappearance of understanding the concept of supporters. Following further exposure related construction pit based on the facts of the student work.

Subject draws a graph of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ with a curved line. The reason is because the function f is a quadratic function. Besides, it also makes the line through the point (0,-4). It shows that the subject cannot draw a graph of the function f correctly as shown on the drawings and the following dialogue.

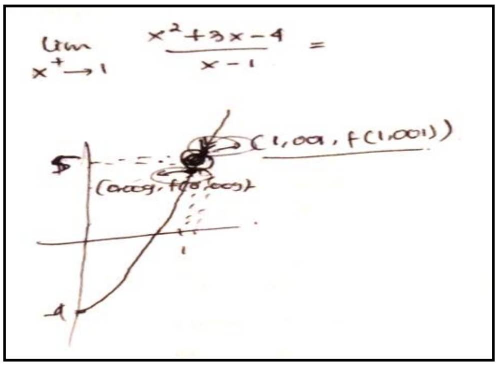

Figure 5. Understanding subject to RKD_{LF}

Subject : if f (x) is slightly curved, what is it called, he was not,, not really straight.
Researcher : Cannot you represented below!
Subject : What is yes, a moment (while making the graph f (x)), this 4 (while writing the number 4 on the y-axis on the graph f (x)), here one on the x axis paired with a 5 on the y axis (while making pictures hollow sphere at the point (1,5) on the graph f (x)), then what is it (pulling slightly curved line through the point (0,4) and the point (1,5)), the value of it, he does not absolutely straight, not straight line, a little bit what yes,, like curves, curves.
Researcher : Why do you say that the graph of the function f in the form of the curve?
Subject : because this mom, the function f (x) khan no form squares, this (pointing $x^2 + 3x - 4$ on the $f(x) = \frac{x^2+3x-4}{x-1}$), khan graph quadratic function curve shape miss, so definitely graph of the function $f(x) = \frac{x^2+3x-4}{x-1}$ is also in the form of curves, slightly curved mom.

Dialog 3. Understanding subject to RKD_{LF}

On the other hand, the subject can understand the meaning of the symbol of the limit and all symbols on $\lim_{x\to 1} \frac{x^2+3x-4}{x-1}$ (AL_F), can be a basic understanding of $\lim_{x\to 1} \frac{x^2+3x-4}{x-1}$($PDL_f$), can understand the intent of the left limit and right limit of the function f for x approaching 1 (PPDLf). This shows that there is construction pit to the understanding of the subject in the basic concept represents the limit function f through charts (RKDLF). The hole is a wrong understanding of the subject of the representation of the function f through charts (RFG). Similar findings were also found in the study the characteristics of error construct mathematical concepts by (Subanji, 2016; Subanji & Nusantara, T, 2013).

The following image shows the structure of the thinking subject of the construction pit in understanding the concept of limit function.

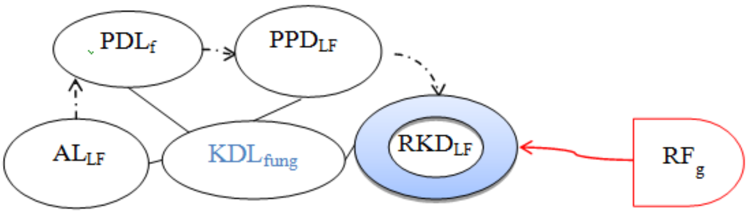

Figure 6. Structure of Thinking of subject in Understanding RKD_{LF}

Remarks :

: Construction pit understanding of fault indicators for misunderstanding the other indicators

: Implication relations indicate an incorrect understanding

Non-holistic representation

Non-holistic representation meant that students could not realize a verbal statement in the form of mathematical or cannot interpret the statement of mathematical forms. Following further exposure related to non-holistic representation based on the facts of the student work.

Subject reveals that a basic understanding of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ is a rule that pairs each $x \in \mathbb{R}$ except x = 1 with exactly one member of $f(x) \in \mathbb{R}$. The following are images and dialogue that supports the statement.

