

# A STUDY OF MATHEMATICS ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN RELATION TO METACOGNITIVE AWARENESS, GENDER AND TYPE OF SCHOOL.

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*Excelling in mathematics needs a deeper, creative and critical thinking skill and metacognitive awareness can play an important role in meaningful learning and for improving the academic excellence in Mathematics. In this light, this study investigated the mathematics achievement in relation to metacognitive awareness and gender and type of school. The sample constituted of 200 randomly students studying in IX grade both boys and girls from CBSE as well as PSEB schools of Kapurthala district. Descriptive survey method of investigation was employed in this study. The data on the study variables has been collected with the help of standardized questionnaires. The findings of the study revealed that there exists significant difference in mathematics achievement of students with respect to metacognition. There exists no significant difference in the mathematics achievement of boys and girls. There exists no significant difference in the mathematics achievement of CBSE and PSEB students. There exists significant difference in metacognitive awareness of boys and girls. There exists significant difference in metacognitive awareness of CBSE and PSEB students.*

**Keywords:** Metacognitive awareness, Mathematics achievement, Gender, School board.

## Introduction

Education is very important for the progress of an individual and society. It is through education that man develops his thinking, reasoning, problem solving ability, intelligence, aptitude, positive statements, good values and attitudes. The aim of education is to make more skilled and lifelong learners. It is possible only if we are capable of doing any task or solving any problem with precision and accuracy. Generally, we do things but we do not bother how we do it or how we can do it more systematically. But the fact is that if we pay attention to our way of thinking, it can help in improving achievement levels. The awareness of one's thinking and the strategies is known as metacognition. It enables students to be more mindful of what they are doing, and why, and of how the skills they are learning might be used differently in different situations. The term metacognition was first introduced by Flavell in 1976 to refer to the individual's own awareness and consideration of his or her cognitive processes and strategies. Flavell (1979) describes three kinds of metacognitive knowledge i.e. awareness of

knowledge, awareness of thinking and awareness of thinking strategies. Hofstadter (1980) considered metacognition as a process by which one jumps out of the system to observe the system. Metacognitive ability is knowledge concerning one's own cognitive process and product. Garner (1987) stated that metacognition is the process of thinking about one's learning and thinking styles. Metacognition is a powerful tool for thinking which involves awareness, understanding and interpreting the world around individual (Anderson, Nielsen, & Nashon, 2009). In nutshell, metacognition can be defined as thinking about one's learning and thinking processes, and unifying these thoughts with acquired experiences.

The issue of metacognitive awareness and its influence on mathematics achievement are considered as an important aspect of effective learning. Nowadays, low achievement in mathematics is the major issue in the field of mathematics education. The somehow cognitive domain is considered to be responsible to be successful in mathematics education. Higher-order cognitive processes are involved in the study of Mathematics like reasoning, questioning, analysis, logical thinking. Metacognitive awareness helps in this area. With metacognitive awareness individuals can better judge how they can accomplish the tasks more systematically and how to plan and monitor the activities towards the achievement of goals. Since previous studies have shown that students, who have high levels of metacognitive awareness, perform better achievement levels than other students (Garner & Alexander, 1989; Maghsudi & Talebi, 2009; Martini & Shore, 2008; Pressley & Ghalata1989). Hence the present study investigates the influence of metacognition on mathematics achievement of students.

## Review of Literature

A detail review of literature has been done on the study variables. The detail is as follows:

**Al Shabibi & Alkharusi (2018)** found that there was no significant difference in the metacognitive skills between male and female students but statistically significant difference in Mathematical problem solving was found with respect to gender.

**Hassan & Rahman (2017)** conducted a study in order to find relation between metacognitive awareness and mathematics achievement. Positive significant relationship between metacognitive awareness and mathematics achievement was found.

**Misu & Masi (2017)** conducted a study in order to see the significant difference between metacognitive awareness of male and female students. No significant difference between metacognitive awareness of male and female students was observed.

## Chandrasekars (2016)

Positive relationship between metacognitive ability and academic achievement of learners in mathematics was found. There was no difference in the metacognitive ability with respect to gender. No significant difference was found in the metacognitive ability of students from rural and urban area.

**Jaleel & Premchandaran (2016)**

The study was conducted to see the significant difference in metacognitive awareness of students with respect to gender, locality. No significant difference in the metacognitive awareness of boys and girls, students from rural and urban area and students from government and private school were found to have similar cognitive abilities.

**Kumar (2014)**

The study was conducted to find the significant difference in the metacognitive awareness of B.Ed. students with respect to gender and locale. Significant difference in the metacognitive awareness of boys and girls was found. No significant difference in metacognitive awareness of students from rural and urban area was found.

**Annaraja & Sheeja (2012)**

The study was conducted to find the significant difference in metacognitive awareness of students with respect to gender and locality and type of college. Significant difference were found in the metacognitive awareness of boys and girls, rural & urban students .

