



## ACADEMIC PERFORMANCE IN RELATION TO METACOGNITIVE SKILLS OF SENIOR SECONDARY SCIENCE STUDENTS

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### ABSTRACT

The present study examined the 'academic performance in relation to metacognitive skills of senior secondary science students' To accomplish the study total sample of 400 students were selected at random basis from twenty government and twenty private schools of Haryana state. 'Meta-Cognitive Skills Scale' developed and standardized by Madhu Gupta and Suman (2017) was used to assess the level of Meta-cognitive Skills. Data of academic performance was collected from the result of 12<sup>th</sup> board exam conducted by Board of School Education Haryana. The result of data analysis revealed significant difference of academic performance with respect to school (government and private), gender (male and female) and coaching ( taking coaching & not taking coaching) however, no significant difference were observed with respect to stream (non medical and medical). It may be concluded that type of school, gender and coaching significantly influenced the academic performance, but stream does not influence the academic performance. Private school students, female students and students taking coaching have more academic performance. The result also revealed significant influence of metacognitive skills on academic performance of senior secondary science students and it accounts for 21.00% of the variance in students' academic performance. Thus, enhancing of students Metacognitive skills could contribute in improving academic performance of students.

**Keywords: Metacognitive Skills, Senior Secondary, Science Students**

### INTRODUCTION

In a literal manner, 'meta' means 'self-realization' and 'cognition' means 'mental-action'. It could be termed as a 'process' too. The process of attaining something or understanding something involving one's thoughts, experiences as well his senses. Every day we are involved in metacognitive activities. Metacognition leads us towards becoming successful learners.

Metacognition concerns to knowledge and skills for organizing, guiding and controlling own thinking and learning process. Persons with good metacognitive skills are at the helm of their own learning process, through which they can carry out a learning task more effectively.

Flavell (1979) define metacognitive skills as "Metacognitive skills are strategies applied consciously or automatically during learning, cognitive activity and communication to manipulate cognitive processes before, during or after a cognitive activity." Having well developed metacognitive skills are associated with better and improved learning. While some students develop metacognitive skills their own, some need explicit instructions for this. "Application of metacognitive skills allows one to be aware of one's own beliefs, attitudes and experiences, to relate those internal states to the external environment and events in order to construct meaning



from information, to infer the mental states of others.” Successful students use metacognitive strategies throughout a task and actually start thinking much before they start the task itself.

Academic performance of student is the ability of the student to study and remember the facts and being able to communicate his knowledge orally or in written form in an exam. Academic performance suggests that it is the data, knowledge and skills gained by students through mastery in a subject or course. Academic performance is the assessment of student attainment across different academic subjects. Teachers and academician generally assess students’ academic performance using classroom performance, examination or through standardized tests. Completion of schooling at middle, secondary, senior secondary level or getting diplomas or bachelor's degrees represent academic performance.

Metacognition plays very important role in successful learning and is a strong determinant of academic performance (Dunning, Johnson, Ehrlinger and Kruger, 2003; Kruger and Dunning, 1999). Narang and Saini (2013) examined the effect of metacognition on academic performance of rural secondary students. Results disclosed that most of scholars with top level of metacognition obtained above average marks in their examinations. Findings of the result also revealed that each part of metacognition considerably contributed towards the academic performance of the scholars. Hinghaempanah et al., (2014) was analyzed the combined effect of metacognition and internet addiction on academic achievement through regression analysis and found 16% of academic achievement was determined and influenced by metacognition and internet addiction. Iqbal et al., (2019) studied the metacognitive awareness and educational achievement of medical scholars in various Medical Colleges of Lahore, Pakistan. There was found a big and positive association in all contributors of metacognition score and educational attainment.

In present days of competitive environment, academic performance is the main area of concern for every parent and the students themselves.

## **OBJECTIVES OF THE STUDY**

1. To study the academic performance of senior secondary science students with respect to type of school, gender, stream and coaching
2. To study the metacognitive skills of senior secondary science students.
3. To study the correlation between metacognitive skills and academic performance of senior secondary science students.
4. To what extent does metacognitive skills determines students’ academic performance?

## **HYPOTHESES OF THE STUDY**

1. Significant difference does not exist in academic performance of senior secondary students with respect to type of school.
2. Significant difference does not exist in academic performance of senior secondary students with respect to gender.



3. Significant difference does not exist in academic performance of senior secondary students with respect to stream.
4. Significant difference does not exist in academic performance of senior secondary students with respect to coaching.
5. Significant relationship does not exist between metacognitive skills and academic performance of senior secondary students.
6. Metacognitive skills does not significantly predict students' academic performance.

