

Leveling Of Students Critical Thinking Abilities In Mathematics Problem Solving In Line With Gender Differences

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Abstract

This research has goal to formulate leveling of students critical thinking abilities in mathematics problems solving in line with gender differences. Data was collected by interview-based tasks. Subjects of research were students in grade XI SMA Islam Sultan Agung Semarang, which consisted of three boys and three girls.

This research has resulted leveling of students critical thinking abilities in mathematics problems solving in line with gender differences as follows: (1) Critical Thinking Ability Level 4 (Very Critical): for girl students, students are able to solve a problem with the answer in accordance with the steps correctly Polya and more careful and willing to re-check of which have been the results. For boy students are able to resolve a problem with answers in accordance with Polya steps correctly but is not thorough and did not want to re-check the results have been obtained, (2) Critical Thinking Ability Level 3 (Critical), boy and girl student when planning issues are still trial with some formula that they already know, they tend to be trial and error, but eventually they can answer correctly. For girl students are still checking back results have been obtained, but the boy students did not, (3) Critical Thinking Ability Level 2 (Less Critical), boy and girl student are able to make plans with a couple of times to write a formula, but the solve of problem can not finish properly.

This research indicates that leveling of students critical thinking ability can be applied in mathematics, specially in mathematics problems solving, to enhance students critical thinking ability, and can be used as a basis for further research are verification and modification.

Keywords: *critical thinking abilities, mathematics problem solving, gender*

A. INTRODUCTION

Background

In the subjects Mathematics Competency Standards issued by the Ministry of Education (2006), the learning of mathematics aims to prepare students to solve everyday problems, involving students in data collection activities, exploration, interpretation, reasoning, designing models, analyzing, formulating hypotheses, and inspect generalize outcome. Thus, in learning mathematics, in addition to achieve the goals that exist in every matter of mathematics, students need to be equipped also with a certain thinking skills so that they can develop and evaluate arguments in a particular problem-solving. One of the thinking abilities should be developed to achieve these objectives is the ability to critical thinking.

Critical thinking that is characterized by the ability to: (1) identify the facts given in a clear and logical, (2) to formulate the issues carefully, (3) apply theme methods that have studied with accurate, (4) reveals data/definitions/theorem in solving the problem properly, (5) decide on and execute the plan correctly, (6) evaluate the arguments in the resolution of an issue carefully, and (7) to distinguish between conclusions based on the logic of the valid/invalid (Nickerson. 2002,Ennis. 1995,Gokhale, 1995).

Mathematics problems by Polya (1973), divided into two types namely the problem of finding (problem to find) and to prove the problem (problem to prove). On the problem of finding, in essence, students are expected to determine the solution or answer to the problem. In the matter to prove, students are expected to demonstrate the truth of a theorem or statement. However, in the learning of mathematics in high school, mathematics problems solving cannot be done quickly and easily. To resolve this problem by thinking groove students need critical thinking abilities.

Ability to solve mathematics problems influenced by several factors, both internal and external factors. Internal factors include: intelligence, motivation, interests, talents, and mathematics skills as well as gender differences. External factors, such as: facilities, infrastructure, media, curriculum, teachers, learning facilities, and so on. Arends (2008) explains that there are differences in cognitive abilities between men and women. Boys are more rational, spirit drawn to things that are intelligent, abstract, making better and more logical to think critically. While girls are more accurate and detailed in making decisions, his memory is better, more emotional, and more interested in verbal skills.

Consideration of selection of high school students as research subjects are as follows: First, the age of high school students if it is associated with Piaget's stages of intellectual development has been the view at this stage of formal operations. At this stage, if student are faced with something, then the students can formulate conjectures or hypotheses and then to deduce consequences based on initial hypotheses.

Based on the background of the problem, the problem to be posed in this research is how leveling of senior high school students critical thinking abilities in mathematics problem solving in line with gender differences?

