

# ENHANCING STUDENTS' CRITICAL THINKING IN MATHEMATICS BY CONTEXTUAL TEACHING AND LEARNING

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**Abstract:** The main objective of this study is to analyze students' critical thinking in mathematics and to analyze students' and teacher's perception on contextual teaching and learning. The data were collected using six instruments; namely, mathematics test, students' journal, observation sheet for students' activities, observation sheet for teacher's activities, students' perception based on Likert scale system, and interview guideline for teacher. The main finding of this study, viewed from all aspects of critical thinking shows that, the students who were treated by contextual teaching and learning, have critical thinking in mathematics better than those who were treated by conventional approach. Further, viewed from student classification, before the implementation of contextual teaching and learning, there is a difference of critical thinking between upper level students and middle level students, but after the implementation of contextual teaching and learning, there is a difference of critical thinking between upper level students and lower level students. Another result, in general, indicates that students' activities in contextual teaching and learning class is good. Apart from that, students and teachers have positive perception on contextual teaching and learning.

**Keyword:** Conventional approach, contextual teaching and learning

## INTRODUCTION

### Background

One of the objectives of mathematics learning is students can use mathematics as the way of reasoning (thinking logically, critically, systematically, and objectively) and have an ability to solve problem. In general, teachers teach mathematics to their students by traditional approach, and research result shows that, the students of Junior High School haven't reached optimally the objective of mathematics learning yet. In other side, contextual teaching and learning (CTL) has several components which theoretically can enhance critical thinking, therefore this study try to conduct mathematics learning by CTL for enhancing critical thinking.

### Research Question

Main problem in this research: " Whether the students of Junior High School who were treated by contextual teaching and learning, have critical thinking in mathematics better than those who were treated by conventional approach? The main problem is detailed to several research questions, namely:

1. How the quality of critical thinking in mathematics of Junior High School students were treated by CTL before and after the implementation of CTL viewed from a) all aspects of critical thinking? b) student classification?
2. How the quality of critical thinking in mathematics of Junior High School students were treated by conventional approach before and after the

implementation of traditional approach viewed from all aspects of critical thinking?

3. How the students activities in contextual teaching and learning class?
4. How the students' and teacher's perception on contextual teaching and learning?

### **Research Hypothesis**

1. Before the implementation of CTL, the students of Junior High School who were treated by CTL, have critical thinking in mathematics same as those who were treated by conventional approach viewed from all aspects of critical thinking.
2. After the implementation of CTL, the students of Junior High School who were treated by CTL, have critical thinking in mathematics better than those who were treated by conventional approach.
3. Before the implementation of CTL, there is no difference of critical thinking in mathematics, between upper level students, middle level students, and lower level students viewed from all aspects of critical thinking.
4. After the implementation of CTL, there is no difference of critical thinking in mathematics, between upper level students, middle level students, and lower level students viewed from all aspects of critical thinking.

### **Objective and Usefulness**

In general, the objective of this research is identifying and analyzing difference of critical thinking of Junior High School students who were treated by CTL and those who were treated by conventional approach. The specific objectives of this research are:

1. To make a description and to shed light on data of measurement of critical thinking in mathematics of students who were treated by CTL before and after the implementation of CTL, viewed from all aspects of critical thinking and student classification (upper level students, middle level students, and lower level students).
2. To make a description and to shed light on data of measurement of critical thinking in mathematics of students who were treated by conventional approach before and after the implementation of conventional approach, viewed from all aspects of critical thinking.
3. To know the students' activities in contextual teaching and learning class?
4. To know the students' and teacher's perception on contextual teaching and learning?

Theoretically, usefulness of this research is giving contribution for enhancing applicative education-knowledge, especially on mathematics education to look for an alternative learning approach which be able to enhance students' critical thinking of Junior High School students.

### **Literature Review**

#### **A. Critical Thinking**

Refer to Webster's New Encyclopedic All New 1994 Edition "critical" is "*Using or involving careful judgment*" Another explanation given by Ennis (1996),

critical thinking is a process, the goal of which is to make reasonable decisions about what to believe and what to do.