### **DELIMITATIONS OF THE STUDY**

1. The study was delimited to 12<sup>th</sup> class students of Haryana state only.
2. The study was delimited to a number of 400 students.
3. The study was delimited to science students only.

### **DESIGN AND SAMPLE OF THE STUDY**

Investigator has adopted Descriptive Survey Method for the conduction of the present research as this method is the best suited for the conduction of present investigation. So as to realize the objectives and to check the corresponding hypotheses, data of 400 science students studying in senior secondary schools affiliated to Board of School Education Haryana was selected by employing Multistage Random Sampling Technique.

The first stage was the selection of districts; out of twenty two districts of Haryana, ten were selected randomly. The second stage was the selection of schools; two government and two private schools were selected randomly from the lists of senior secondary schools of concern districts. Next stage was the selection of students; ten students were selected randomly from each selected school so as to make a total sample of 400 students.

### **TOOLS USED**

1. Meta Cognitive Skills Scale developed and standardized by Madhu Gupta and Suman (2017) was used to measure the metacognitive skills of senior secondary students.
2. Academic performance was determined on the basis of marks obtained by senior secondary science students in 12<sup>th</sup> board exam.

### **STATISTICAL TECHNIQUES USED FOR ANALYSIS OF DATA**

The obtained data was processed, analyzed and interpreted by applying the following statistical measures:

1. Descriptive analysis as mean, median and standard deviations
2. t-test technique was employed to find out the significant differences in academic performance
3. Pearson's Product Moment Correlation (r) was calculated to find out the relationship of metacognitive skills with academic performance.

- R Square and Percentage contribution for finding the percentage contribution of metacognitive skills in determining academic performance

## ANALYSIS AND INTERPRETATION

### 1. Study of Academic Performance of senior secondary science students

In order to categorize the academic performance score in different level z score norms was calculated using formula

$$z \text{ Score} = (X - \mu) / S.D$$

X= Raw Score (0 to 500),  $\mu$ = Population Mean (376.22), S.D. = Standard Deviation (58.79)

The calculated z score range are interpreted as:

**Table-1 Norms for Interpretation of the Level of Academic Performance**

Sr. No.	Range of Raw Scores	Range of z-Scores	Grade	Level of Academic Performance
1.	495 & above	+2.01 & above	A	Extremely High
2.	451 -494	+1.26 to +2.00	B	High
3.	406-450	+0.51 to +1.25	C	Above Average
4.	347-405	-0.50 to +0.50	D	Average
5.	303-346	-1.25 to -0.51	E	Below Average
6.	258-302	-2.00 to -1.26	F	Low
7.	257 & below	-2.01 & below	G	Extremely Low

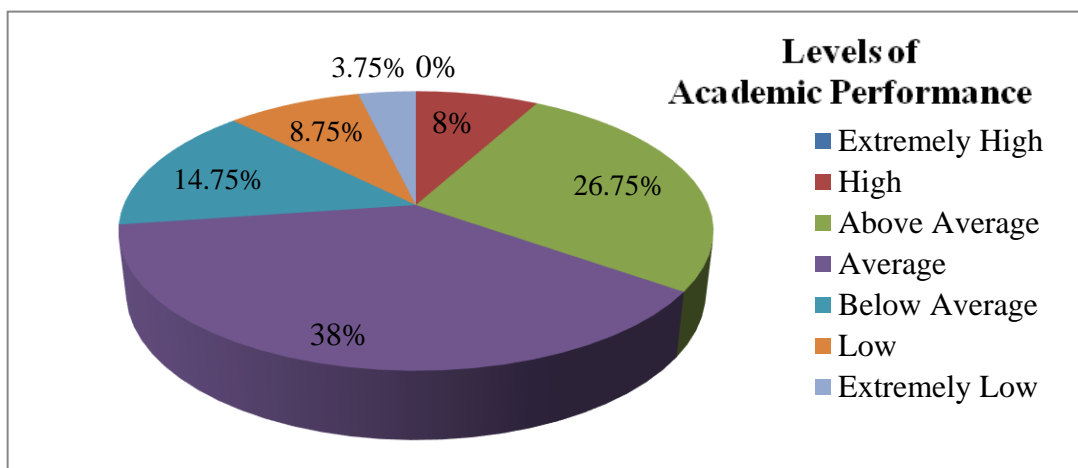
Percentage of students across levels of academic performance based on z score norms is given in table-2:

**Table-2 Percentage Distribution of Students across Levels of Academic Performance**

Academic Performance Scores	Percentage of Score	Level	No. of Students	Percentage of Students
495 & above	99.00% & above	Extremely High	0	0%
451 -494	90.20 - 98.80%	High	32	8%
406-450	81.20 - 90.00%	Above Average	107	26.75%
347-405	69.40 - 81.00%	Average	152	38%
303-346	60.60 - 69.20%	Below Average	59	14.75%
258-302	51.60 - 60.40%	Low	35	8.75%
257 & below	51.40% & below	Extremely Low	15	3.75%