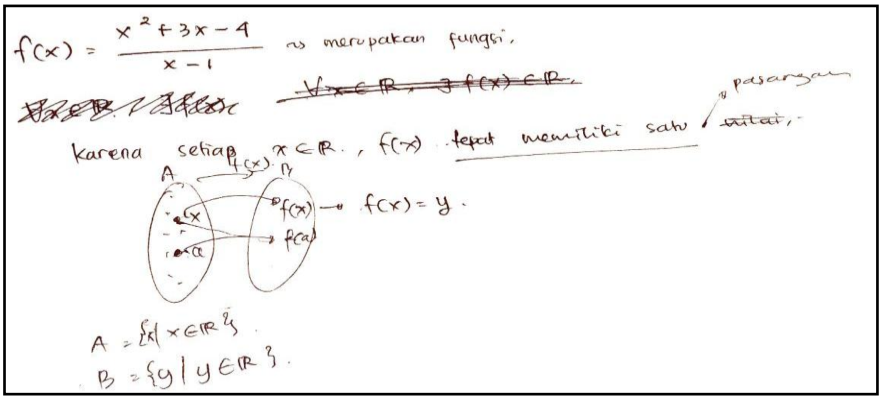

Figure 7. An understanding of the subject Basics of Function f

Researcher : What do you mean that this (pointing $\frac{x^2+3x-4}{x-1}$ on the matter) is a function?

Subject : function, what it actually,, yes, the function of the relation, the relation for example there is exactly one pair, so if for x for each,, This (pointing ($\frac{x^2+3x-4}{x-1}$ on $\lim_{x\to 1} \frac{x^2+3x-4}{x-1}$ I call the function because for each value, the value of x yes, he was right to have one partner and she did not have a partner other than the value of f (x) itself, so. $f(x) = \frac{x^2+3x-4}{x-1}$ is a function. So for every element x R, x it,,, briefly, for definition difficulty, moment,, ok, it is a function for each x element of R it only has exactly one value of f (x) (as he wrote ∀x∈ R, ∃f (x) ∈R), how writing it, or wear a sentence, is a function for each element x real numbers, the function of x, has exactly one value. So, if for example it sets yes (while making figure 6) from A to B, kept here there is a function f (x), x it was with A where x her the set of real numbers, and B where y it was, y element numbers real well. x exist f (x) here (while making arrows from x at A to f (x) in B), f (x) of course it was, and x has only one partner alone, just one pair, so unlikely that (pointing x in set A) have two pairs. So if for example here there was a (while writing a on a set A in figure 6), here is f (a) (while writing f (a) on the set B in Figure 6), there is not a possibility that f (x) and (a) it was the same, but it is clear to every member A, it has exactly one pair and all must have a partner.

Researcher : If for example, this (pointing to in set A in figure 6), a yes, I attach it here (pointing to f (x) on the set B in figure 6) and here (pointing f (a) on the set B in figure 6), the function is not it?

Subject : should not be, because it does not function because, since the function it must have exactly one pair (while changing the word 'value' with the word 'partner' in the statement 'due to every x element R it only has exactly one value'), a couple of , the local man.

Dialog 3. Understanding subject to the Basics of Function f

The above statement indicates that the subject can be a basic understanding of the function f correctly.

Further subject reveals that the definition of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ mathematically namely:

- $if\ \forall x \epsilon \mathbb{R}, f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ then $f(x)$ defined
- $\forall a \epsilon \mathbb{R} - \{1\}, \forall b \epsilon \mathbb{R} - \{1\}, f(a) = f(b) \Rightarrow a = b$

Defining the limit is based on the basic understanding of the function f. This is supported by dialogue 1 and the following picture.

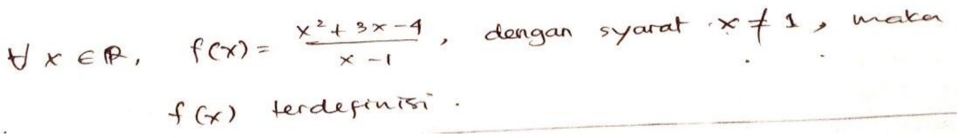

Figure 8. Understanding subject to $\mathrm{Def_f}$

Based on the figure 8 and dialog 1, subject cannot realize the definition of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ algebraically correctly. This means, there is a non-holistic representation of the definition of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ mathematically. That is because the subject made an error in defining the singularity of each element pair Df mathematically. Subject mistake because it works only by his memory of prior knowledge without trying to rethink the meaning or definition of truth is revealed.

