# RELATION OF META-COGNITIVE SKILLS WITH ROUTINE AND NON-ROUTINE MATHEMATICAL PROBLEM SOLVING SKILLS OF THE STUDENTS OF MALDA DISTRICT

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## ABSTRACT:

*The main purpose of mathematics learning is acquiring the skill of mathematical problem solving. More the capacity of solving mathematical problem a student has more he has the mathematical learning. Problem solving power of the students has received a considerable attention not only by the students but also by the parents, by the teachers and at last by the nation itself. The scientific and technological development of a nation depends upon the persons with high capacity of mathematical problem solving powers. These problems have been classified in two categories, one is routine problem and the other is non-routine problem. The routine problems are those which are usually contained in text books and which can be solved by learning the particular technique to solve the problems. On the contrary non-routine problems are those which are not usually contained in textbooks and which has no particular method of solving and it cannot be learnt to solve those problems from anyone. Both these types of problem needs higher order thinking skill like meta-cognitive skill. The present study intends to find how far the meta-cognitive skill is related with solving of routine mathematical problems and non-routine mathematical problems. For this purpose a sample of 226 students of class IX were taken from two randomly selected secondary schools of Malda district by cluster sampling out of which 107 were male and 119 were female students. Their meta-cognitive skill were measured by the Meta-cognitive Skill Scale as developed and standardized by Gupta and Suman (2016) the test retest reliability coefficient being 0.763 and split half reliability coefficient being 0.949. The routine problem solving skill is measured by a test as developed by the researcher himself and non-routine problem solving skill is measured by instrument developed by the researcher. The study shows that the correlation coefficient between meta-cognitive skill score and routine problem solving skill is 0.53956, that for the male students is 0.407957 and for the female students is 0.651593. The significance of the correlation coefficients are tested by t test and it is seen that the correlation coefficients are significant at 1% level of significance. Similarly the correlation coefficient between meta-cognitive skill score and non-routine problem solving skill is 0.632073, that for the male students is 0.455488 and for the female students is 0.790668. The significance of the correlation coefficient is tested by t test and it is seen that the correlation coefficients are significant at 1% level of significance.*

*Keywords:* *Meta-cognitive skill, Routine problem, Non-routine problem.*

## INTRODUCTION:

The term meta-cognition was introduced by Flavell in 1976 and it has been attracting much attention of the cognitive psychologists and mathematics teacher educators day by day. It is one of the important higher orders thinking skill as described in revised Bloom's taxonomy. It is a crucial aspect of problem solving ability and there is no doubt about the importance of meta-cognition in problem solving. On the other hand mathematics learning is actually acquiring the power of mathematical problem solving. A student having high capacity of mathematical problem solving is considered as the highly learned in mathematics. Every parents, teachers, students and overall the nation have the demand of the students having high capacity of problem solving power. The importance of problem solving power is recognized by the national as well as international level, because the modern scientific and technological development is impossible without the mathematical problem solving capacity. It is one of the important cognitive activities of the modern day world. There are two types of mathematical problems. One is routine problems which has particular technique of solving and one can solve easily by learning that technique of problem solving from teacher or any other person and the other is non-routine problems which has no particular method of solving and one cannot solve this types of problem by merely learning the method of solving from others. Previous studies show that the meta-cognitive skill plays an important role in mathematical problem solving. The success or failure of a student in life mainly depends upon the meta-cognitive skill of the students. Particularly the students who want to take mathematics as his career must have meta-cognitive skill, otherwise failure is inevitable. The present study aims at finding the relation, if there is any, between the meta-cognitive skill and the routine problem solving skill as well the relation between the meta-cognitive skill and the non-routine problem solving skill.

## OBJECTIVES:

The main objectives of the study are as the followings:

1. To study whether there is any correlation between the meta-cognitive skill and the routine problem solving skill of the students.
2. To study whether there is any correlation between the meta-cognitive skill and the non-routine problem solving skill of the students.
3. To study whether there is any correlation between the meta-cognitive skill and the routine problem solving skill of the male students only.
4. To study whether there is any correlation between the meta-cognitive skill and the routine problem solving skill of the female students only.

5. To study whether there is any correlation between the meta-cognitive skill and the non-routine problem solving skill of the male students only.

6. To study whether there is any correlation between the meta-cognitive skill and the non-routine problem solving skill of the female students only.

## HYPOTHESES:

The following hypotheses are made:

$H_{01}$ : There is no correlation between the meta-cognitive skill and the routine problem solving skill of the students.

$H_{02}$ : There is no correlation between the meta-cognitive skill and the non-routine problem solving skill of the students.

$H_{03}$ : There is no correlation between the meta-cognitive skill and the routine problem solving skill of the male students only.

$H_{04}$ : There is no correlation between the meta-cognitive skill and the routine problem solving skill of the female students only.

$H_{05}$ : There is no correlation between the meta-cognitive skill and the non-routine problem solving skill of the male students only.

$H_{06}$ : There is no correlation between the meta-cognitive skill and the non-routine problem solving skill of the female students only.

## METHODOLOGY:

The methodology used in this study is descriptive survey correlational study. For this study a sample of 226 students was taken from two randomly selected secondary schools of Malda district. The sampling method followed in the study is cluster sampling. The sample consists of 107 male and 119 female students. The meta-cognitive skills of the students are measured by the Meta-cognitive Skill Scale as developed and standardized by Gupta and Suman (2016). Routine problem solving skill is measured by the test developed by the researcher himself and the non-routine problem solving skill is measured by the instrument developed by the researcher. The Pearson's coefficient of correlation between the meta-cognitive skill and routine problem solving skill is found out and it the significance of the correlation is tested by t- test. Similarly the Pearson's coefficient of correlation between the meta-cognitive skill and the non-routine problem solving skill is found out and the significance of the correlation is tested by t- test. Similarly, the Pearson's coefficient of correlation between the meta-cognitive skill

and the routine problem solving skill and non-routine problem solving skill of the male and female students are calculated separately and the significance of the correlation is tested by t- test.