**Total number of students = 400**

Illustration of above table finding in form of pie chart is given in figure 1:



**Figure-1 Percentage distribution of Students across Levels of Academic Performance**

The table-2 and figure-1 depicted the percentage of students with extremely high, high, above average, average, below average, low and extremely low level of academic performance. Out of total 400 students, none of the student scored extremely high (99% and above), 8% students have high (who scores 90.20 - 98.80% of marks), 26.75% students have above average (who scores 81.20 - 90.00% of marks), 38% students have average (who scores 69.40 - 81.00% of marks), 14.75% students have below average (who scores 60.60 - 69.20% of marks), 8.75% students have low (who scores 51.60 - 60.40% of marks) and 3.75% students have extremely low (who scores below 51.40% of marks) level of academic performance. It can be concluded that majority of students have Average, Above Average, Below Average level of academic performance.

**Table-3 Descriptive Statistics of Score of Academic Performance**

Variables	Mean	Median	Mode	Min.	Max.	Range	S.D.	Skewness	Kurtosis
Academic Performance	376.22	385	385	218	494	276	58.79	-0.569	-0.365

**Total number of students = 400**

The table-3 exhibits the descriptive statistics of score of academic performance of senior secondary school students. Values of mean, medium and mode were found to be 376.22, 385 and 385 respectively. Standard deviation was 58.79. Range of the scores was 276. All the three measures of central tendency are close to each other, indicating normal distribution of score. Values of skewness and kurtosis were calculated and these values come out to be -0.569 and -0.365 respectively. Both the values of skewness and kurtosis, comparing to normal values were found negligibly distorted. Hence the distribution is treated as normal. Observation leads to conclusion that academic performance scores of senior secondary students are normally distributed.

**Study the academic performance of senior secondary science students with respect to type of school, gender, stream and coaching**

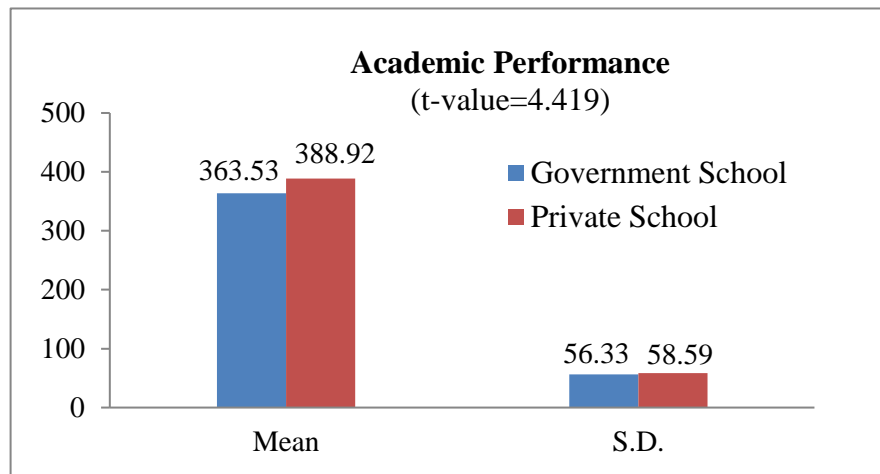
Significance of difference is assessed by employing mean, standard deviation and t-test.

**Table-4 Differences in Academic Performance of Government and Private School Students**

Variable	School	N	Mean	S.D.	p-value	t-value	Level of Significance
Academic Performance	Government	200	363.53	56.33	0.000	4.419	0.05 & 0.01 Significant
	Private	200	388.92	58.59			

**N = 400, df = 398 Significant at both 0.05 and 0.01 level of significance**

Illustration of table-4 finding in form of bar graph is given in figure 2:



**Figure-2 Mean and S.D. values of Academic Performance of Government and Private School Students**

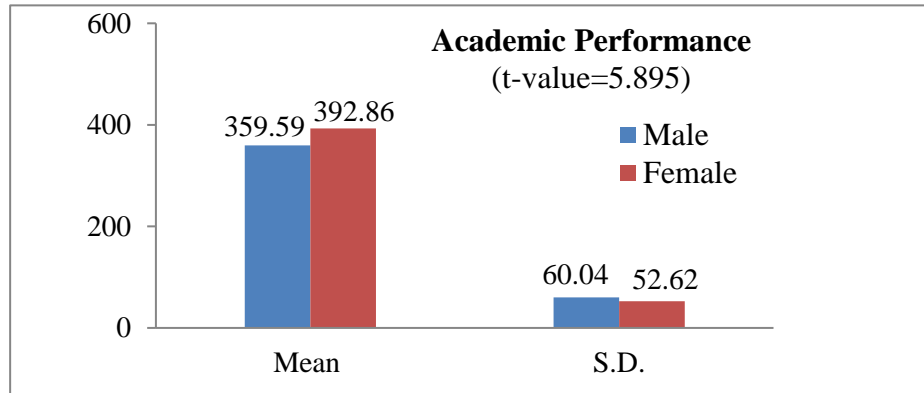
It is revealed from the table-4 and figure-2 that mean scores of academic performance of government and private school students are 363.53 and 388.92 with S.D's 56.33 and 58.59 respectively. The computed t-value for the scores of academic performance of government and private school students is 4.419 and when compared with the table value (df 398), it is found higher than table value at both the level of significance i.e. 0.05 and 0.01, so the t-value is significant at both the level of significance. Therefore null hypothesis 'Significant difference does not exist in academic performance of senior secondary students with respect to type of school' is rejected. So, it is stated that there exists a significant difference in academic performance of government and private school students. Further observation of the table notify that mean score value of private school students is significantly higher than mean score value of government school students, it shows better academic performance of students studying in private school than the students studying in government school.

**Table-5 Differences in Academic Performance of Male and Female Students**

Variable	Gender	N	Mean	S.D.	p-value	t-value	Level of Significance
Academic Performance	Male	200	359.59	60.04	0.000	5.895	0.05 & 0.01 Significant
	Female	200	392.86	52.62			

**N = 400, df = 398      Significant at both 0.05 and 0.01 level of significance**

Illustration of table-5 finding in form of bar graph is given in figure 3:



**Figure-3 Mean and S.D. values of Academic Performance of Male and Female Students**

It is revealed from the table-5 and figure-3 that mean scores of academic performance of male and female students are 359.59 and 392.86 with S.D's 60.04 and 52.62 respectively. The computed t-value for the scores of academic performance of male and female students is 5.895 and when compared with the table value (df 398), it is found higher than table value at both the level of significance i.e. 0.05 and 0.01, so the t-value is significant at both the level of significance. Therefore null hypothesis 'Significant difference does not exist in academic performance of senior secondary students with respect to gender' is rejected. It shows that there exists a significant difference in academic performance of male and female students. Further observation of the table notify that mean score of female students is significantly higher than mean score of male students, it shows better academic performance of female students than male students.

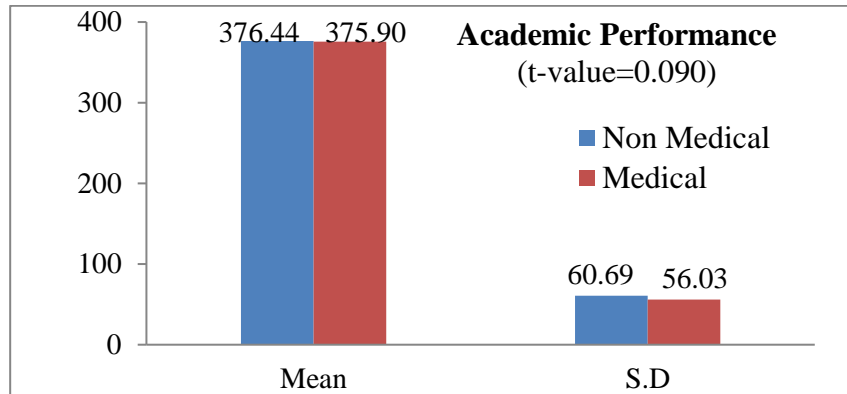
**Table-6 Differences in Academic Performance of Non Medical and Medical students**

Variable	Stream	N	Mean	S.D.	p-value	t-value	Level of Significance
Academic Performance	Non Medical	239	376.44	60.69	0.929	0.090	0.05 & 0.01 Not Significant
	Medical	161	375.90	56.03			

**N = 400, df = 398      Not Significant at both 0.05 and 0.01 level of significance**

Illustration of table-6 finding in form of bar graph is given in figure 4:





**Figure-4 Mean and S.D. values of Academic Performance of Non Medical and Medical Students**

It is revealed from the table-6 and figure-4 that mean scores of academic performance of non medical and medical students are 376.44 and 375.90 with S.D's 60.69 and 56.03 respectively. The computed t-value for the scores of academic performance of non medical and medical students is 0.090 and when compared with the table value (df 398), it is found lesser than table value at both level of significance i.e. 0.05 and 0.01, so the t-value is not significant at both the levels. Therefore null hypothesis 'Significant difference does not exist in academic performance of senior secondary students with respect to stream' is accepted. It shows that there is no significant difference in academic performance of non medical and medical students.