Critical thinking is one step of higher thinking. Costa (Liliasari, 2000: 136) categorized that process of complex thinking or higher thinking into four groups include problem solving, decision making, critical thinking, and creative thinking. Critical thinking needed in society life, because in society life people always faced problem needed to solve. Of course data needed for solving problem in order to make a decision logically and accurately. For those reasons people should have a good critical thinking. Because critical thinking is an important thing, the ability to think critically is generally regarded as major goal of academic instruction. It is also known to play an an important role in many kinds of occupations, particularly those in which careful, analytical thinking is an essential part of the job (Watson and Glaser (1980:1)). That perception agrees with objective of learning mathematics at basic education level and middle education level as presented in Curriculum 1994 and Curriculum 2004

Krulik dan Rudnick (1995: 2) presented that reasoning includes basic thinking, critical thinking, and creative thinking. There are eight description can be related with critical thinking, namely examining, relating and evaluating all aspects of a situation or problem, focusing on part of a situation or problem, collecting and organizing information, validating and analyzing information, remembering and analyzing information, determining is an answer logically or not, has analytic and reflective nature.

In briefly, Ennis (1996), presented that there are six basic elements in critical thinking, namely focus, reason, inference, situation, clarity, and overview. To evaluate critical thinking, Watson and Glaser (1980), conducted measurement trough test includes five indicators, namely inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments. In this research measurement of critical thinking referred to Watson and Glaser perception.

## **B. Learning for Enhancing critical Thinking Ability**

There are three strategies for teaching about critical thinking abilities, namely (1) Building Categories, (2) Finding Problem, dan (3) Enhancing the Environment (Bonnie and Potts, 2003). Also presented that there are several “characteristics” of learning for critical thinking involve (1) to increase interaction among students as learners, (2) With raising open-ended question, (3) Giving enough time to the students for giving reflection to raised question or problems given, and (4) Teaching for transfer.

## **C. Contextual Approach**

There are seven characteristics of contextual teaching and learning, those are constructivism, questioning, inquiry, learning community, modeling, reflection, and authentic assessment (Depdiknas, 2002). Zahorik (Depdiknas, 2002: 7) presented there are five elements should be regarded in practice contextual learning:

- (1) Activating knowledge.
- (2) Acquiring knowledge with studying all of object first, and then regarding its detail.

- (3) Understanding knowledge
- (4) Applying knowledge.
- (5) Reflecting knowledge on the development knowledge strategy.

## **METHODOLOGY**

### **Research Design**

This study is experimental in nature, using control groups pre-test and post-test design. The experimental group was treated by contextual teaching and learning, containing seven characteristics, emphasizes on three characteristics; namely constructivism, questioning, and inquiry. The control group was treated by conventional approach.

In control groups pre-test and post-test design, the subject in both experimental and control groups were pretested. The experimental group was taught using contextual teaching and learning while the control group was taught using conventional approach. The two groups were then posttested. The following is the research design that was utilized in this study.

A	O	X	O	
A	O		O	(Ruseffendi, 1994: 45)

Explanation:

A = subject of research taken randomize.

O = pretest/ posttest = test of critical thinking in mathematics ability.

X = learning mathematics using contextual teaching and learning.

In this study, the independent variable were the approach of learning mathematics, contextual teaching and learning and conventional approach. The dependent variable was the students' critical thinking ability in mathematics of second year student of Junior High School.

### **Subject of Research**

The subject of this study is second year students of a Junior High School in Bandung and its sample consists of two classes of second year students of Junior High School 15 Bandung.

## **INSTRUMENTATION**

The data were collected using six instruments; namely, mathematics test, students' journal, observation sheet for students' activities, observation sheet for teacher's activities, students' perception based on Likert scale system, and interview guideline for teacher.

### **Treatment**

This study conducted in Junior High School 15 Bandung for two months. The same teacher taught all the two classes for two months after which, a posttest was administrated simultaneously. This was aimed to separate teacher effect from treatment effect.

In the experimental class, for enhancing good learning community, which one of CTL component, the students were grouped in small group consist of four students who has different ability based on mark of each students' report in

previous semester. They work together in group in order to share ideas. After they work in group, a representation of each group presented the result of their discussion result in class discussion.