**Population:**

All the students of Malda district comprises the population of this study.
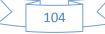
**Sample:**

For this study a sample of 226 students is taken from two randomly selected secondary schools of Malda district. The method of the sampling followed in this study is cluster sampling. The sample consists of 107 male and 119 female students.

**Tools:**

The meta-cognitive skills of the students are measured by the Meta-cognitive Skill Scale as developed and standardized by Gupta and Suman (2016). The test-retest reliability of the scale is 0.763 and the reliability measured by split-half method is 0.949. The scale consists of 42 items. There is no negative statement in the items. The respondents have five alternatives for each item, strongly agree, agree, undecided, disagree and strongly disagree. The scores for these five alternatives are respectively 5, 4, 3, 2, 1. The total score obtained by the respondent gives the measure of the meta-cognitive skill. The routine problem solving skill of the students are measured by the test developed by the researcher himself. It consists of 20 items each carrying maximum 5 marks. The non-routine problem solving skill is measured by the instrument developed by the researcher. This instrument consists of four non-routine problems.

## RESULT AND DISCUSSION:

The study shows that the mean meta-cognitive skill score of all the students is 144.2212 with S.D 30.9581, but that of the male students is 143.4019 with S.D 30.95793 and that of the female students is 144.958 with S.D 31.07056. The mean routine problem solving skill score of all students taken together is 50.53982 with S.D 20.11656, but that of the male students is 48.66355 with S.D 19.50469 and that of the female students is 52.22689 with S.D 20.58691. Similarly, the mean non-routine problem solving skill score of all students taken together is 15.29646 with S.D 6.005604, but that of the male students is 15.62617 with S.D 5.929656 and that of the female students is 15 with S.D 6.082763.

**Table 1: Showing mean and S.D of the meta-cognitive skill score, routine problem solving skill score and non-routine problem solving skill score.**

| Groups | Mean | S.D |
|---|---|---|
| Meta-cognitive skill score of all students | 144.2212 | 30.9581 |
| Meta-cognitive skill score of all male students | 143.4019 | 30.95793 |
| Meta-cognitive skill score of  female students | 144.958 | 31.07056 |
| Routine problem solving skill score of all students | 50.53982 | 20.11656 |
| Routine problem solving skill score of male students | 48.66355 | 19.50469 |
| Routine problem solving skill score of female students | 52.22689 | 20.58691 |
| Non-routine problem solving skill score of all students | 15.29646 | 6.005604 |
| Non-routine problem solving skill score of male students | 15.62617 | 5.929656 |
| Non-routine problem solving skill score of female students | 15 | 6.082763 |

The Pearson's coefficient of correlation between the meta-cognitive skill score and the routine problem solving skill score is calculated and it is 0.53956. That is the meta-cognitive skill and the routine problem solving skill have medium correlation. The significance of the coefficient of correlation is tested by t-test.  t value for testing the significance of the coefficient of correlation between  the meta-cognitive skill score and the routine problem solving skill score is 9.591336 and the degree of freedom is 224. The critical value of t for 224 degree of freedom at 1% of level of significance is 2.597955**.** That is, t = 9.591336 > 2.597955 (the critical value) and so $H_{01}$ is rejected at 1% level of significance. That is, the coefficient of correlation is significant at 1% level of significance. Similarly, Pearson's coefficient of correlation between the meta-cognitive skill score and the non-routine problem solving skill score of all students is 0.632073. The t value for the significance of correlation coefficient is t = 12.20789 > 2.597955 (the critical value of t at 1 % level of significance and 224 degree of freedom). So, $H_{02}$ is rejected at 1 % level of significance. Pearson's coefficient of correlation between the meta-cognitive skill score and the routine problem solving skill score of the male students is 0.407957. The t value for the significance of correlation coefficient is t = 4.578653 > 2.6235 (the critical value of t at 1 % level of significance and 105 degree of freedom). So, $H_{03}$ is also rejected at 1 % level of significance. Pearson's coefficient of correlation between the meta-cognitive skill score and the non-routine problem solving skill score of the male students is 0.455488.The t value for the significance of correlation coefficient is t = 5.242806 > 2.6235 ( the critical value of t at 1 % level of significance and 105 degree of freedom). So, $H_{04}$ is rejected at 1 % level of significance. Pearson's coefficient of correlation between the meta-cognitive skill score and the routine problem solving skill score of the female students is 0.651593 and Pearson's coefficient of correlation between the meta-cognitive skill score and the non-routine problem solving skill score of the female students is 0.790668.

Significance of both these coefficient of correlations are tested by t test and $H_{05}$ and $H_{06}$ are both rejected at 1 % level of significance. That is, both the coefficients of correlation are significant at 1 % level of significance.

## CONCLUSION:

The result of the study shows that the meta-cognitive skill has medium positive correlation with the routine problem solving skill and non-routine problem solving skill of all the students, of male students and of female students. But the meta-cognitive skill has high positive correlation with the non-routine problem solving skill of the female students. Also the significance of the correlation is tested by t test and it is seen that all the correlations as stated above are significant at 1% level of significance.

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