PRESPECTIVE OF THEORY OF DIDACTICAL SITUATION TOWARD THE LEARNING OBSTACLE IN LEARNING MATHEMATICS

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Abstract

The learning process of mathematics does not always achieved the expected goals. Various obstacles and difficulties was always coloring process. This is due to various factors that become obstacles in the learning process. Diversity intellectual ability of students in math vary greatly. The attitude and behavior of students vary, as well as interest and emotions. Methods and designed all aspects of teachers, teaching materials, learning resources, media and classroom situations can help give a boost or provide learning obstacle to the students. The learning obstacles are not only experienced by students who are capable below average, but can also be experienced by students at all levels of ability. Brousseau (2002) states that the students' thinking evolved from their natural thinking towards logical thinking, which is associated with mathematical reasoning, accompanied by the construction process, the rejection and the use of a method. In the theory of didactical situations Brousseau was introduced in 1986, the learning obstacles are theoretical foundations, because it is a means to acquire knowledge. Obstacles are part of the knowledge of the students in general to solve certain problems, but when faced with a new problem, the knowledge that has been held is not fully used and are difficult to apply it into new material. In other words, the barriers are one way to find out something (Brown, 2008). Cognitive obstacles helps to identify the difficulties faced by the students in the learning process, and to determine the right strategy for teaching (Cornu 2002: 158). Brousseau what is proposed in line with Piaget that knowledge is constructed in the minds of children. Students begin the learning process when they are in an environment full of difficulties and obstacles as occurs in adults in general. The new knowledge that comes from the ability to adapt to new situations and stimuli and new reactions to these conditions is evidence that learning has occurred. Students know that the "problem had to face was deliberately chosen to make learning and acquiring new knowledge, knowledge that is justified by the logic of the situation" (Spagnolo in Manno, 2006). Cornu explained that planning for teaching math concepts is very important to overcome obstacles that may occur. Furthermore, according to artigue (1994), aims to model the situation didactic teaching situations that can be developed with a controlled stages. Thus, in this didactic situations students are involved in the process of thinking to solve a problem in the learning process. This paper describes how the perspective of theory didactical situation toward the learning obstacle in learning mathematics.

Key Words: learning obstacles, theory of didactical situation, learning mathematics

1. Introduction

According to Piaget, the intellectual development occurs is uncertain and spontaneous. While the children are learning mathematics is flexible, does not depend on age. It is understood that Piaget did not agree if mathematics is seen as a process that is limited, which is more driven towards spontaneity limited to a single problem (stimulus response theory). This is due to the cognitive structure of the child which is a factor that can not be ignored in learning mathematics.

Mathematics as a science that is structured according to the structure should be taught in a systematic way, orderly, logical and appropriate intellectual development of children. By way of this kind of teaching, student learning will be ready to receive lessons in terms of intellectual development. That is why the mathematics content taught to students varies by level of education and intellectual development of children. Students at the elementary education level, grain is concrete, and the higher the level of education the students will increasingly abstract mathematical content.

Diversity intellectual ability of students in math vary greatly. These include the ability to recall, understand, interpret information, abstracting, generalizing, reasoning, problem solving, and many more. The attitude and behavior of students vary, as well as interest and emotions. Methods and designed all aspects of teachers, teaching materials, learning resources, media and classroom situations can help give a boost or provide learning obstacle to students. In fact, every student from a variety of backgrounds naturally have a situation that is called learning obstacle.

According Sunarta (1985) learning difficulties are difficulties encountered by students in their learning activities, resulting in lower academic achievement and behavioral changes that occur are not in accordance with the participation acquired as classmates. Difficulties in psychology is a condition that describes a condition that can interfere with a person in the study. Students who experience these obstacles do not usually have a problem with intelligence. Difficulties experienced by students is associated with cognitive conditions.

According to Cornu (2002: 158), cognitive constraints is the product of a previous student experience and the experience of the process in themselves, occur when students have difficulty in learning. Cognitive barriers helps to identify the difficulties faced by the students in the learning process, and to determine the right strategy for teaching (Cornu 2002: 158). Planning for teaching math concepts is very important to overcome obstacles that may occur. The learning process will go well, if the interaction that exists between the Teacher-Student-Matter can overcome any barriers to learning that occurs.

