

**RESEARCH ARTICLE**  
**DEVELOPING COURSWARE OF MATHEMATICS FOR SECONDARY**  
**SCHOOL LEARNING AS SUPPORT**  
**FOR EDUCATION UNIT LEVEL CURRICULUM**



**By:**

- 1. Dra. Nurjanah, M. Pd.**
- 2. Dr. Dadang Juandi, M. Si.**
- 3. Dra. Hj. Ade Rohayati, M. Pd.**

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**A. Background of the Problem**

Learning mathematics at school gives an important contribution for students to develop their capabilities. In education unit level curriculum (KTSP) for mathematics, (BNSP, 2006), the students of Yuniior High Shool and Senior High Scool should have several capabilities such as understanding mathematical concept, reasoning capability, capability for solving problem, to communicate their ideas, and to appreciate of mathematics usefulness in daily life.

The same opinion expressed by Mathematics Learning Study Committee, National Research Council (NRC), USA in the book Adding It Up: Helping Children Learn Mathematics in 2001, the usefulness of mathematics as facilities to build students' mind can be measured from their mathematical proficiency.

Based on research result on mathematics learning, Kilpatrick and Findell (2001: 116) conclude there are five mathematical competencies need to be improved on learning mathematics at school, such as conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Researchers of mathematics education at National Research Council (NRC) consider that the fifth aspects absolutely should be their own complete capabilities on mathematics.

By changing in curriculum, it means teachers' opinion and belief, teaching material and resources and model of evaluation should be constructed. Those can't be prepared in a short time, but need socialization and deep study.

In order to reach the goal, mathematics learning at school should be optimized using various learning strategics, learning methodes, and right learning approach which appropriate with condition of student in the class. To prepa

implementation and to succeed it, we need develop concrete effort simultaneously and continuously. One of consider as a right mean for contributing the effort through development research collaboratively between students, teacher, and lecturer. Through this research will develop mathematical learning courseware to increase mathematical competencies in mathematical learning at school such as concept understanding, strategic competence, and adaptive reasoning.

### **B. Formulation of Problem**

1. Can learning model of concept achievement improve students' mathematics understanding?
2. Can guided-reinvention model improve students' adaptive reasoning?
3. Can model of traffinger model improve students' strategic competence?
4. How the students' response to each learning method improved?

### **C. The Aim of Research**

1. To know can learning model of concept achievement improve students' mathematical understanding?
2. To know can guided-reinvention model improve students' adaptive reasoning?
3. To know can model of traffinger improve students' strategic competence?
4. To know how the students' response to each learning method improved?

### **D. Usefulness of Research**

1. To contribute about learning model developed for teacher and students.
2. To contribute about courseware model developed for teacher and students
3. To contribute about developed evaluation model

### **E. Literature Study**

#### **1. Concept Understanding**

Concept understanding in this research is concept understanding based on Skemp (Kariadinata, 2001: 12), namely instrumental understanding and relational understanding. Instrumental understanding is understanding about separated

concept and only know formulation in simple calculation. In this case student just learning an algorithm. In the opposite side, instrumental understanding included structure which can be used on wider solving problem and characteristic of it's using more meaningful. The student who has relational understanding can relate one concept with other concept correctly and realize working process.

## **2. Model of Concept Achievement**

Model of concept achievement using in this research is model of concept achievement based on Joice and Weil (Kurnia, 2006: 13), argue that model of concept achievement has several unsures as follow:

### a. Implementation Step (Syntax)

First fase: Data presentation and concept identification.

### b. Social System

### c. Principles of reaction

### d. Support System

## **3. Adaptive Reasoning**

One of aspect of basic competencies mathematics is reasoning which include step of higher mathematics thinking, include capacity for thinking logically and sistematically. Reasoning is a process to reach logically conclusion based on facts and relevant resources.

Mathematical competence that bocomme main problem in this research is adaptive reasoning which translated as adaptive reasoning based on Klipatrick and Findell (2001, : 116).

Indicators of adaptive reasoning:

- a. competency on propose hypothesis or conjecture
- b. can give reason of the given answer
- c. can make conclusion from a statement
- d. can correct the thruth of an argument
- e. can find pattern of a mathematics problem.

