Man In India, 95 (3) : 813-820

MATH PROBLEM SOLVING WITH METACOGNITIVE SKILLS INVOLVING FOREIGN STUDENTS SENIOR HIGH SCHOOL 3 PAREPARE

Mas'ud, Arifin Ahmad and Gufran Darma Dirawan

The research objective was to determine the ability to solve mathematical problem involving metacognitive skills in class XI Science Senior High School 3 Pare Pare. The focus of this research is based on analysing the ability level of class XI science student in solving mathematical problems involving metacognitive skills, and analysis of student ability of men and women in terms of mathematical problem solving skills involving metakogntif. Subjects in this study were students of class XI science in total 26 people, consisting of 9 men and 17 women. The method used is descriptive method with quantitative approach. The variables of this study is problem solving based on the following indicators developed; understanding the problem, device learning planning,implementation of the plan, and feedback. While indicators of metacognitive skills is planning skills, monitoring skills, skills evaluation and prediction skills. The analysis showed that the ability of solving problems involving metacognitive skills better than before. It is characterized by 50% of the 26 students who meet the minimum completeness criteria (MCC) after involving metacognitive skills, whereas before involving metacognitive skills only 38.46% of the 26 students who meet the MCC. Other findings indicate that the ability of solving problems involving metacognitive skills of women better than men.

Keywords: Metacognitive Skills, Mathematics, Problem Solving

Introduction

Law No. 20 of 2003 on National Education System states that the national education aimed at developing the potential of students in order to become a man of faith and fear of God Almighty, noble, healthy, knowledgeable, capable, creative, and become citizens of a democratic and responsible. Based on national education goals, then education at every level of the school unit, should be systematically organized in order to achieve the objectives of the national education. Mathematics is the major subjects taught at every level of education units, ranging from basic education to higher education. Realizing the importance of mastering mathematics, then in Act No. 20 Year 2003 on National Education System Article 37 stated that the subjects of mathematics is one of the compulsory subjects for students in primary and secondary education.

Mathematics is taught in schools aims to support the achievement of the objectives of national education. Because mathematics as an organized structure plays an important role in shaping the mindset of students that is critical, systematic, logical, and creative. This mindset can help people solve problems in everyday

Address for communication: **Mas'ud, Arifin Ahmad, Gufran Darma Dirawan**, Post Graduate Program, Makassar State University, *E-mail: Masud_umpar@yahoo.com; Arifin_unm@yahoo.co.id; gufrandarma@yahoo.com*

life. Relation to mathematics learning in school, math facilitate the formation of students' skills in problem solving both in daily life and in education in schools. These capabilities, and the competence needed by students in order to have the ability to acquire, manage, and use information to survive in a state of ever-changing, uncertain, and competitive. This is in line with the Decree No. 22 Year 2006 concerning the purpose of learning mathematics, where one of the goals of mathematics teaching is that students have a "problem-solving skills that include the ability to understand a problem, design a mathematical model, solve the model and interpret the obtained solution" (Depdiknas, 2008).

Therefore this study focused on analyzing the student's ability in solving mathematical problems involving metacognitive skills and mathematical problem solving abilities comparisons involving metacognitive skills among male students to female students.

Research Method

This research is a descriptive qualitative research, because this research will describe the problem solving ability of students by involving metacognitive skills. Subjects in this study were students of class XI Science Senior High School 3 Parepare second semester of academic year 2014/2015, totaling 26 people, consisting of 9 men and 17 women. The instrument used to retrieve the data in this study a test sheet problem solving abilities. Data on problem-solving skills involving metacognitive skills collected by using the test. Data analysis techniques used in this research is qualitative descriptive analysis technique. Step qualitative data analysis is done in three stages, namely data reduction, data presentation, and conclusion or verification data.

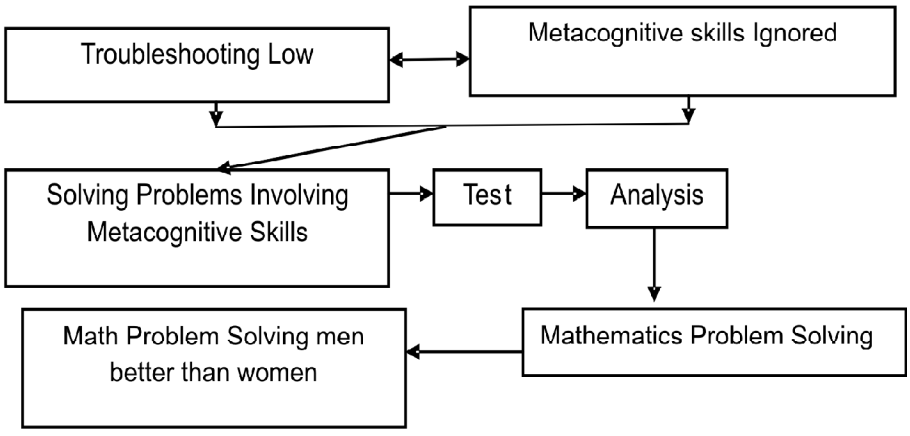

Figure 1: Schematic Mindset Research

Research Result

Data description problem solving ability of students by involving metacognitive skills are presented as follows.