This situation is difficult to know the teacher, the teacher usually only realized when learners' achievements decline, not the spirit of learning, even grades. If the difficulties experienced by students is allowed to drag on will lead to academic failure, confidence levels are low, the motivation decreases, learning styles unplanned, and poor ability to problem resolution shown by the behavior of withdrawing, malingering, playacting, anxiety dependent on others excessively and ditching (Sandri, 2013).

Teachers have a very important role in overcoming the barriers experienced by students. Teacher in the action concerning the relationship between teachers and students are expected to anticipate all the obstacles that may arise. Suryadi (2013) states that "two fundamental aspects in the process of learning mathematics is the relationship of matter and the student-teacher-student relationship, it can create a didactic or pedagogical situation is not simple and often happen very complex". Thus, a teacher at the time of designing a learning or didactic situations, need to think about how the predictions of a student's response to the situation and the anticipation of all the obstacles that may be experienced by students in order to reach the expected learning objectives.

2. Theoretical Background

Cornu (2002) classifies the obstacle into several types, namely: genetic and pshycological obstacles, didactical obstacles, and epistemological obstacles. Genetic and psychological barriers occur as a result of the student's personal development. Barriers didactic occur as a result of learning activities that teachers do. This didactic obstacles can be avoided. Avoided through the development of alternative learning approaches. While the epistemological barriers instead, unrelated to teaching approaches used by teachers, but from the nature of the mathematical concept itself.

Brousseau (2002: 82) uses the term obstacles of the theory presented by Bechelard (1938) and Piaget (1975) about the "errors ", that errors and failures play a role that is not simple. This type of error does not know and unpredictable, so-called obstacles . In other words, the obstacles are one way to find out something (Brown, 2008). Brousseau (2002: 86) categorizes barriers didactic three types, namely:

1) Ontogenetic Obstacles, a development obstacle, namely the constraints associated with the stage of mental development of children according to age and biological development. Some children have sometimes lacks the necessary capacity for age-related cognitive purposes. If the deficiencies just because mental development was slow (and not for pathological situation) then it will disappear together with the growth. Based on the results of the study (Sari, 2014), the cause of these difficulties can be seen from many things, among others due to inaccuracy in reading, carelessness in thinking, weakness in the analysis of problems, less persistent. Many students underestimate the problem is that students determine the answer carelessly or randomly select an answer or choose answers, solve problems only technically mere thinking without thought or reason only a small proportion of the problem, then gave up. In addition, because the confidence is low, lack of confidence and attitude of students dare to take risks to solve the problem according to ability and attitude that considers the resolution of

a problem too difficult including part of one form affective that math anxiety.

2) Didactical Obstacles, namely the obstacles that arise as a result of the choice of learning related to the education system. These barriers can be avoided through the development of alternative learning approaches.
3) Epistemological obstacles, barriers yaang emerged from learning approaches derived from the concept itself. Brown (2008) states that "epistemological obstacles can be construed as faulty ways of thinking but such a perspective ignores Reviews their importance, Reviews their developmental necessity, and their productivity in specific settings". Brousseau has explained the relationship between learning and mathematical structure of the learning content (Prediger, 2008). Contrary to the 'barriers didactic', Brousseau has created the idea of 'epistemological obstacle' for the obstacles that are rooted in the structure of self mathematical content itself, in the history and development of the application.

Bachelard (Cornu, 2002: 158, Manno, 2006: 32) states that the epistemological obstacle occurs both in the history of scientific thought and practice of education:

> "We have of scientific knowladge think about in terms of obstacles. We are not talking about external obstacles such as the non-lasting character of the phenomenom or Reviews their complexity, nor to think that it is weakness of meaning or of human spirit's fault; is the only and simple act of knowing that brings troubles and unbalance wthin. Is there, where we go slow and back, is there where we find epistemological obstacles ".

According to Bachelard barriers epsitemologis has two important characteristics, namely:

a) Epistemological obstacle unavoidable and significant body of knowledge to be gained.

b) Epistemological obstacle is found, at least partially, in the history of the development of the concept.