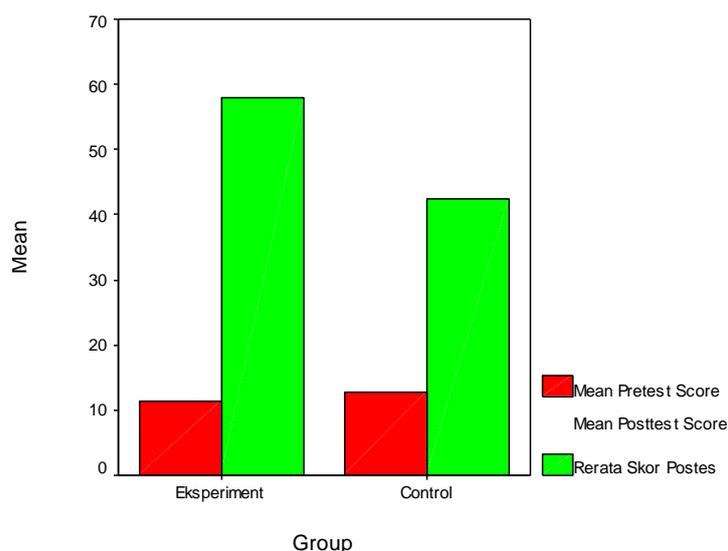
## DATA ANALYSIS PROCEDURES

After quantitative data scored, data were analyzed using Casio fx 3600 P and SPSS 10.0 for Windows. To know about reaching ideal score used percent, and to see is there difference on critical thinking between students who were treated by CTL and students who were treated by conventional approach examined by statistics test, namely used mean-difference test. Observation result, students' journal, students' perception scale, and result of interview with the teacher analyzed and presented narratively. Before using kind of statistics, parametric or nonparametric statistics, normality of distribution of each class was tested first. The result of observation on students' activities used to know how the students' activities in contextual teaching and learning class. The result of journal and students' questioner used to know students' perception on CTL while the result of interview with teacher and the result of teacher's observation on reseacher's activities as a teacher in learning process used to know teacher's perception on CTL.

## RESULT

### Analysis

Visually, mean of pretest and posttest score that show students' critical thinking in mathematics before and after implementation of treatment can be seen at picture below.



*Mean* of Critical Thinking Before and After implementation of treatment

Result of statistics test showed that for pretest score in  $\alpha = 0,05$   $H_0$  received. It's means that before treatment implemented, there is no difference of critical thinking in mathematics between students who were treated by CTL and those who were treated by conventional approach viewed from all aspects of critical thinking.

While for posttest score in  $\alpha = 0,05$   $H_0$  rejected. It's means that viewed from all aspects of critical thinking, there are any differences of critical thinking in mathematics between students who were treated by CTL and those who were treated by conventional approach. Because experimental class has mean of posttest score higher than control class's posttest score, therefore concluded that viewed from all aspects of critical thinking shows that, the students who were treated by contextual teaching and learning, have critical thinking in mathematics better than those who were treated by conventional approach, even though hasn't reach a good category yet. It showed by mean posttest score = 57,894 for experimental class and 42,439 for control class.

Result of ANOVA showed that in  $\alpha = 0,05$   $H_0$  rejected. It's means that before the treatment (CTL) implemented, there are any differences of critical thinking between upper level students, middle level students, and lower level students, viewed from all aspects of critical thinking. Because between one level students and another has differences, then data analyzed by Scheffe.test. From Scheffe.test acquired that in  $\alpha = 0,05$  there is a difference of critical thinking between upper level students and middle level students.

Not only before the implementation of CTL there is a difference of critical thinking between upper level students, middle level students, and lower level students, viewed from all aspects of critical thinking, but also after the implementation of CTL. Because their variance are not equal, then data examine by Dunnett test. From Dunnett test acquired that in  $\alpha = 0,05$  there is a difference of critical thinking between upper level students and lower level students.

## **CONCLUSIONS**

Viewed from all aspects of critical thinking shows that, the students who were treated by contextual teaching and learning, have critical thinking in mathematics better than those who were treated by conventional approach. Further, viewed from student classification, before the implementation of contextual teaching and learning, there is a difference of critical thinking between upper level students and middle level students, but after the implementation of contextual teaching and learning, there is a difference of critical thinking between upper level students and lower level students. Another result, in general, indicates that students' activities in contextual teaching and learning class is good. Apart from that, students and teachers have positive perception on contextual teaching and learning.

## **IMPLICATION FOR PRECTICE**

The findings of this study suggest that use of CTL may benefit Students of Junior High School in enhancing students' critical thinking in mathematics. Therefore, it follows that CTL can be implemented as an alternative approach in learning mathematics to reach the goal of mathematics education.

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