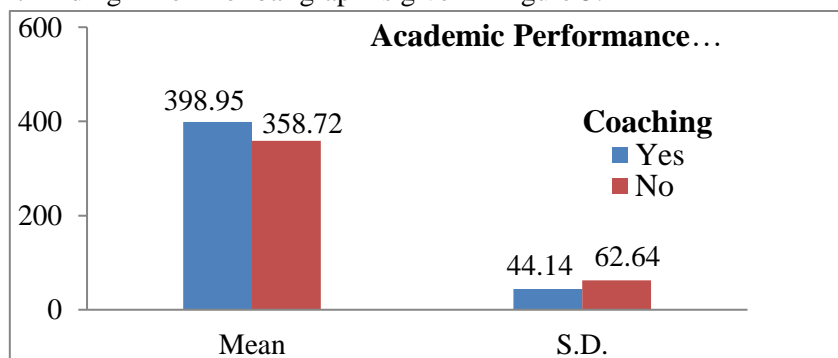
#### Comparison of Academic Performance of Senior Secondary Students with respect to Coaching

**Table-7 Differences in Academic Performance of Students Taking Coaching and Not Taking Coaching**

Variable	Coaching	N	Mean	S.D.	p-value	t-value	Level of Significance
Academic Performance	Yes	174	398.95	44.14	0.000	7.529	0.05 & 0.01 Significant
	No	226	358.72	62.64			

N = 400, df = 398      Significant at both 0.05 and 0.01 level of significance

Illustration of table-7 finding in form of bar graph is given in figure 5:



**Figure-5 Mean and S.D. values of Academic Performance of Students Taking Coaching and Not Taking Coaching**

It is revealed from the table-7 and figure-5 that mean scores of academic performance of students taking coaching and not taking coaching are 398.95 and 358.72 with S.D's 44.14 and 62.64 respectively. The computed



t-value for the scores of academic performance of students taking coaching and not taking coaching is 7.529 and when compared with the table value (df 398), it is found higher than table value at both the level of significance i.e. 0.05 and 0.01, so the t-value is significant at both the level of significance. Therefore null hypothesis ‘Significant difference does not exist in academic performance of senior secondary students with respect to coaching’ is rejected. It shows that there exists a significant difference in academic performance of students taking coaching and not taking coaching. Further observation of the table notify that mean score of students taking coaching is significantly higher than mean score of students not taking coaching, it shows better academic performance of students taking coaching than the students not taking coaching.