Brousseau then bring the idea into a didactic situation theory that the concept of "leap of information" (Brousseau 2002: 98, Moru, 2009: 433). The leap is the acquisition of knowledge of information that is not felt. If the information leap obstacles then there epsitemologi constraints. Barriers epistemology of scientific knowledge can lead to stagnation and even decline in a person's knowledge.

The term didactical situation was introduced in the 1960s, referring to the situation in the teaching of mathematics (Brouseeau and Waefield, 2014: 164). This term is a new concept in teaching mathematics. Didactic, in mainland Europe is seen as a discipline of teaching, whatever the field of science and education levels (Suratno, 2016). Didactic examines the things that teachers do with regard to what the material, how to learn and teach, and how to develop the viewpoint of the content of the lessons. According to the situation didactic, teaching is rebuilding communication formal text in the language of symbols that are not yet understood and expressed by the new formula, metaphorical representation, and the description is ambiguous by the students, in other words, the teacher gives a problem that will be explored students as a learning experience, and will kosep given the fundamental (concept) by the teacher at the end of the lesson (Brouseeau and Waefield, 2014: 164).

Furthermore, the phenomenon of a didactic situation in France developed into a didactic situation theory (Theory of didactical Situation / TDS) introduced by Brousseau in 1986. TDS is based on the principle that a student's behavior can only be understood if the behavior is closely related to the situation in which he observed, where situation and cognitive potential should be characterized by the observed reality (Artigue, 1994). TDS is trying to offer a model that was inspired by mathematical game theory in a scientific way, issues related to the teaching of mathematics and means to improve the teaching of mathematics (Radford, 2008).

Theory of didactic situations developed to design the material conditions and the social contract which framed the action together undergo a didactic situation is

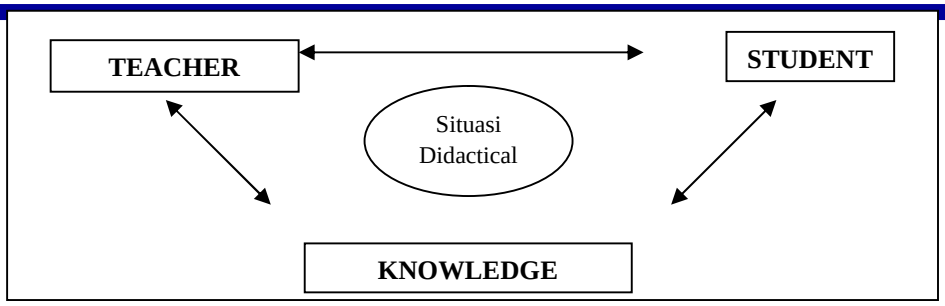
expected especially from the student's perspective (Brousseau, 2002). The theory assumes that the teachings can be modeled in the form of game activity that involves three steps. First, a situation adidaktis are provided for students to practice the rules of the game so that students can play in it. The game in this adidaktis situation has a purpose that is easily recognizable from the student's perspective. Second, the student jointly working to find ways of improving their actions in order to more easily achieve the goal of the game. Third, students are directed to develop consideration to the conclusions they make. At the final stage of this conceptual understanding aligned in accordance with the discipline of science. The third stage is called as the situation of action, formulation and validation.

3. Method

The method used is a theoretical study or literature. Source reference obtained from a variety of scientific work, either in the form of books as well as national and international journals.

4. Result and Discussion

The first step in this theoretical approach is a didactic analysis triangle, known since 1982 and was first raised by Yves Chevallard (Manno, 2006), where the word "knowledge" means the academic knowledge and standards, the object of mathematical discovery.



Picture 1. a didactic triangle

The third element in the triangle above have their respective roles. The teacher's role is to enable a didactic transposition; in other words, teachers must change the "knowledge" that comes from the discovery of students into the "knowledge taught" through the lessons that have been designed teachers. Furthermore Artigue (2014: 48) states that the integrated didactic mathematics in his Theory of didactical Situation (TDS), which was adopted from a systemic perspective, which is reflected in the preparation of teaching theory with the idea of the situation. The situation itself is a system. Brousseau (2002) divides the two possible perspectives on this didactic situation, namely; vision as the conditioning of students in an organized manner directed by the teacher; broader vision, including teachers and the education system itself.