Research Urgency

Learning is a mental activity in the minds of students that result in changes behavior. Gagne in Dahar (1988: 12) defines learning as a process where organisms turn his knowledge as a result of experience. Thus the learning process is strongly influenced by an ability to think, one of these thinking skills are critical thinking skills.

But the reality, mathematics teachers do not easily determine the ability and the process of critical thinking students through of learning mathematics. A student is said to have critical thinking skills if you have a systematic thinking, awareness of thinking, and have the ability to differ between a true and false. Critical thinking skills that can not easily be known only through the work of the students in answering the questions given both written and oral teacher.

Critical thinking skills is one of the basic capital or intellectual capital is very important for everyone and is a fundamental part of human maturity (Depdiknas, 2006). Therefore, the development of critical thinking skills become very important for students at every level of education. Critical thinking skills are used as the basis for analyzing an argument and the interpretation of patterns in developing a consistent and logical reasoning, the ability to understand the assumptions, formulate problems, to deduction and induction as well as taking the right decision. Critical thinking skills are one type of thinking skills can be developed through the learning process.

The process of critical thinking can provide accurate guidance in thinking and solving a problem, and also helps in determining linkages with other things more accurately. Therefore the process of critical thinking is needed in problem solving or finding a solution of a problem (Siswono, 2007).

Problem of Research

Based on the background, then the formulation of the problem to research are: How does critical thinking leveling of high school students in problem solving of mathematics in line of gender differences?

Aim of Research

The purpose of this research was to describe the leveling of senior high school student critical thinking abilities in mathematics problem solving in line with gender differences. Main contribution of this research is classify students critical thinking processes in learning mathematics, especially regarding the completion of senior high school mathematics problem in line with gender differences.

Benefits of Research

To classify the critical thinking of students in learning mathematics, particularly about the completion of high school mathematics problem in line with gender differences.

B. METHODS OF RESEARCH

Design

This research is an exploratory study with a qualitative approach, which seeks to find meaning or essence behind the symptoms that occur in study subjects. This means that research conducted aims to unravel the hierarchy think the students, the hierarchy of critical thinking in mathematics problems solving (problems of proof) in terms of gender differences. Based on the answers the students, is used as a base in search of the hierarchy of critical thinking students with the interview. Interviews in this study aims to reveal a picture of students thinking processes associated with the hierarchy of critical thinking students.

Subject

The subjects of this research were senior high school students in grade XI, XI-class high school students chosen by reason of: (1) students are at a formal level, thus being able to think more abstractly to produce answers that is critical, (2) students have enough knowledge and experience about mathematics before, having missed the basic school level and junior high school. The method of selection of subjects sought in accordance with established criteria and met the criteria hierarchy of critical thinking in solving mathematics problems. Furthermore, we selected two students to study subjects based on gender differences in each of the students. So the research subjects were two students (male and female).

Instrument

The main instrument in this research were researchers themselves, because at the time of data collection in the field of researchers serve as data collectors during the research process, followed by in deeper views.

Beside the main instrument, there is aids instrument namely assignment sheet and a test of mathematical ability. In this research, the assignment sheet is a mathematics exercise in the form of problem mathematics. This task sheet instruments in order to function optimally it first started with the validation by experts, consisting of teachers of mathematics, mathematics education specialists, and mathematicians. Validation of the suitability of the instrument is directed to work with problems, mathematical context, and context of the mathematical language used.