TABLE 1: STATISTICS PROBLEM SOLVING ABILITY SCORES THAT INVOLVING METACOGNITIVE SKILLS

Statistic	*Statistic value*
Subject Research	26
Ideal Score	100
Top Scores	91,66
Lowest Score	25
Score Range	66,66
Scores Average	61,62
Standard Deviation	4,29

Based on Table 1 above shows that the average score of students' mathematical problem solving ability after involving metacognitive skills is at 61.62 with a standard deviation of 4.29 the lowest score was 25 and the highest score of 91.66 is possible to achieve an ideal score of 100. If the mathematical problem solving ability scores are grouped in five categories, and the percentage obtained frequency distribution as shown in Table 2 below:

TABLE 2: FREQUENCY AND PERCENTAGE DISTRIBUTION OF PROBLEM SOLVING ABILITY TO ENGAGE STUDENTS METACOGNITIVE SKILLS

Score Range	*Frecuency*	*%*	*Category*
0 – 20	0	0	Not Very Good
21 – 40	7	26,92	Not Good
41 – 60	6	23,08	Enough
61 – 80	3	11,54	Good
81 – 100	10	38,46	Very Good
Total 26		100	

Source: Ridwan, 2012

Data student on problem-solving skills involving metacognitive skills presented in Graph 1 as below:

Data Table 2 above shows that 50% of students who completed their study, while preliminary data showed before involving metacognitive skills in problem solving, students who completed their study 38.46%. This proves that involve problem-solving ability after metacognitive skills better than before.

Description of student data on problem solving capabilities by involving metacognitive skills by sex are presented in Table 3 below.

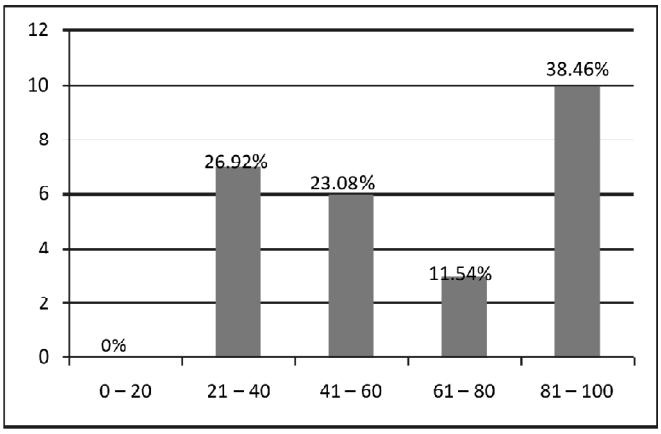

Figure 2: Graph of Distribution of Problem Solving Ability to Engage Students Metacognitive Skills

TABLE 3: STATISTICS PROBLEM SOLVING ABILITY SCORE INVOLVING METACOGNITIVE SKILLS FOR STUDENTS MAN AND WOMEN

Score for Man		*Score for Women*	
Statistic	*Statistic Value*	*Statistic*	*Statistic Value*
Subject Research	9	Subject Research	17
Ideal Score	100	Ideal Score	100
Top Scores	85,41	Top Scores	91,66
Lowest score	35	Lowest score	25
Score Range	50,41	Score Range	66,67
Average	61,79	Average	59,89
Standard Deviation	23,06	Standard Deviation	25,36

Furthermore, the average score of problem-solving skills involving metacognitive skills for boys and girls, are presented in figure 2 below:

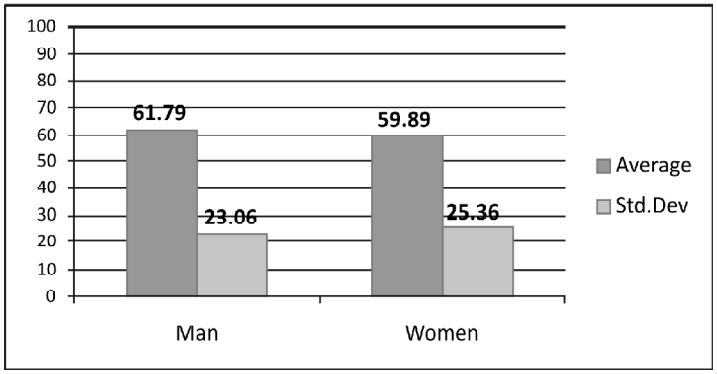

Figure 3: Graph Scores Troubleshooting Capabilities Students Man and Women

Based on Table 3 and Graph image 3, shows that the average score of mathematical problem solving abilities involving metacognitive skills of boys and girls respectively 61.79 and 59.89, respectively standard deviation of 23.06 and 25, 36. This proves that the mathematical problem solving abilities by involving metacognitive skills boys better than girls.

Discussion

Discussion of this study is to demonstrate the ability of students in mathematical problem solving involving metacognitive skills and mathematical problem solving abilities comparisons involving metacognitive skills among male students with female students as follows.

Based on the facts on the ground indicate that the problem-solving and metacognitive skills have not been used as the main goal in the study of mathematics. Based on interviews with teachers who teach mathematics in class XI Science Senior High School 3 ParePare, obtained information that "more than 50% of students still have difficulty in solving mathematical problems in the form of word problems. This is confirmed by the data on average daily test results of every subject, from 26 students of class XI Science only 10 people (38.46%), which reached a minimum completeness criteria (MCC) is set, that is 78. This indicates that the ability of students in solving mathematical problems still low. Low ability students in solving mathematical problems caused by lack of teachers provide opportunities for students to explore the thinking ability, learning that takes place in schools is still limited transper mere knowledge so that students become lazy to find a solution to a given problem. It was also found that not only the differences in mathematical ability based on the gender factor, but how to acquire knowledge of mathematics is also associated with gender differences. Kamid research results (2013) found that there were differences in the procedures and implement measures to understand the problem-solving mathematics between boys and girls in class VIII SMP Jambi.

Whereas students' skills in problem solving depends heavily on awareness of what is known and how to do it (Suherman, 2003). This relates to the metacognitive students.

Mathematics Problem Solving

Problems in mathematics can be problems which have not been known solution procedures by students. Troubleshooting an effort to obtain solutions to problems by applying mathematical knowledge and skills involving students think and reason. In everyday life we are faced with diverse problems. Each of these problems of course requires a way of solving different. One of them is through a mathematical problem solving (Mathematical Problem Solving). General measures to solve the problem by Polya (1973) is (a) understanding the problem, (b) planning devise learning, (c) implementation of the plan, and (d) feedback.

Skills Metacognition

Metacognitive understanding, Flavel (1976) emphasizes the thinking person's awareness of their own thought processes. Schoenfeld, 1992; Anderson & Kathwohl 2001 stated, metacognition refers to the person's knowledge or awareness of the process and results of thinking. Tobias and Everson (1998) stated that metacognition as a combination of metacognitive knowledge and metacognitive skills. Furthermore, Tobias & Everson stated, the components of the hierarchical nature, ie metacognitive knowledge is a prerequisite to enable the metacognitive skills. Desoete (2001) states, metacognition has three components on solving mathematical problems in learning, namely: (1) metacognitive knowledge, (2) metacognitive skills, and (3) metacognitive beliefs. Metacognitive knowledge refers to declarative knowledge, procedural knowledge, and the knowledge of a person conditional on solving problems in learning. While referring to the prediction metacognitive skills skills, planning skills, skills monitoring, and evaluation skills. Desoete (2001) briefly describes metacognition skills as the ability of a person to control their own cognitive skills. Desoete; 2010, Wall K; 2009, and Lucangeli & Cornoldi; 1997, stating that substantially metacognition skills are divided into four components, namely: (1) prediction skill, (2) planning skills, (3) monitoring skills, and (4) evaluation skills. Metacognition skills have a role in mathematical problem-solving activities.

Between cognitive and metacognitive skills, though related but different. The cognitive skills required to carry out the task, while the metacognitive skills necessary to understand how the task was executed (Rivers, 2001 and Schraw, 1998 in Anathime, 2009). Coutinho (2007) states that students who have good metacognitive skills will show good learning performance is also compared with the students who have low metacognitive skills. Learners who use metacognition skills, have a better performance than students who do not use metacognition their skills. This is due to the metacognitive skills enable learners to do the planning, to follow developments and monitor the learning process.