### Comparative analysis of Academic Performance with respect to School, Gender, Stream and Coaching

#### Comparison of t-value

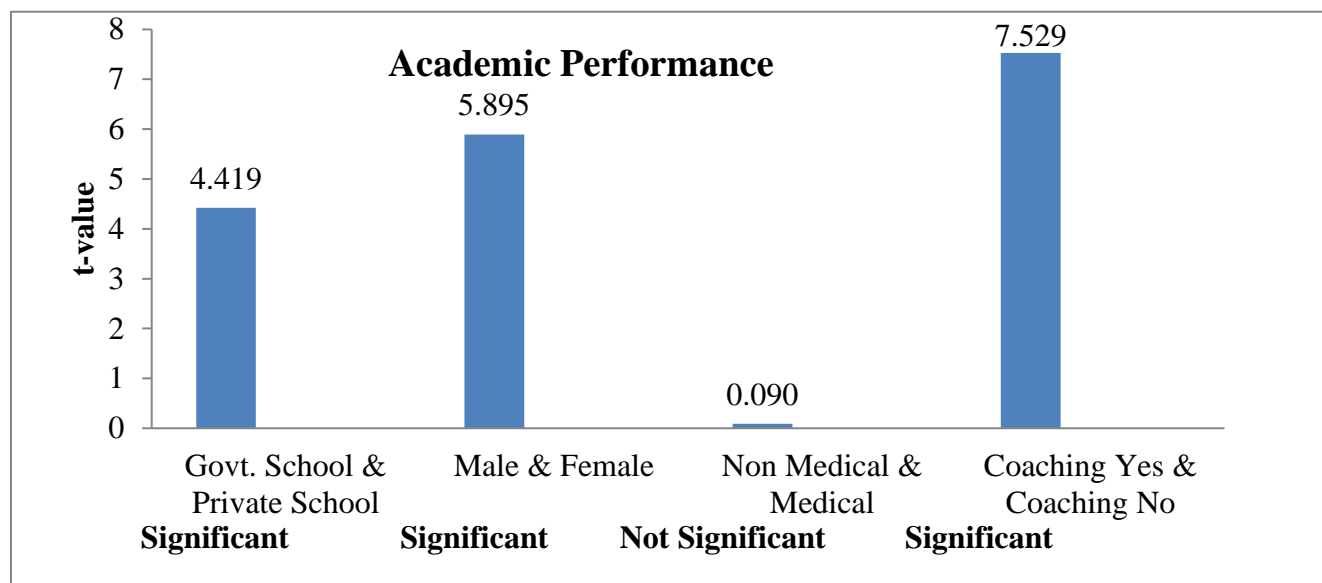


Figure-6 Showing comparison of t-value of Academic Performance with respect to School, Gender, Stream and Coaching

It is illustrated in figure-6 that there is a significant difference in academic performance of senior secondary students with respect to school (government and private), gender (male and female) and coaching (taking coaching and not taking coaching), but there is no significant difference with respect to stream (non medical and medical).

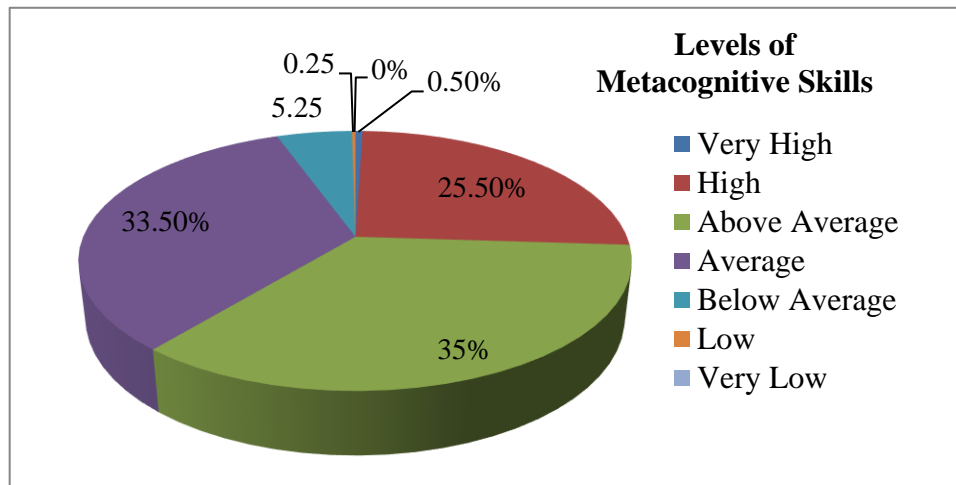
## 2. Study of metacognitive skills of senior secondary science students

**Table-8. Percentage Distribution of Students across Levels of Metacognitive Skills**

Metacognitive Skills Score	Level	No. of Students	Percentage
202 and above	Very High	2	0.50%
183-201	High	102	25.50%
164-182	Above Average	140	35%
138-163	Average	134	33.50%
119-137	Below Average	21	5.25%
100-118	Low	1	0.25%
99 and below	Very Low	0	0%

**Total number of students = 400**

Illustration of table-8 finding in form of pie chart is given in figure 7:



**Figure-7. Percentage distribution of Students across Levels of Metacognitive Skills**

The table-8 and figure-7 depicted the percentage of students with very high, high, above average, average, below average, low, very low level of metacognitive skills of senior secondary students. Out of total 400 students, 0.50% students have very high (who scores 202 and above), 25.50% students have high (who scores 183-201), 35.00% students have above average (who scores 164-182), 33.50% students have average (who scores 138-163), 5.25% students have below average (who scores 119-137), 0.25% students have low (who scores 100-118) and 0% (none of the student) students have very low level of metacognitive skills. It can be concluded that majority of students have Average, Above Average, Below Average level of metacognitive skills

**Table-9 Descriptive Statistics of Score of Metacognitive Skills**

Variables	Mean	Median	Mode	Min.	Max.	Range	S.D.	Skewness	Kurtosis
Meta Cognitive Skills	168.37	170	180	102	205	103	18.34	-0.356	-0.568

**Total number of students = 400**

The table-9 exhibits the descriptive statistics of score of metacognitive skills of senior secondary school students. Values of mean, medium and mode were found to be 168.37, 170 and 180 respectively. Standard deviation was 18.34. Range of the scores was 103. All the three measures of central tendency are close to each other, indicating normal distribution of score. Values of skewness and kurtosis were found -0.356 and -0.568 respectively. Both the values of skewness and kurtosis, comparing to normal values were found negligibly distorted. Hence the distribution can be treated as normal. Observation leads to conclusion that metacognitive skills scores of senior secondary students are normally distributed.