The following image shows the structure of the thinking subject the non-holistic representation in understanding the concept of limit function.

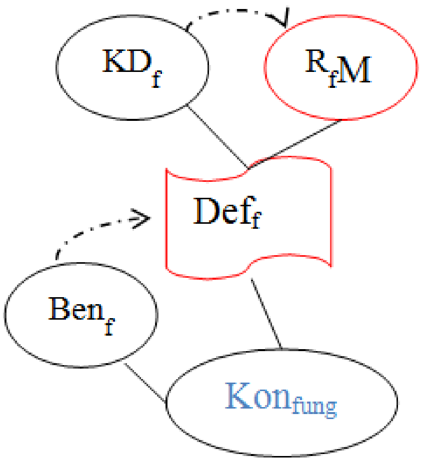

Figure 9. Structure of Thinking of subject in Understanding $\mathrm{Def_f}$

Remarks :

: Understanding of fault indicators for errors represents concepts or statements into mathematical form (non-holistic representation)

: Understanding of fault indicators

Partial Thinking

Partial thinking meant that one of the students' understanding of mathematical concepts because they think partially. Following further exposure associated partial thinking based on facts from the work of students. Subject draws a graph of the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ in the form of a curved line. The reason is, because the function $f(x) = \frac{x^2+3x-4}{x-1}, x \neq 1$ contains a quadratic form $x^2 + 3x - 4$. This happens because he confused with meth-related beforenya graph quadratic function in the form of a curved line or curve. The following images and dialogue are supporting the statement.

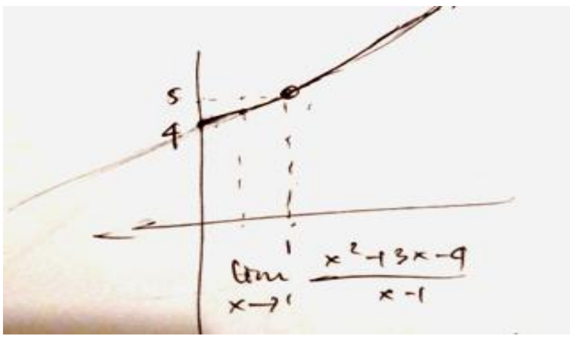

Figure 10. Understanding subject to $\mathrm{RF_g}$

Subject	: if f (x) is slightly curved, what is it called, he was not,, not really straight.
Researcher	: Cannot you represented below!
Subject	: What is yes, a moment (while making the graph f (x)), this 4 (while writing the number 4 on the y-axis on the graph f (x)), here one on the x axis paired with a 5 on the y axis (while making pictures hollow sphere at the point (1,5) on the graph f (x)), then what is it (pulling slightly curved line through the point (0,4) and the point (1,5)), the value of it, he does not absolutely straight, not straight line, like,, such as curves, curves.
Researcher	: Why do you say that the graph of the function f in the form of the curve?
Subject	: because of this, the function f (x) khan no form squares, this (pointing x^2+3x-4 on the $f(x)=\frac{x^2+3x-4}{x-1}$), khan graph a quadratic function curve shape, so definitely graph of the function $f(x)=\frac{x^2+3x-4}{x-1}$ is also in the form of curves, slightly curved mom.

Dialog 4. Understanding subject to RF_g

It shows that the Partial thinking occurs when subjects attempt to represent the function $f(x)=\frac{x^2+3x-4}{x-1}, x\neq 1$ through charts (RF_g). Subject assume rational function as a quadratic function as just pay attention to the function $f(x)=x^2+3x-4$. As a result, the subject can not be merepsentasikan graph of the function $f(x)=\frac{x^2+3x-4}{x-1}, x\neq 1$ (RF_g) correctly. This is consistent with the concept of fault analogy of constructing mathematical concepts by (Subanji, 2016; Subanji & Nusantara, T, 2013).
The following image shows the structure of the thinking subject partial occurrence of thinking to understand the concept of limit function.