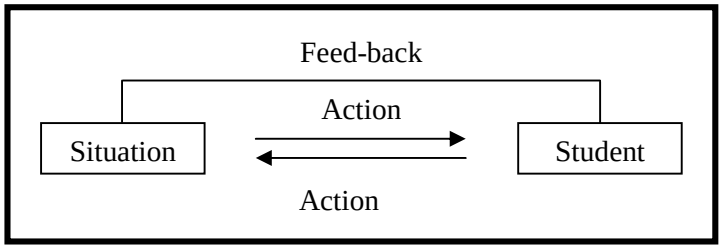
The new knowledge that comes from the ability to adapt to new situations and stimuli and new reactions to these conditions is evidence that learning has occurred. Students know that the "problem had to face was deliberately chosen to make learning and acquiring new knowledge, knowledge that is justified by the logic of the situation" (Spagnolo in Manno, 2006).In a didactic situation, students construct their own knowledge not because they were taught, but because of the logic that he found himself pushed through a new situation to a certain understanding. Brousseau reveals new role of teachers in teacher-student relationship. Manno (2006) stated that teachers must build a state that allows students to learn certain at the end of each activity.

Student relationship - the object - the material is an important component in any didactic activities. This situation is built so that students receive a lot of feedback and tried to solve the problem through the effort and errors, as the strategy to be a winner. Students learn to interact with its environment adapting their knowledge to a wide range of possibilities of different strategies without teacher assistance. Didactic actions of a teacher in the learning process will create a situation that can be a starting point for the process of learning (Suryadi, 2013).

The effectiveness of a didactic situation is that students have the responsibility to solve the problem and the teacher gave them the responsibility. Students are given the freedom to build their own knowledge. Brousseau identifies four types of situation, namely action, formulation, validation, and institutionalisation (Artigue, 2014, Brousseau, 2002, Kislenko, 2005, Manno 2006, Wisdom 2014).

1) Action

Each student is faced with a problem. Students interact with other students, teachers, and milieu. Brousseau (2002) defines milieu as everything that affects students' Within a situation of action, everyhing that acts on the student or that she acts on is called "milieu" (Brousseau, 2002: 9). Students develop their own strategies to find a solution.

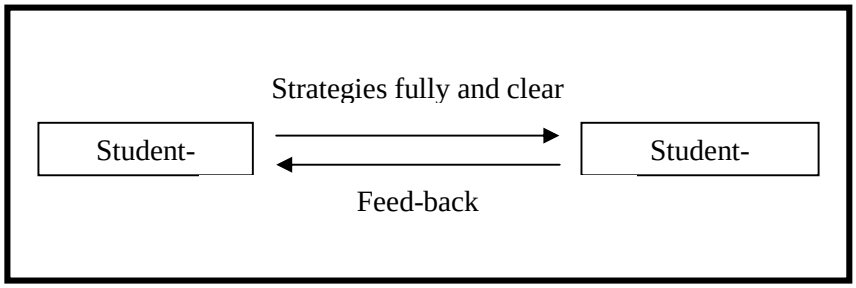


Picture 2. Action

Students make decisions about the process of resolving the problem, the process by which the students formed a strategy for how the method of solving the problem. Students start looking for solutions, generate hypotheses and determine

which strategy is evidenced by new experiences. The interaction between the student and the milieu (the other students, the context of the problem, teachers) are useful for making some of the strategies and the so-called "didactic of action". At this stage, students build models implicitly: a set of rules and relations to take a new decision without being recognized or required to be disclosed explicitly (Manno, 2006). Piaget considers cognitive confusion and contradictions become very important in changing one's mind. Confusion and conflicts occur during a class discussion where the emphasis is on students' thinking and reasoning. This case arose out of ideas or a mixed response filed by children (Wood, 1999).

2. Formulation



Picture 3. Formulation

This stage gives students the opportunity to create their own models implicitly and reveals a strategy with words that can be understood other students, discussing and arguing that make other students accept his explanation. Two-way communication between students and directing them to a strategy (Manno, 2006). Strategies that they get the agreement of the arguments they put forward in a discussion.