**Ozsoy (2011)**

The study was conducted in order to see the metacognitive knowledge and skills with respect to mathematics achievement. Significant and positive relationship between metacognition and mathematics achievement was found.

**Liliana & Lavinia (2011)**

The study was conducted to see the metacognitive skills with respect to gender. Significant difference in metacognitive skills of boys and girls was found.

**Zakaria, Yazid & Ahmad (2009)**

The study was conducted to see the relationship between metacognitive awareness and achievement in mathematics problem solving with respect to gender. Significant difference in the dimensions of metacognition with respect to gender and discipline of the study was found.

To sum up, studies with respect to metacognition stressed that students with metacognitive abilities were having high achievement in mathematics (Ozsoi, 2011; Chandrasekars, 2016; Hidayat, Zulnaidi and Syed Zamri 2018). There was significant relationship between metacognitive awareness and mathematics achievement (Baltaci, Yildiz & Ozcakilir 2016; Hassan & Rahman, 2017). There was no significant difference in achievement in Mathematics with respect to gender (Ma & Xu. 2004; Arhin, & Offoe, 2015 and Li, Zhang, Liu & Hao 2017).

## Delimitations of the study

The present study was delimited to 200 (IX th class) secondary school students (114 boys and 86 girls) belonging to CBSE and PSEB of Kapurthala district only.

## Objectives of the study

The objectives of the present study are-

1. To study the difference in mathematics achievement and metacognition awareness of students with respect to gender.
2. To study significant difference in mathematics achievement and metacognition awareness of students with respect to type of school.
3. To study the difference in mathematics achievement of students with respect to metacognitive awareness.

## Hypotheses

In the present study following hypotheses are framed-

H<sub>01</sub>: There is no significant difference in mathematics achievement of boys and girls.

H<sub>02</sub> : There is no significant difference in metacognitive awareness of boys and girls.

H<sub>03</sub>: There is no the significant difference in mathematics achievement of CBSE and PSEB students.

H<sub>04</sub> : There is no significant difference in metacognitive awareness of CBSE and PSEB students.

H<sub>05</sub> : There is no significant difference in mathematics achievement of students with respect to low, average and high level of metacognitive awareness.

## Methodology

### Variables

Independent variable: Metacognition

Dependent variable: Mathematics achievement

### Design of the study

Descriptive research design was employed in this study. This study was descriptive in the sense that it aims at describing the nature and distributions of variables under study i.e. achievement in mathematics and metacognitive awareness. The survey research is one of the most important areas of measurement in applied social research.

## Sample

Total sample of 200 secondary school students, both boys and girls from CBSE and PSEB Kapurthala district were randomly selected.

**Table 1- Distribution of sample**

Boys	Girls	Total Students
114	86	200
CBSE students	PSEB students	Total
75	125	200

## Research tool used

Mathematics achievement of the students was measured by the Achievement in Mathematics scale by Singh & Kumar (2009). There are 58 questions in this scale. Metacognitive awareness was measured by Metacognitive Awareness Inventory (MAI) by Schraw & Dennison(1994).The Metacognitive awareness inventory consisted of 52 statements. All statements are categorized into two dimensions, knowledge about cognition and regulation of cognition. Knowledge of cognition consists of 17 statements and regulation of cognition has 35 statements. By test-retest method, the reliability coefficient was calculated as 0.87.

## Data Collection Procedure

Both the scales Achievement in Mathematics scale and Metacognitive Awareness Inventory was administered on all the 200 participants of Kapurthala district. Instructions were read to all the participants. Rapport was established with the participants. They were encouraged to give true and correct responses. Data collection was done and answer sheets were retrieved from the students.

## Statistical Techniques Used

In order to see the significant difference in achievement of students in Mathematics with respect to metacognitive awareness, ANOVA was used. T-test was used to find the significant difference in achievement of students in Mathematics with respect to gender and type of school.Ch-square was used to find the significant difference in metacognitive awareness with respect to gender and type of school.

## Analysis and Interpretation of data

### Hypothesis-1

**H<sub>01</sub>: There is no significant difference in mathematics achievement of boys and girls.**

In order to test this hypothesis, mean and S.D and t-test was used.

**Table 2: Descriptive statistics and t-test for the difference in Achievement in Mathematics in relation to gender**

Gender	N	Mean	Std. Deviation	t- value	df	P
Boys	114	25.3509	7.68861	-1.150	198	.251
Girls	86	26.5814	7.21675			

From table-2 it is inferred that there was no significant difference in achievement boys and girls in Mathematics. As t-value was found to be -1.150 with  $p$ -value= .251, which was not significant at .05 level of significance. Therefore, hypothesis that 'There is no significant difference in mathematics achievement of boys and girls stands accepted.

### Hypothesis-2

**H<sub>02</sub>: There is no the significant difference in the mathematics achievement of CBSE and PSEB students.**

In order to test this hypothesis, mean and S.D and t-test was used.