#### **4. Guided-reinvention method to improve adaptive reasoning**

Role of teacher in guided-reinvention model, besides as planner for learning process, teacher's role as guide too, students' facilitator and motivator. Guidance will be given if student get threat in finding certain process. Given guidance depend on students' competency and learning subject matter. In this method, students encourage to critical thinking, self analysis, so can find concept or general principle based on data has been prepared by teacher.

#### **5. Creative Learning Model Based on Treffinger**

Treffinger model is a learning strategic expanded from model of developmental creative learning and priority of process. Learning strategic developed by Treffinger based on model of creative learning (Pamalato, 2005: 19) are as follow:

##### a. Step 1

Key of learning assignment is open to various new ideas, look at much more possibilities and alternative to solve problem. Technic can be used are warming up, open-ended thinking/ feeling, discussion dan pending evaluation, to sign up idea, technic of relationship affirm.

##### b. Step II

Key of leaning assignment is competence to use and to apply various creative ideas at complex situation, involve thinking process and complex feeling, and conflict cognitive.

##### c. Step III

Key of leaning assignment is using much more and optimally feel process and creative thinking in to problem solving independetly.

#### **6. Strategic Competence**

Strategic competence is competency to formulate, to present, and to solve mathematical problem.

The indicators of students' strategic competence are:

- a. Understanding situation and condition of a problem

- b. Finding key words and let irrelevant thing from a problem.
- c. To present problem mathematically in various shape.
- d. To select appropriate presentation to help solving problem
- e. Finding mathematical relationship containing in a problem
- f. To select and to improve method of effective solution in solving a problem.
- g. Finding solution from given problem,

#### **F. Research Methode**

This study is experimental, using experimental groups pre-test and post-test design. Involving group in this study using experimental method and classroom action research method, those are improvement activity collaboratively between students, teacher, and lecturer.

#### **G. Subject of Research**

The subject involved in this research selected from three schools in Bandung region, those are year X Senior High School 22 Bandung, year X Senior High School 9 Bandung, and year VIII-B Junior High School 29 Bandung.

#### **H. Research Procedure**

In global, this research held in two steps, namely:

##### a. First Step

This step is identification and improvement of courseware, model of learning, and model of evaluation for each subresearch. The steps done in this step are: (1) identification of problem happened related with teaching material, model of learning used now, and model of evaluation usually held, as reference for further improvement, and (2) improvement learning components include courseware, model of evaluation, and the relevant learning strategic for each subresearch.

## b. Second Step

The activity at second step, begin by initial study about learning components have been developed by main researcher, teachers, students, and mathematics education expert. Based on inputs found from the initial study then perfecting of learning components. Following to the step of initial study, implementation of learning held for each subresearch. Several activities at the step of this implementation are: (1) How effectively and efficiently of model of learning based on teaching material, model of evaluation, and model of learning developed, (2) How the main characteristic or the profil of model of learning viewed theoretically and empirically, (3) How the students' response and performance as result of model of learning implementation developed, and (4) what basic principles should be used to guarantee developed model held optimally.

## I. Research Instruments

In this research used several instrument as follow:

1. Written test
2. Student work sheet
3. Questionnaire
4. Interview guideline
5. Daily journal
6. Observation sheet

## J. Discussion of Research Result

### 1. Mathematics Understanding capability

Mean of pre-test of students' mathematics understanding for students come from control group is 11,925, while for students come from experimental group is 13,050. Based on the equality of two means tests result, both of means haven't significantly differences. We can conclude that students' mathematics understanding capability for student come from control and experiment group is same. But the post-test result, showed that mean of post-test of control group is 21,925 and for experimental group is 25,975. Based on the equality of two means

tests result, both of pos-test means have significantly differences between control group and experimental group, it means that mathematical learning in experimental group gave better influence than mathematical learning in control group. Considering control group's post-test mean and experimental group's post-test mean, we can conclude that experimental group's mathematical understanding better than control group's mathematical understanding.

Based on the students' questionnaire, generally the students have positive attitude to mathematical learning through model of concept-achievement learning. It is happened, because mathematics learning held at the experimental group gives an opportunity to the students to expres their own ideas. Besides, when the students was formulating hipotesis they had been given an opportunity to discuss with other students.

But, there are several students who have negative attitude to learning held, when the students prefer mathematical learning held before, namely teacher explain the subject matter, gives example of exercise, and then gives exercises. It is happened because the students always get all informations from their teacher, so they get difficulties in concept understanding they receive.