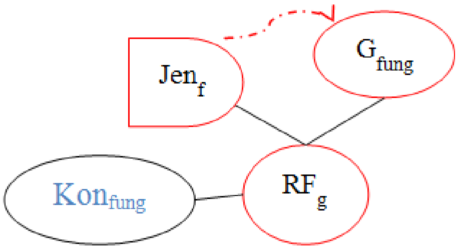

Figure 11. Structure of Thinking of Subject in Understanding RF_g

Remarks :
: Think partially (partial thinking)
: Implications for understanding the relationship which shows that one of understanding in the process of understanding the components of the concept of limit function.

Miss logical Thinking

Miss logical thinking meant that students do deviations in use rules of logic in the process of formation of mathematical concepts. Following further exposure related to miss logical thinking based on facts from the work of students.
Subject pointed out the similarities between the functions f and g with:
as the proof is f (x) = g (x) Take any $a \epsilon \mathbb{R}, a\neq 1$, and it will be shown that f (a) = g (a) We first consider $\frac{a^2+3a-4}{a-1}=a+4$, then we do the cross product to obtain $a^2+3a-4=(a+4)(a-1)$, and because $(a+$ $4a-1$ is equal to $a2+3a-4$ then $a2+3a-4=a2+3a-4$.
The following images and dialogue are supporting the statement.

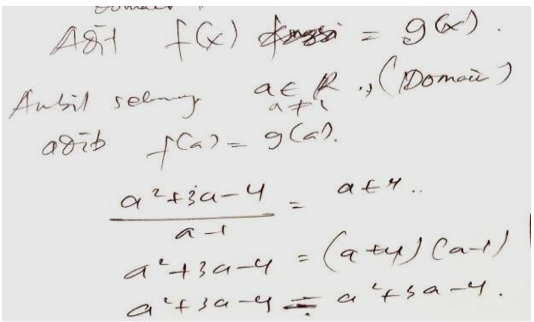

Figure 12. Understanding Subject to PK_f

Researcher	: you try to show the similarity of the functions f and g!
Subject	: will be shown that f (x) = g (x). Take any a element and a real number may not be equal to 1, continues to be shown that f (a) = g (a). We first consider $\frac{a^2+3a-4}{a-1} = a+4$, continue to do the cross product to obtain $a^2+3a-4 = (a+4)(a-1)$, and because (a + 4) times (a-1) is equal to a^2+3a-4 then $a^2+3a-4 = a^2+3a-4$.

Dialog 5. Understanding Subject to PK_f

The picture above shows that there is miss logical thinking on the subject pointed out the similarities between the functions f and g (PK_f). Where is the logic of proof Subject problematic, it should indicate that $\frac{a^2+3a-4}{a-1}$ can be manipulated in order to obtain a + 4, but he was just doing algebraic manipulations which showed that $\frac{a^2+3a-4}{a-1} = a+4 \Leftrightarrow a^2+3a-4 = (a+4)(a-1)$. Similar findings were also found in the study the characteristics of error construct mathematical concepts by (Subanji, 2016; Subanji & Nusantara, T, 2013).

The following image shows the structure of the thinking subject occurrence of mis-logical thinking in understanding the concept of limit function.

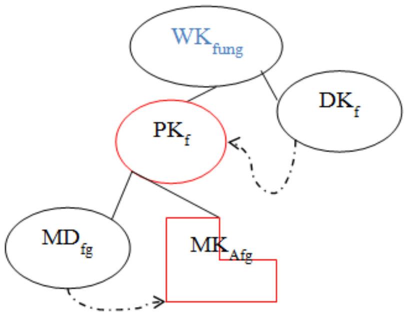

Figure 13. Structure of Thinking of Subject in Understanding PK_f

Remarks:

: Understanding of fault indicators due to the miss-logical thinking

IV. Conclusion

Based on the results of research and the previous discussion, we conclude that in constructing the understanding of the concept of construction pseudo limit function occurs right. Construction characteristics pseudo truly is a student undergoing construction pseudo true because (1) occurs miss connection among the components making up the concept of limit function, (2) occurs pit construction to understanding the components of the concept of limit functions (understanding of the concept is wrong or not at all appear), (3) occurs non holistic representation (from the basic concept to the form of mathematical or meaning of the concept in the form of mathematics), (4) there think partially (partial thinking), and (5) occurs miss logical thinking in understanding the constituent components the concept of limit function.