**Table 3: Descriptive statistics and t-test for the difference in mathematics achievement in relation to type of school**

Type of school	N	Mean	Std. Deviation	t value	df	P
CBSE	75	28.0933	9.25199	-1.150	198	.251
PSEB	125	24.5520	5.86055			

From table-3 it is inferred that there was no significant difference in achievement of students in mathematics studying in schools affiliated to CBSE and PSEB. As t-value was found to be -1.150 with  $p$ -value= .251, which was not significant at .05 level of significance. Therefore hypothesis that 'There is no the significant difference in mathematics achievement of CBSE and PSEB students' stands accepted.

### Hypothesis-3

In order to test this hypothesis, mean and S.D and chi-square was used.

**Table 4: Metacognitive awareness of students with respect to gender.**

			Metacognitive awareness			Total	Chi-square value	p
			Low	Average	High			
Gender	Boys	Count	26	50	38	114	9.921	.007
		%	22.8%	43.9%	33.3%	100.0%		
	Girls	Count	10	29	47	86		
		%	11.6%	33.7%	54.7%	100.0%		
Total		Count	36	79	85	200		
		%	18.0%	39.5%	42.5%	100.0%		

From table-4 it is inferred that there was significant difference in metacognitive awareness of boys and girls studying in secondary schools. As chi-square-value was found to be 9.921 with  $p$ -value= .007, which was significant at .05 level of significance. Therefore hypothesis that 'There is no significant difference in metacognitive awareness with respect to gender' stands rejected.

### Hypothesis-4

**H4: 'There is no significant difference in the metacognitive awareness with respect type of school'.**

In order to test this hypothesis, mean and S.D and chi-square was used.

**Table 5: Metacognitive awareness of students with respect to type of school**

			Metacognitive awareness			Total	Chi-square value	p
			Low	Average	High			
Board	CBSE	Count	19	33	23	75	8.154	.017
		%	25.3%	44.0%	30.7%	100.0%		
	PSEB	Count	17	46	62	125		
		%	13.6%	36.8%	49.6%	100.0%		
Total		Count	36	79	85	200		
		%	18.0%	39.5%	42.5%	100.0%		

From table-5 it is inferred that there was significant difference in metacognitive awareness of students studying in schools affiliated to CBSE and PSEB. As chi-square-value was found to be 8.154 with  $p$ -value= .017, which was significant at .05 level of significance. Therefore hypothesis that ‘There is no significant difference in metacognitive awareness with respect to type of school’ stands rejected.

### Hypothesis-5

**H<sub>05</sub> : There is no significant difference in mathematics achievement of students with respect to low, average and high level of metacognitive awareness.**

In order to test this hypothesis, mean and S.D and F-test was used.

**Table 6: Descriptive statistics and One way ANOVA for the difference in Achievement in Mathematics in relation to metacognition**

Metacognitive awareness	N	Mean	Std. Deviation	F	P
Low	36	15.66	11.72	46.670	.000
Average	79	24.54	9.35		
High	85	31.65	5.52		

From table-6 it is inferred that there was significant difference in achievement of students in mathematics with respect to low, average and high level of metacognitive awareness. As F-value was found to be 46.67 with  $p$ -value= .00, which was significant at .05 level of significance. Therefore hypothesis that ‘There is no significant difference in mathematics achievement of students with respect to low, average and high level of metacognitive awareness’ stands rejected.

### Major findings of the study

- There was significant difference in the achievement of students in mathematics with respect to metacognitive awareness.
- There was no significant difference in the mathematics achievement of boys and girls.
- There was no significant difference in the mathematics achievement of students studying in schools affiliated to CBSE and PSEB.
- There was significant difference in metacognitive awareness of boys and girls.



- There was significant difference in the metacognitive awareness of students studying in schools affiliated to CBSE and PSEB.

## Conclusions

The findings of the study have several educational implications, especially in secondary school context. Findings indicated that significant influence of metacognitive awareness was observed on mathematics achievement of secondary school students which means metacognitive awareness play significant role in improving the mathematics achievement of secondary school students. No significant difference in mathematics achievement of boys and girls was found. There was no significant difference in mathematics achievement of CBSE and PSEB schools. There was significant difference in metacognitive awareness of boys and girls. There was significant difference in metacognitive awareness of CBSE and PSEB students. The current research revealed that metacognitive awareness should be developed more so that achievement in mathematics can be improved. Hence, an educational course is recommended in order to strengthen metacognitive strategies. Besides, different activities like seminars, workshops should be organized in schools which can further enhance metacognition level of students.

## Suggestions for further study

The suggestions for the further studies have been given below:

1. The present study was conducted on IX class students, a study may be replicated on students at other level of education .
2. The study can be conducted in relation to other variables like learning styles, attitude towards mathematics, cooperative learning etc.
3. The interaction effect of two independent variables on dependent variable may also be studied.

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