## **2. Adaptive Reasoning Capability**

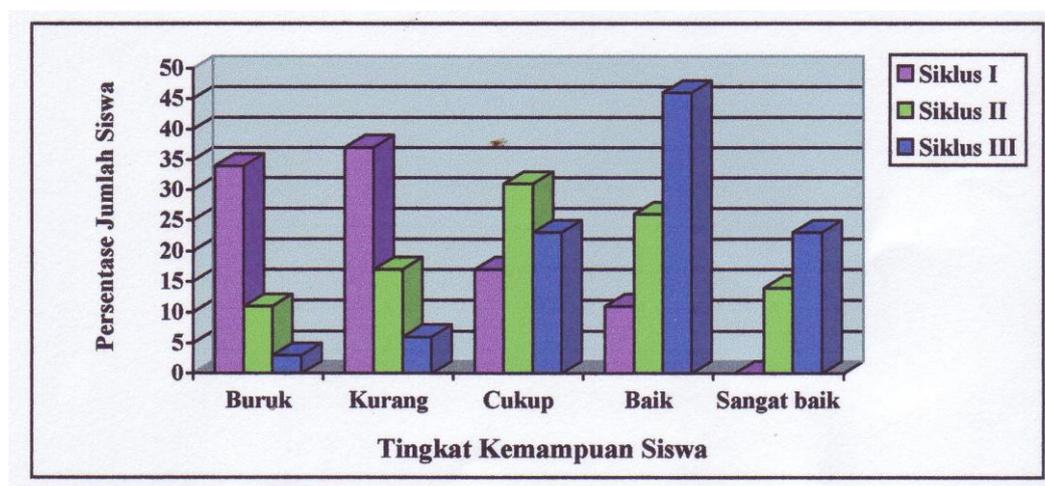
Based on the result of data processing, pre-test mean of students' adaptive reasoning from experimental class is 2,7568 while pre-test mean of students' adaptive reasoning from control class is 3,5676. Further, from differences of two-meas test, we get that both of mens have not significant differences. So, we can conclude that initial capability of students' adaptive resoning who come from experimental and control class are same. While based on the result of post-test data processing, mean of experimental class is 27,7568 and mean of control class is 17,5767. The result of differences of two-meas test, we get that pre-test mean of experimental class higher than pre-test mean of control class. So, we can conclude that students' adaptive reasoning capability who get learning through guided reinvention methode higher than students' adaptive reasoning capability who get mathematics learning through konventional methode.

Based on data processing of gain index score, we get that mean of experimental class is 0,5245 and mean of control class is 0,3090. Further, result of differences of two gain index mean, there is a significant difference gain index mean between experimental and control class. From the result of analysis, we can conclude that increasing of students' adaptive reasoning who get mathematical learning through guided-reinvention method is higher than students' adaptive reasoning who get mathematical learning through conventional method.

Analized questionnaire result, shown that learning through guided-reinvention method gets positive responses from students. Learning through guided-reinvention can facilitate students to improve students' thinking and socialization capability. Besides, the students feel more enjoy when they can get a conclusion as formulations or concepts. But, because the learning method is rarely held, cause several students prefer to follow learning as held by their teacher before.

### 3. Strategic Competence

To improve students' strategic competence teacher used model of Treffinger learning. The data as result of the third cyclic test shown in follow diagram:



Based on the diagram, we can conclude that on post-test level of students' competencies generally increase from the first test up to the third one. It expressed that students' strategic capability increase step by step.

Based on students' questionnaire, we get that positive responses to model of Treffinger learning from each meeting always increase. At the first meeting, almost half (46,88%) give positive response. At the second meeting, it increases to become 61,76%, at the third meeting to become 65,71%. At the fourth meeting 62,86%, at the fifth meeting 82,35% and the sixth meeting 82,86%.

### **K. Conclusion**

Based on research results held, we can make conclusions as follows:

1. Learning through model of concept achievement learning can increase students' mathematical understanding.
2. Learning through guided-reinvention method can increase students' adaptive reasoning capability.
3. Learning through Treffinger model can increase students' strategic competence.
4. The students' response is positive and adequate to each learning method held.

### **L. Recommendations**

Based on research results held, several things are recommended as follows:

1. For teachers, this research can be used as a reference to make a learning plan which can improve concept understanding, reasoning, and students' mathematical strategic competence.
2. For further researchers, to improve the same research with a different model of learning or different grade of class, and different topic or using teaching aids.