References

[1]. Cornu, B. 1992. *Limits. In D. Tall (Ed.),* Advanced mathematical thinking (pp. 153-166). Dordrecht: Kluwer Academic Publishers

[2]. Cornu, B. & Tall, D. 2002.*Limits: Advanced Mathematics Thinking*. Mathematics Education Library. Volume 11.

[3]. Davis, R. B., & Vinner, S. 1986. *The notion of limit: Some seemingly unavoidable misconception stages.* Journal of Mathematical Behavior, *5,* 281-303.

[4]. Juter, K. 2006.Limits of Functions. *Dissertation.* Department of Mathematics Luleå University of Technology.

[5]. Katalog Jurusan Matematika FMIPA UM. 2010. UM Press.

[6]. Leron, U. & Hazzan (2009). *Intuitive versus Analytical Thinking: Four perspectives.* Educ Stud Math. 71(3), 263-278. ME2009f.00534.

[7]. Li, L., & Tall, D. 1993. *Constructing different concept images of sequences and limits by programming. In I. Hirabayashi, N. Nohda, K. Shigematsu, & F. Lin (Eds.).*Proceedings of the 17th Conference of theInternational Group for the Psychology of Mathematics Education(Vol 2, pp. 41-48). Tsukuba, Japan.

[8]. Lithner, J. 2000. *Mathematical Reasoning in Task Solving.* Educational Studies in Mathematics, Vol 41, pp. 165-190.

[9]. Maharajh, N., Brijlall,D., & Govender, N. 2008. *Preservice mathematics students' notions of the concept definition of continuity in calculus through collaborative instructional design worksheets.* African Journal of Research in Mathematics, Science and Technology Education, *12*, 93-108.

[10]. Monaghan, J., Sun, S., & Tall, D. 1994. *Construction of the limit concept with a computer algebra system. In J. P. Ponte & J. F. Matos (Eds.).* Proceedings of the 18th Conference of the International Group for the Psychology of Mathematics Education(Vol. 3, pp. 279-286). Lisbon: University of Lisbon.

[11]. Pape, J.Steven. 2004. *Middle School Children's Problem Solving Behavior: A Cognitive Analysis from A Reading Comprehension Perspective.* Journal for Research in Mathematics Education, 35(3).

[12]. Permen Dikbud Nomor 69. 2013. *Kerangka Dasar dan Struktur Kurikulum Sekolah Menengah Atas/ Madrasah Aliyah*.
[13]. Subanji. 2007. *Proses Berpikir Penalaran Kovariasional Pseudo dalam Mengkonstruksi Grafik Fungsi Kejadian Dinamika Berkebalikan.* Unpublished dissertation, Surabaya: Program Pascasarjana UNESA.
[14]. Subanji. 2011. *Teori Berpikir Pseudo Penalaran Kovariasional.* Malang: Universitas Negeri Malang (UM Press).
[15]. Subanji. 2016. *Teori Defragmentasi Struktur Berpikir dalam Mengonstruksi Konsep dan Pemecahan Masalah Matematika.* Malang: Universitas Negeri Malang (UM Press).
[16]. Subanji & Nusantara, T. 2013. Karakterisasi Kesalahan Berpikir Siswa dalam Mengkonstruksi Konsep Matematika. *Jurnal Ilmu Pendidikan*, 19(2), hal. 129-251.
[17]. Tall, D. dan Kats, M. (2014). A Cognitive Analysis of Cauchy"s Conceptions of Function, Continuity, Limit, and Infinitesimal, with Implications for Teaching The Calculus. *Mathematics Education Research Centre University of Warwick*. http://arxiv.org/ftp/arxiv/papers/1401/1401.1468.
[18]. Vinner, S. 1997. The Pseudo-conceptual and The pseudo-analytical thought Processes in Mathematics Learning. *Educational Studies in Mathematics* 34, pp. 97-129.