### 3. Study of correlation between metacognitive skills and academic performance of senior secondary science students.

Relationship between metacognitive skills and academic performance is studied by computing the Pearson's Product Moment Coefficient of Correlation (r).

**Table-10 Correlation between Academic Performance and Metacognitive Skills**

Variables	N	Mean	S.D.	Coefficient of Correlation (r)	Level of Significance
Academic Performance	400	376.22	58.79	0.459	0.05 & 0.01 Significant
Metacognitive Skills	400	168.37	18.34		

**N = 400, df = 398    Significant at both 0.05 and 0.01 level of significance**

It is depicted from table-10 that computed value of coefficient of correlation (r) between academic performance and metacognitive skills is 0.459 and is significant at both levels of significance. Therefore null hypothesis 'Significant relationship does not exist between metacognitive skills and academic performance of senior secondary students' is rejected. It shows that academic performance and metacognitive skills have positive and significant relationship with each other, which indicates that increase in metacognitive skills leads to increase in academic performance.

### 4. To what extent does metacognitive skills determines students'academic performance

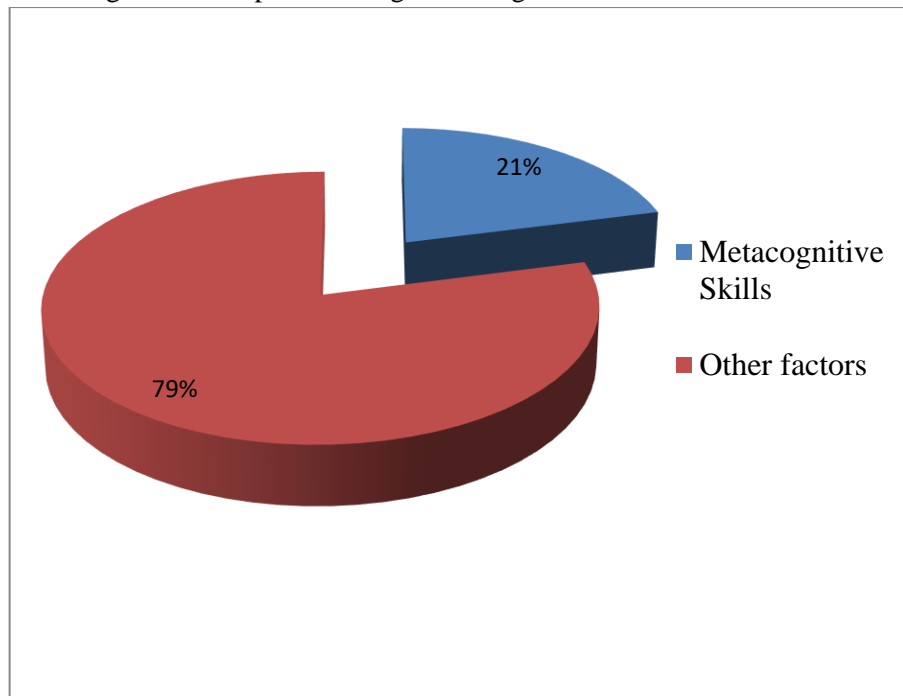
Coefficient of correlation reveals the relationship between variables but does not provide any information regarding direction and magnitude of effect. Value of R and R Square tells about the magnitude of the effect. For the present study scores of academic performance were taken as criterion and scores on metacognitive skills were taken as predictor.

**Table-11 Analysis to study the effect of Metacognitive Skills on Academic Performance**

S. N.	Models	R	R Square	Percentage contribution	F	p value	Level of Significance
1.	Predictors (Constant) Metacognitive Skills	0.459	0.210	21%	105.965	.000	0.05 & 0.01 Significant

It is depicted from the above table-11 that computed value of F for metacognitive skills is 105.965 and is found significant at both levels of significance. It shows that academic performance has a significant and positive regression with metacognitive skills. 0.210 value of coefficient of determination (R Square) indicates that metacognitive skills explain 21% of variability of academic performance that is 21% of academic performance is influenced and determined by metacognitive skills. Therefore null hypothesis 'Metacognitive skills does not significantly predict students' academic performance' is rejected

Illustration of table-11 finding in form of pie chart is given in figure-8:



**Figure-8. Percentage contribution of Metacognitive Skills in determining Academic Performance**



## FINDINGS

- A significant difference in academic performance of government and private school students was found. Academic performance of students studying in private school was found better than the students studying in government school.
- A significant difference in academic performance of male and female students was found. Academic performance of female students was found better than the male students.
- It was found that there is no significant difference in academic performance of non medical and medical students.
- It was found that there is a significant difference in academic performance of students taking coaching and not taking coaching. Academic performance of students taking coaching was found better than the students not taking coaching.
- Significant and positive correlation was found between academic performance and metacognitive skills. This indicated that increase in metacognitive skills leads to increase in academic performance.
- It was found that metacognitive skills are a powerful determinant of academic performance of senior secondary science students. In this study it was also found that 21% of academic performance is influenced and determined by metacognitive skills and it is interpreted that metacognitive skills is the significant predictor of academic performance of senior secondary science students.