Metacognition skills will help a person regulate the process and results of thinking before, after, and while the process of problem solving that help a person solve the problem well and get results right problem solving. Yong & Kiong, 2006;

TABLE 4: RELATION BETWEEN PHASE SOLVE MATHEMATICAL PROBLEMS WITH METACOGNITION SKILLS INVOLVED

Phase Mathematics Problem Solving	*Aspects of Metacognition Skills are Involved*
Phase *understanding the problem*	*prediction skill* *planning skill*
Phase *planningdevise learning*	*prediction skill* *planning skill*
Phase *implementation of the plan*	*monitoring skill*
Phase *feedback*	*evaluation skill*

Panoura, 2005; and Gama, in 2004, suggested that a person's success in solving the problem also affected by metacognitive activity. Because the process of problem solving, the interaction between cognitive and metacognitive activities. Cognitive activity is limited in how information is processed to achieve the goal, while metacognitive activity emphasis is on one's awareness of what it does.

Here is presented a link between the phases of solving a mathematical problem with metacognition skills involved for each phase.

Conclusion

Based on the results of research and discussion concluded that that: (1) the ability of students in mathematical problem solving as involving metacognitive skills better than before involving metacognitive skills, (2) the ability of male students in mathematical problem solving involving metacognitive skills better than female students.

References

Anathime. (2009). *KeterampilanMetakognitif*. [online]. Tersedia: *http://biologyeducationresearch.blogspot.com/2009/12/keterampilan-metakognitif.html*

Anderson, O. W. & Krathwohl, D. R. (2001). *A Taxonomy For Learning, Teaching, and Assessing (A Revision of Bloom's Taxonomy of Educational Objectives*). New York: Addision Wesley Longman, Inc.

Coutinho, A. S. (2007). Educate~ Vol. 7, No.1, 2007, pp. 39-47. (Online). *The Relati onship Between Goals, Metacognition, And Academic Success*. Tersedia pada: *http://www.educatejournal.org/.*

Depdiknas. (2003). *Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional*. Jakarta: Depdiknas RI.

Depdiknas. (2008). *PermendiknasNo. 22 Tahun 2006 tentang Tujuan Pembelajaran Matematika.* Jakarta: Depdiknas.

Desoete, A. (2001). *Off-LineMetacognitionin Children with Mathematics Learning Disabilities. Faculteit Psychologiesen Pedagogische Wetenschappen*. Universiteit-Gent. *http://tip.psychology.org/meta.html*

Flavell, J. H., (1976). *Metacognitive aspects of problem solving*. In L. B. Resnick (Ed.), *The nature of intelligence*. Hillsdale, NJ: Erlbaum. *http://tip.psychology.org/meta.html.*

Gama, C. (2004). *Integrating Metacognition In structionin Interactive Learning Environments.* Submitted for thedegree of D. Phil. *http://www.dcc.utba.br/~clauding/thesis/index_Gama.pdf.*

Kamid. (2013). *Metakognisi Siswa dalam Menyelesaikan Soal Matematika.* Jambi: Universitas Jambi.

Lucangeli, D., & Cornoldi, C. (1997). *Mathematics and metacognition: What is thenature of the relationship*? Mathematical Cognition, 2, 121–139.*https://books.google.co.id/books?id.*

Mulbar,Usman. (2014). *Metakognisi Siswa dalam Pembelajaran Matematika Realistik.* Makassar: Universitas Negeri Makassar.

Nur, Muhammad., Retno Prima., Bambang Sugiarto. (1999). *Teori Belajar*. Surabaya: University Press.

Panaoura, Areti, and Philippou, George. (2005). *Young Pupils´ Metacognitive Abilities in Mathematics in Relation to Working Memory and Processing Efficiency***.** University of Cyprus, Cyprus.

Polya, G. (1973). *How To Solve It* (2nd Ed). Princeton: Princeton University Press.

Ridwan. (2012). *Skala Pengukuran Variabel-Variabel Penelitian.* Bandung: Alfabeta.

Schoenfeld, A. (1992). *Hand Book of Researh on Mathematics Teaching and Learning*, Mc Millan Co.New York.

Suherman, E. *et al.* (2003). *Strategi Pembelajaran MatematikaKontemporer.* Bandung: JICA.

Tobias, S. & Everson, H.T. (1998). *Research on theAssessment of MetacognitiveKnowledge Monitoring*. San Diego: American Educational Research. *http://www.fordham.edu/gse/faculty/tobias/SSSR.html*

Wall, K.& Hall, E. (2009). *Developing New Understandings of Learning to Learn*. *Research Matters* (33): 3-14.

Yong, H.T.Y. & Kiong, L.N.K. (2006). *Metacognitive Aspect of Mathematics Problem Solving*, MARA University of Technology Malaysia. Kuala Lumpur.