3) Validation

Validation is a process that brings the idea of 'establishment theorem' (Brousseau, 2002: 13). Teachers should start from what is known and ending with knowledge of mathematics through the construction process (Kinsleko, 2005). Students are required to solve the problem and they made a complete explanation of how that has been used to solve the problem. How the completion of a student may be accepted or rejected by the other students. In the group of all students in the class have the same opportunity to discuss their strategies and hypotheses that they agree to be theorem (Manno, 2006). Situation didactic guides them through a process to ensure that they use the right strategies. In this way the fault is the starting point in the process of building knowledge. In this section, the teacher can influence the students (dialectic of validation). Brousseau explains that this stage can serve as a means to communicate explicitly for students and also as a means to learn to build logical reasoning based on evidence. As for the teachers themselves, propose theorems and strategies on the board is one way to demonstrate an understanding of the content of mathematics teachers (Kinslenko, 2005)

4) Institutionalisation

At this stage, the teacher ensure that students have the skills so that knowledge becomes part of the permanent student (Wisdom, 2014: 13). Institutionalization is basically the process that allows students to change their previous knowledge into new knowledge through strengthened by a teacher who gives them the value of truth and allow it to use the new knowledge to solve the next problem (Brousseeau, 2002: 18).

Based on TDS, teachers play a major role in the context of the didactic triangle in creating a didactic situation resulting in a process of learning in students. In other words, a teacher needs to have the ability to create a didactic relationship (didactical relations) between the student and teaching materials so as to create an ideal situation for students didactic. Didactic situations designed by the teacher to

make students learn something. Learning situations created really encourage students active in learning to argue, discuss various strategies, and others so unknowingly students directed a mathematical concepts.

Three characteristics TDSM according Artique (2014: 48-49), namely:

a) Emphasis on math and epistemology.

b) Knowledge of mathematics allows us to act on the environment, but the power of mathematics pragmatic depending on the specific language was created in the form of validation. These characteristics are reflected in three different situations, namely; the situation of action, formulation and validation.

c) Based on the students' cognitive dimension, the merger process of adaptation and acculturation. Brousseau (2002: 30) states that students learn how to adjust to the surroundings which could lead to contradictions, difficulties and balance, as was the case in general in humans. Knowledge is the result of adaptation of students, will form the students establish himself with the response or new insights that give reason for him to learn.

In the TDS there are two very important process which is in the form of an independent adaptation adidactical situation and environment, acculturation in the form of didactic situations and the didactic contract (Artique, 2014: 49). In the contract, there are two rules adidaktis namely devolution and institutionalization (Brousseau, 2002; Perrin-Glorian, 2009; Artique, 2014). Adidactical situation and milieu intertwined with the vision of learning as a process of adaptation and with the aim to optimize the process. Achievement of those goals came from the interaction of students with the milieu. Milieu is a system in which students interact in a didactic situation and also a place for teachers and researchers to play an important role in designing the milieu. This system involves a lot of elements, including a variety of materials, instructional media (calculator, computer, various kinds of electronic items), and those who have their respective roles. The learning process is structured to be a process of adaptation, therefore milieu should be a source of contradiction, imbalance, and build knowledge. Milieu that is designed to be made of students who

initially had a poor strategy, a strategy to become rich because of the opportunities that mncul as a result of the action and feedback of a strategy that enables the establishment of knowledge.

According to Brousseau, in adidactical situation pose a problem to the student teacher can recognize and stimulate students to move, speak, think and develop their own kemauannnya. So that adaptation is going well, in this situation there is no intervention from the teacher, the student is responsible to solve the problem given. In situations adidaktis, students build their own new knowledge with direct involvement in solving problems. In Piaget's theory of cognitive development, equilibrium is an important basis adidaktis adaptation. According to Perrin-Glorian and Laborde (2005), the situation adidaktis designed with didactic intent to minimize the involvement of teachers in the learning process.