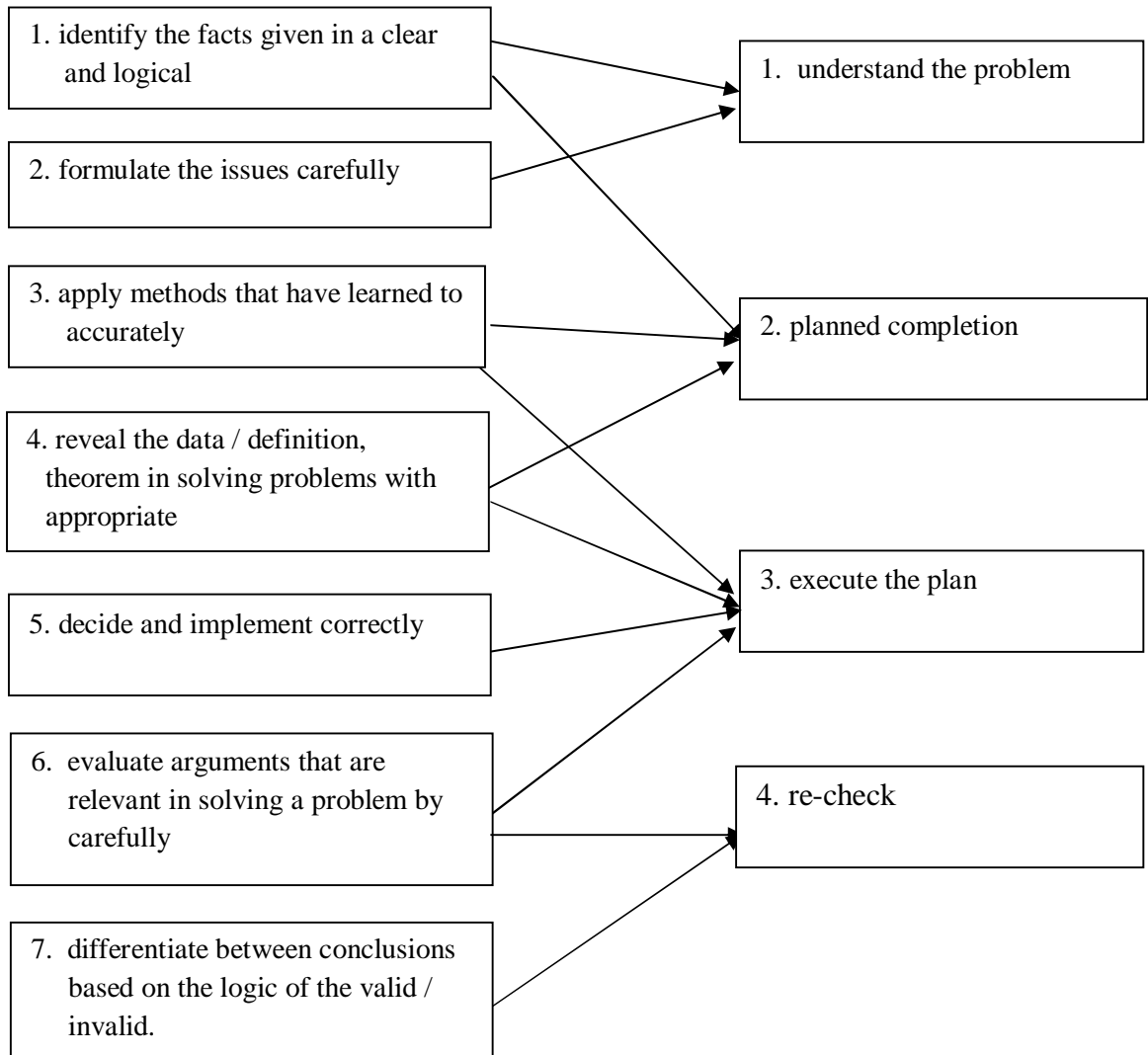
Data Collection Procedures

Research data collection is done by giving students the problem mathematics related to high school mathematics materials. From the results of student work is used as the basis of my interviews. To get a picture of students' critical thinking process, carried out the following steps: (1) students were given the task to solve problem mathematics, (2) researchers examined the results of student work, and (3) researchers conducted interviews related to the answers given by students. Furthermore, from the results of written and verbal data (data from interviews) collected and examined its provisions. If there are inconsistent data, then re-interviews were conducted to obtain data according to the research question.

To obtain research data used to study questions are based on indicators of critical thinking and in accordance with Polya measures, such as the following diagram:

Diagram 1. Key indicators of critical thinking and measure mathematics problems solving.

