THE IMPLEMENTATION OF CONCEPT OF ATTAINMENT MODEL ON MATHEMATICS LEARNING

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Abstract: Mathematics is a subject that is learnt in all school levels. It deals with the study of fact, concept, operation and principle that needs psychological activities in abstracting and classifying something. Learning the mathematics is a process that is directed to create mindset and to develop logic or reasoning; so that if teachers want to make their students successful, they have to give them chance or conducive learning atmosphere to manipulate concept of mathematics by themselves. One of the learning models is concept of attainment model. This model consists of three stages that are presenting and identifying concept, testing the concept, and analyzing thinking strategy. The concept of attainment model is designed to develop inductive reasoning, to increase concept attainment and create analytical logic.

Key Words: Concept of Attainment Model, Learning Mathematics

1 INTRODUCTION

Mathematics is a logic and systematic arranged subject.[1] So that, the students are taught to improve thinking and reasoning skills logically and rationally. Soedjadi stated that mathematics school is part of mathematics, is chosen based on science and technology interest, in line with student's demand interest to face future life[2]. However, the meaning of mathematics in general (as the only definition) is not easy. Many opinions emerge about the meaning of mathematics seen from science and experience of each mathematician. The meanings of mathematics proposed by mathematicians complete.

James and James in Suherman said that mathematics is a science of logic concerning form, structure, large, and concepts which are interrelated each other in a huge number divided in three areas namely algebra, analysis, and geometry[3].

Johnson and Risingin Suherman said that:

> Mathematics is a logic thinking, organizing, and proving pattern. Mathematics is a language which uses precise, clear, and accurate term, symbolic representation, more about symbol of idea than sound.[4]

On the other hand, Reys in Suhermansaid that mathematics is a study of pattern and relation, thinking way, an art, a language, and a tool.[5]Hudoyo proposed that the essence of mathematics concern about ideas, structures, and relationships which is arranged by abstract concept.[6]

Based on the views above, to comprehend the concept of mathematics and to appropriate manipulate, so the language of mathematics is used. Through mathematics we learn to think logically and other sciences can develop rapidly.

Soedjadi suggested that it is concluded based on various definition of mathematics, there are similarities which is called mathematics characteristics namely (1) it has abstract discussion, (2) it rests on agreement, (3) it is deductive thinking way, (4) it has meaningless symbol, (5) it pays attention to whole deliberation, (6) its system is consistent.[7]

One of mathematics characteristics is having abstract discussion. According to Soedjadi those objects include: (1) fact, (2) concept, (3) operation or relation, and (4) principle.[8]

Based on the explanation above, the essence of mathematics is association of abstract ideas, developed structures of logic proving which is defined precisely, clearly, and symbolic representation.

Therefore, it goes without saying that mathematics is a hierarchy subject of tight concepts. In order to succeed, the teacher should condition learning atmosphere that enable students to manipulate their own mathematics concepts. Concept of attainment model is one of learning model that help students to comprehend mathematics concepts.

2 DISCUSSION

2.1 Definition of Learning Mathematics

Mathematics as a subject of discussing facts, concepts, abstract operations and principles which need psychological activities like making abstract or classifying. Making abstract is to understand the similarities of many objects or different situation activity. And, classifying is understanding object or situation grouping way activity based on its similarities.

In principal, learning mathematics is directed process to one objective that is to create thinking way to understand meaning and develop analysis to discover the relationships of different definitions. As Suherman proposed that learning mathematics for students is to create thinking way to understand the definition or analysis of relationships of those definitions. Ruseffendisuggested that learning mathematics improve logic and appropriate thinking way.[10]

To conclude that learning mathematics is a psychological process of active activities to understand the materials and improve logic and appropriate thinking way.

2.2 Definition of Concept

Concept is one of basic objects learned in mathematics. According to Ruseffendi, concept is an abstract idea which enables us to group objects into example and not example[11]. While, Soedjadi proposed that concept is an abstract idea used to combine or classify group of objects[12]. Concept in mathematics according to PKG Instructor team is abstract definition that enable to classify (to group) object or event, example or not example of definition.[13] Rosser in Dahardefined concept as abstraction that represents a class of objects, events, activities, or relationships that have same attribute.[14]

The core of views above is that concept is attained trough abstraction process. So that, an individual recognize the similarities between some objects, whether the object is example or not example of idea and based on that similarities the class of objects is formed. Thus, the concept is formed based on same characteristics.

Concept, according to Martinis, is divided into concrete and defined concepts. The defined concept is constructed from concrete concept as its reference.[15] According to Nasution, the object of concrete concept is can be showed, so it is attained through observation. At the higher level, the abstract concept is gotten, that is the concept based on definition.[16]Winataputra proposed that every concept has four elements namely name, example or exemplar, essential and non-essential characteristics (attributes), and values of those characteristics.[17]

In this paper, concept is abstract idea that can be used or classify or group the object into example or not example.