## DISCUSSION

In this study a significant difference in academic performance of government and private school students was found. Academic performance of students studying in private school was found better than the students studying in government school. This difference in academic performance of above two types of schools students may be due to more resource input in private schools. More over government school students belongs to poor, uneducated and backward families. Students from poor families are more likely to be employed for livelihood and this leads to poor academic performance. The findings of the present study were in concordance with previous studies. Wangoo and Khan (1991) also reported that the students from public and private schools differ in academic achievement due to their social and economic status. Correlation between socioeconomic status and academic performance was recorded and found significant. Suhane (2012) also reported that the scholars of government schools differ considerably from their private schools in regard to their accomplishment in science. The private school students have higher accomplishment in science as compared to government school students.

In present study a significant difference in academic performance of male and female students was found. Academic performance of female students was found higher than the male students. The female student's high academic performance may be due to sincerity in studies, more time input in studies, hard work and a desire to uplift their social status compared to male students. Nayar and Visweswaran (1966) reported the same finding that there was significant distinction in the achievements of urban male and female students of 10<sup>th</sup> class. Vijayalakshmi and Natesan (1992) reported a significant gender distinction in academic achievement and female students were better in academic achievement as compared to male students. Leeson et al., (2008) and Asthana (2011) observed that female students performed better than male students. Their results indicated that sex play



very important role in the level of academic achievement. Karthigeyan & Nirmala (2012) and Kalaivani (2018) reported higher mean score of female students as compared to the male students in their scholastic achievement.

In current investigation it was found that there is no significant difference in academic performance of non medical and medical students. The no difference in academic performance on the basis of stream (medical or nonmedical) can be explained because stream could not affect the academic performance once it had been preferred by the students or we can say interest of the student in his/her subject influence the academic performance instead of streams. Moreover both non medical and medical streams are discipline of science.

In present study it was found that there is a significant difference in academic performance of students taking coaching and not taking coaching. Academic performance of students taking coaching was found better than the students not taking coaching. Gafoor et al., (2007) reported the similar results that there was an important distinction in achievement in science of students belonging to coaching and non coaching teams. The achievement motivation and achievement in science was improved by receiving private tuition by the low achiever students.

In present study it was found that there is a significant and positive relationship between academic performance and metacognitive skills. It was concluded that metacognitive skills is a powerful determinant of academic performance of senior secondary science students. The similar type of relationship was reported in many studies. Zulkipli (2006) established vital, positive and significant correlation among academic performance and metacognitive awareness among students. Also found significant distinction in metacognitive awareness between boys and girls. Metacognitive awareness and learning strategies has important role in determining academic achievement (Eva, 2012). Findings of his study stated that, metacognitive awareness and some learning strategies favours the achievement of academic success in the particular learning environment. Van der Stel and Veenman (2014) investigated metacognition as a tool for measuring intellectual ability and educational betterment. The finding of their investigation located the existence of significant and meaningful relationship between metacognition, intellectual ability, academic achievement and learning. Wei et al., (2015) found a very big and positive correlation in the two dimensions of metacognition and noticed moderate correlation in knowledge and regulation of metacognition with pupils' academic performance. Iqbal et al., (2019) reported that there was found a big and positive association in all contributors of metacognition score and educational attainment. In current study it was found that there is a significant effect of metacognitive skills on academic performance of senior secondary school students. It was also found that 21% of academic performance is influenced and determined by metacognitive skills and it is interpreted that metacognitive skills is the second most significant predictor of academic performance of senior secondary science students in the present investigation.

## CONCLUSION

The conclusion of the study indicated that academic performance of students studying in private school was found better than the students studying in government school. Academic performance of female students was found higher than the male students. The Academic performance of students taking coaching was found better than the students not taking coaching. But there was no significant difference in academic performance of non



medical and medical students. A significant and positive relationship was recorded between academic performance and metacognitive skills. Metacognition plays an essential role in learning and furthermore in improving the academic performance, so it is important to develop metacognitive skills in students, and for this teachers and parents ought to play their respective roles in developing the metacognitive environment, whether at school or at home. It concluded that metacognitive skills is a determinant of academic performance of senior secondary science students. Teachers need to be aware of students that metacognitive ability in the process of teaching and learning process.

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