The interaction in the learning process involves three elements, namely students, teachers, and milieu. The relationship between teachers and students in a particular situation is one of the important ideas in the TDS. Participation of students is carried out by interaction with teachers and peers. In other words, students need to participate in all stages of learning activities .. Theory of Zone of Proximal Development (ZPD) Vygotsky explained that when children learn to interact with adults (teachers) or in collaboration with his friend, it can form a variety of mental processes on the child and the development of problem-solving skills in students.

The ideal learning allows students to interact with the milieu even without teacher intervention (adidactical situation), so the student activity does not depend on teachers (Miyakawa and Winslow, 2009). In the relationship between teacher and student in the didactic sistuasi no didactic contract (didactical contract). Brousseau (2014) describe a didactic contract as a set of rules that determine the rules of responsibility of students and teachers, that teachers are required to teach and students learn. Didactic contract also defined as the rules of the game and strategy in a didactic situation. Didactic contract also an interpretation of the commitments, expectations, beliefs, facilities, results, and punishment. Broussseau also stated that the didactic

contract refers to the behavior of teachers (especially for the knowledge being taught) are expected by the student and the student's behavior expected by the teacher. Didactic contract is different for each different mathematical concept and also for each student, so it is difficult to describe the didactic contract.

Brosseau (2002) states that the didactical contract is an important thing, in a didactic situation if teachers feel the failure in the learning process, students are not expected to achieve the learning objectives, it is implicit that the teacher can not meet the expectations of students. Students' complaint"because it can not solve the problem given by the teacher. This situation raises a conflict on the teacher, why this could happen. Conflicts experienced by teachers, negotiations, and efforts to seek new contracts will continue its relationship didactic situation through a new didactic situation. In this case, the teacher assumes that prior learning and new conditions take students on new learning possibilities.

Each process contains a series of didactic situations, which every situation contains three types, namely; situation of Devolution, mathematical situation, and the situation Institutionalization. There are two categories in the didactical contract, namely devolution contract and contract institutionalization. In the devolution contract regulates the activities of student mathematics teachers who provide feedback or responses to such activities. While in the institutionalization of the contract, the student who suggested the results they get and teachers provide appropriate referrals to referesensi knowledge (Brousseau et al, 2014; Hersant & Perrin-Glorian, 2005). The process of devolution and subsequent institutionalization introduced to connect the acculturation and adaptation in the world of education is the responsibility of the teacher. Through devolution, the teachers made their students accept responsibility for solving math problems without neglecting the didactic purposes and creates conditions to be a means of learning through the process of adaptation. Through institutionalization, teachers help students to link contextual knowledge that has been built in accordance with the adidactical situation learning objectives to be achieved and the teacher puts the concept of decontextualization and

transformation into knowledge. If the teacher directs students about what they should do, then students will not learn. Artique (2014) stated that the devolution process is a process of negotiation with the teacher through didactic contract that whilst there is a transfer of responsibility from teacher to student.

Furthermore, the idea of a didactic contract evolved into some kind of contract. Changes in circumstances allow the modification of contracts in new situations that occur. The level of didactic contract structure proposed by Hersant and Perrin-Glorian (2005) is; macro-contract, meso and micro-contract contract. Macro-contract related to the purpose of teaching, meso contract relating to the realization of an activity, while the micro contract relating to mathematical content unit, eg concrete questions in the exercise.

The structure is a draft contract didactic learning which involves a series of complex processes, quaint and unique. Usually teachers start of a series of curriculum analysis to determine the themes and topics that will be delivered. However, mastery of the material alone is not enough to equip a teacher in arranging meaningful learning activities. Therefore, in depth review of the material required so teachers can find and define the meaning and how to learn the material, especially for himself. Moreover, the process of implementation anaisis and reflection also need to be done by the teacher, so the teacher's task includes the process before, during and after the learning takes place.

5. Conlusion and Remark

Learning is complicated by the variety of possible obstacles that will occur and the various factors affecting the process. Changes in student achievement and psychological decline, a signal to teachers that there are barriers that occur in students. Barriers to learning faced by students is a challenge for a teacher to be able to design an effective learning, innovative, and quality. Therefore, many aspects such as material and structure of the curriculum, the school and the learning environment, teachers along with the philosophy and approach of teaching, students and ways of

learning and other matters relating to the social, cultural, historical and institusionl, should be a primary consideration for teacher in designing learning.

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