2.3Learning Model

In general, the term "model" is interpreted as conceptual framework used as orientation to do an activity. In other definition, "model" is defined as a thing or

imitation of thing, such as globe as model of earth. Due to learning is not a thing, so that learning model is defined as a conceptual framework of learning activities. Winataputra limits learning model as a conceptual framework that describes systematic procedure in organizing learning experience to achieve learning objective and function as orientation for learning designer and teachers to plan and implement learning activities.[18]

In accorandce with learning model, Bruce Joice and Marsha Weil present various learning models which its utilization was developed and tested by educational experts. Furthermore, Joice and Weil group learning models into four categories:

a. Group of Information Processing Model

This group emphasizes ways to support human internal (coming from oneself) encouragements to understand the world by finding and organizing data, experiencing problems and solution, and developing language to uncover it.

The models of this group:

1. Concept of Attainment
2. Inductive Thinking
3. Research Training
4. Early Guide
5. Memorization
6. Intellect Development
7. Scientific Research

b. Group of Personal Model

This group focuses on one's perception and tries to promote productive independence, thus human beings will aware and be responsible for their purpose.

The models of this group:

1. Teaching without Direction
2. Sinectics
3. Conscious Training
4. Class Meeting

c. Group of Social Model

This group is oriented to development students' skills in cooperating with others.

The models of this group:

1. Group Investigating
2. Role Play
3. Jurisprudential Research
4. Labratoric Training
5. Social Science Research

d. Group of Behavior System Model

This group focuses on observed behavior, method and task given in order to communicate success.

The models of this group:

1. Complete Learning
2. Direct Learning
3. Self Control Learning
4. Developing Skill and Concept Training
5. Assertive Training.[19]

2.4General Characteristics of Learning Model

Every learning model as explained before belongs to certain characteristics. In contrary, according to Joyce and Weil, in general every learning model has elements include:

1. Syntax, activity phases of the model.
2. Social System, situation or atmosphere and legal norm in the model.
3. Reaction Principle, activity that describes how teacher should see and treat students, and how teacher should respond them.
4. Supporting System, all needed medium, materials, and tools to implement the model.
5. Instructional and Accompanist Impact
   Instructional impact is result of study that is directly achieved by directing students to objective of learning. Accompanist impact is other result of study produced by learning process as the effect of learning atmosphere experienced by students without teacher's direction.[20]

2.5 Concept of Attainment Model

Concept of attainment model was first designed by Joyce and Weil based on Jerome Bruner et al research finding. Its purpose is not only designed to develop

inductive thinking, but also to analyze and develop concept. The usage of this model: (1) to help students to understand concept by giving attention to object, idea and events, (2) in order to help students to attain concept effectively by understanding thinking strategy.

In principle, concept of attainment model is a teaching strategy which uses data to teach concept to students. In this model, teacher begins the lesson by presenting data or example, the students, then is asked to observe the data. Based on the observation, an abstraction is formed.

Concept of attainment model is designed to develop inductive reasoning, develop reasoning to attain concept, and develop analytic reasoning. Bruner said that this model is suitable for all school levels.[21] according to this model, learning is an active process concerning about information, then is arranged and formed in unique way by each individual. This is said as an active process because perception is arranged and concluded actively.

In this model, the activities and interaction between students is controlled by teacher. Activity controlling can be in free dialogue. Activities organizing is aimed at improving students' initiative to do inductive process coincide with increasing the experience of involving in learning activities.

Concept of attainment model as one of processing information models has a design as said by Joice and Weil as follow:

a. Syntax

Concept of attainment model has three phases:

1 First Phase: Presenting Data and Identifying Concept

1) Teacher presents the given level example.
2) Students compare characteristics of example and not example.
3) Students make and test hypothesis
4) Students define concept based on principal or essential characteristics.

2 Second Phase: Testing Concept Attainment

1) Students identify added unlabeled examples by saying "yes" or "no".
2) Students assert hypothesis, name of concept, and restate the definition of concept based on essential characteristics.