Indicator of critical thinking Measure mathematics problem solving



Analysis

Qualitative data analysis has done at the time of the shooting, this means that data analysis can be done since the first time of data collection at the field and it ends at the time of arrangement of research reports. This analysis is an attempt to look for and organize observations systematically, interviews, and others to improve researchers understanding and serve as the research findings. This is in accordance with the opinion

of Muhajir (2002) that data analysis is an attempt to look for and organize systematically about record observations, interviews, and others to improve researchers understanding of the studied cases and presented it as a research finding that may be useful to others.

Based on the above opinion, we get that data analysis in this research followed by these steps : (1) recapitulation the students answers, (2) interpretation data of students answers from many resources namely, interview, observation based on real field condition, (3) data reduction (4) data category, (5) analyze critical thinking process, and (6) draw conclusions.

In this research, to analyze and know the process of critical thinking can be traced through students critical thinking ability of students are integrated in the process of learning mathematics in high school involving students actively and is associated with the completion of mathematics problems by creating indicators.

C. RESEARCH RESULTS

Based on the last analysis of research data, the obtained results about the hierarchy of critical thinking abilities of students in mathematics problems solving in terms of gender differences as follows: (1) Critical Thinking Ability Level 4 (Very Critical): for women students, students are able to solve a problem with an answers in accordance with the steps Polya properly and more thoroughly and would re-check the results that have been obtained. For male students are able to solve a problem with an answer in accordance with the steps Polya correctly but is not thorough and did not want to re-check the results have been obtained, (2) Critical Thinking ability level 3 (Critical), male and female students when planning issues are still experimenting with some formula that they already know, they tend to be trial and error, but in the end they can answer correctly. Female students are still re-check the results have been obtained, but the male students did not do it, and (3) Critical Thinking Ability Level 2 (Less Critical), female and male students are able to make plans to write down the formula a few times, but ultimately unable to resolve the problem by true.

Based on these results, the hierarchy of critical thinking abilities of students learning mathematics can be applied in particular in mathematics problem solving by

taking into account gender differences, and also to enhance students critical thinking abilities, and can be used as a basis for further research into the nature of verification and modification.

D. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

From data analysis result which is based on research questions, we get the conclusion below :

1. Formulation of leveling critical thinking abilities which follow these steps: (a) Formulate draft of critical thinking level, (b) validation this draft, (c) revision draft of critical thinking level by showing new hypothesis theory (*improvement critical thinking level*), (d) do data collection, (e) do data analysis, and (f) write the theory, product leveling critical thinking abilities in solving look at differences gender.
2. Leveling critical thinking abilities follow the steps of Polya such as problem understanding, plan the solution, do the plan and check overall.

In the step of student problem understanding at level 4, 3 and 2 , male and female students can do well so they can decide what is the known point and actually what is the question from the mathematic problem served.

In the solution plan step, students at level 3 and 2 (female and male) can make plan correctly. For female students at level 2, in making plan of solution has been done correctly after read the problems repeatedly. For male students at level 2 is still finding difficulties in plan the solution.

In the steps of action check overall, female students at level 4 can finish a problem with suitable answers by Polya steps correctly and accurately. They also want to check overall again about their result. Male students can finish a problem with suitable answers by Polya steps correctly but not accurately and they do not want to check overall again about their result.

For male and female students at level 3, at the time of finishing problems is still trial and error by known formula, however at the last they can answer correctly. Female students still check again about their result but male do not. While female

and male students at level 2 cannot answer correctly and do not want to check it again.

Recommendations

Based on research conclusions, we get the recommendations below

1. Further research needs to be done which is the verification and modification in order to make sure the result of leveling critical thinking abilities and complete characteristic of leveling critical thinking in math problem solving.
2. Knowledge of leveling abilities and step of critical thinking can be used to devise model or lesson strategy for increasing or optimizing students critical thinking abilities.

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