3Third Phase: Analyzing Thinking Strategy

1) Students express their thought
2) Students discuss hypothesis and concept characteristics
3) Students discuss hypothesis

b. Social System

Social system of concept of attainment model is situation or atmosphere and legal norm in concept of attainment model. This model belongs to moderate model. Teacher controls the activities, but it can be a free dialogue activity in that phase. By organizing the activities, it is hoped that students will become more initiative to do inductive process concaide with increasing experience to involve in learning activities.

c. Reaction Principle

Reaction principle of concept of attainment model is an activity that describes how teacher should see and treat students, and how teacher should respond to them. The reaction principles in this model as follow:

(1) Giving support by emphasizing hypothesis characteristic from underway discussions.
(2) Help students to consider hypothesis from others.
(3) Centralize students' attention to specific examples.
(4) Help students to discuss and appraise thinking strategy they use.

d. Supporting System

Supporting system of concept of attainment model is all needed medium, materials, and tools to implement the model. Supporting medium can be in picture, photo, diagram, slide, tape, students' activities

sheet, and chosen and organized data in units function to give examples.

e. Instructional and Accompanist Impact

Instructional impact of concept of attainment model is result of study which is directly achieved by directing students to learning objectives. Accompanist impact of concept of attainment model is other result of study produced by learning process as the effect of learning atmosphere experienced by students without teacher's direction.[22]

Instructional and accompanist impact of concept of attainment model can be described as follow:

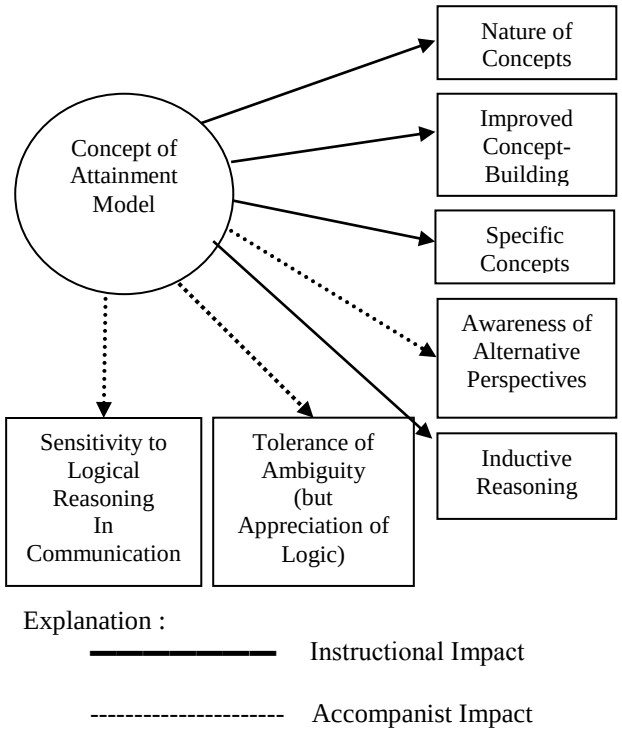

Figure 1
Instructional and Accompanist Impacts of Concept of Attainment Model
(Joyce and Weil, 1992 : 157)

As what is showed in the figure that in concept of attainment model, instructional impact consists of four elements namely (1) the essence of concept, (2) making concept strategy, (3) specific concepts, and (4) inductive reasoning, whereas accompanist impact consists of three elements namely (1) aware of chosen perception, (2) tolerance of ambiguity (but appreciate logic) and (3) sensitivity to logical reasoning in communication.

Elements of social system, reaction principle and supporting system to support implementation of phases in activities process in syntaxmatics.

Elements of impact is the effect of implementation phases in activity process in syntax, it is explained as follow:

Phase 1stage 1: ensued instructional impact, that is impact-1.
stage 2: ensued instructional impact, that is impact-2.
stage 3 : ensued instructional impact, that is impact-2.
stage 4 : ensued instructional impact, that is impact-3.

Phase 2 stage1: ensued instructional impact, that is impact -4.
stage2: ensued instructional impact, that is impact-3.

Phase 3 stage1: ensued accompanist impact, that is impact-1.
stage2: ensued accompanist impact, that is impact-2 and -3.
stage3: ensued instructional impact, that is impact-3 and accompanist impact, that is impact-3.

For the importance of practice, concept of attainment model is adapted into operational framework and is described as follow:

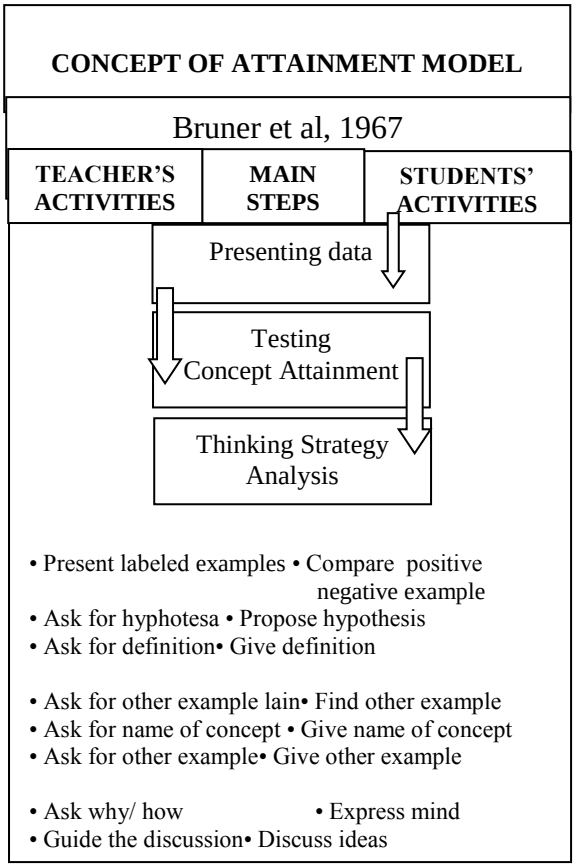

Figure 2
Operationla Framework of Concept of Attainment Model

Winataputra (2001 : 15)

Explanation : ⇨ Activities series

6. The Implementation of Concept of Attainment in Mathematics Learning

Concept of attainment model is an inductive model which is designed to teach concept by using examples. The given examples present the data which enable students to think to comprehend the concept.

Example of implementation in mathematics learning on the case factorization of algebra term as follow:

First Phase: Presenting Data and Identifying Concept

(1). Teacher gives the example of many terms and not.

Pay attention to the following algebraic forms:

1. $4x + 5$
2. $3a^2 + 4a – 8$
3. $-4y$
4. $2ab^3 – 2ab^2 + 7b + 5$
5. $8x^5 + 3x^3y + 2xy^2 + 4y^3 + 6$
6. $4p + 3q$

From algebraic forms above, so algebraic form:

1. $3a^2 + 4a – 8$, consists of three terms, **is called** many terms.
2. $2ab^3 – 2ab^2 + 7b + 5$, consists of four terms, **is called** many terms.
3. $8x^5 + 3x^3y + 2xy^2 + 4y^3 + 6$, consists of three terms, **is called** many terms.

Whereas algebraic form:

1. $4x + 5$, consists of two terms, **is not called***many terms.*
2. $-4y$, consists of one term, **is not called***many terms.*
3. $4p + 3q$, consists of two terms, **is not called***many terms.*

(2) Students compare differences or characteristics of many terms concepts with what is not many terms.

(3) Students make hypothesis. After understanding many terms, they are required to make hypothesis by their own words about the concept. It is hoped that they can propose that many terms is algebra form which has many terms.

(4) Based on the hypothesis, the students are able to define many terms by their own words. It is hoped that they can propose that many terms is algebra form which consists of three terms or more.

Second Phase: Testing Concept of Attainment

Teacher gives six algebra forms:

1. $12 x$
2. $x^2 + 2x – 5$
3. $x^2 – 4x$
4. $3x^3 + 2x^2 + 5x + 6$
5. $2x^2 + 5$
6. $9y^3 + 2y^2 – 3y – 5$

And asks atudents, from algebra one until six, determine algebra form which is categorized into many terms and not many terms.

Many terms**:**

1. $x^2 + 2x – 5$
2. $3x^3 + 2x^2 + 5x + 6$
3. $9y^3 + 2y^2 – 3y – 5$

Not many terms:

1. $12x$
2. $x^2 – 4x$
3. $2x^2 + 5$

Third Phase: Analyzing Thinking Strategy

(1) After comprehending the definition of many terms, teacher asks students to write some examples of algebra other than the given example. Accordingly, students will

try to explore their thinking to answer the questions.

(2) Students discuss their answer.

(3) Students conclude: Many terms is algebra form which consists of three terms or more.

The strengths and weaknesses of concept of attainment model are tabulated as follow:

Strengths

1. Implementation phases make teacher and students enjoy because the process can present the competition which students try to identify the ides (concept) by their own minds.[23]
2. It is efficient to present the information which is organized in various subjects and is able to improve learning skill by using easy and effective way and can be used for all ages.[24]
3. It can be used to increase kinds of class activities and students' motivation (Stipek).[25]

Weaknesses

1. It takes time to create and develop the equipment.
2. If the students are in a huge number, the teacher will find difficulties to guide the students.
3. It needs more cost.

3 CONCLUSION

Concept of attainment model is designed to foster inductive reasoning to attain concept and to foster students' analytic reasoning. Concept of attainment model consists of three activities: presenting data and identifying concept, testing concept attainment, and analyzing thinking strategy.

This model is compatible for all school levels or all ages and can be used for all mathematics materials. According to this model, learning is an active process of information and is arranged and formed by unique way by individual or student. It is said to be an active process because the perception is actively arranged and concluded by students themselves.

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