

## **EFFECTS OF METACOGNITIVE ABILITY AND SELECTIVE ATTENTION ABILITY ON ACADEMIC PERFORMANCE OF ADOLESCENTS**

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*Key words:* Metacognitive ability, Selective attention ability, Academic performance

### **Abstract**

The present study investigated the effect of metacognitive ability and selective attention on academic achievement; whether selective attention and metacognitive ability influence a student's academic achievement and whether all these three variables vary across gender. Three hundred adolescents were selected conveniently and purposively among which 150 were females and another 150 were males. Participant's metacognitive ability was measured by using a Bangla translated version of Metacognitive Skill Scale (MCT); and selective attention was measured by a Bangla version of the Stroop Color and Word Test (SCWT). Their academic achievement was assessed by their GPA in previous class examination. The results showed that all these variables were significantly correlated with each other. Metacognitive ability and selective attention were the strong predictors of academic achievement. Significant difference in selective attention was also found across gender where females outperformed males. But no significant difference between males and females was found for the metacognitive ability and academic achievement.

### **Introduction**

Selective attention and metacognitive ability are some of the important psychological variables or attributes. Selective attention is the ability to devote one's own attention to the perceived relevant matters and not to the perceived irrelevant matters<sup>(1)</sup>. Another variable of the present study is metacognition which is well known as "knowledge and cognition about cognitive phenomena"<sup>(2)</sup>. Academic achievement is simply known as the performance quality of someone in his/her academic life.

A study showed relation between selective attention and processing of mathematics, language and literacy<sup>(3)</sup>. Deficit in visual selective attention disorder is also found to be related with dyslexia which is a reading disorder<sup>(4-5)</sup>. These findings suggest a link between selective attention and academic achievements.

One's academic achievement can also be significantly influenced by metacognition<sup>(6)</sup> because it is related to academic monitoring<sup>(7)</sup>, helps to develop, maintain, reflect and evaluate a plan of action effectively<sup>(8)</sup> and training on metacognition can improve

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academic performance<sup>(9)</sup>. Many studies showed negative relation between metacognition and academic achievement<sup>(10)</sup> while some studies found no relation between these two variables<sup>(11)</sup>.

Selective attention and metacognition both underlie cognitive activities. When someone uses selective attention strategies successfully they must identify important information, focus extra attention on that information, and perform these two functions effectively<sup>(12)</sup>. To perform these activities they must engage in several different cognitive activities such as assessing the task, evaluate strengths and weaknesses, plan the approach, apply strategies and reflect. These are the phases of metacognition<sup>(13)</sup>. Selective attention ability is impaired in Attention-Deficit/Hyperactivity Disorder (ADHD) patients<sup>(14-15)</sup>. Metacognitive therapy<sup>(16)</sup> can improve the symptoms of these patients<sup>(17)</sup>. So it can be said that any understanding of how the selective attention strategy works must take into account differences in individual's metacognitive ability.

These three variables vary from person to person, age to age, and also vary between genders. Most of the studies using multiple objects found that men are better on their selective attention ability than women<sup>(18-20)</sup>. In the present study a version of stroop task is used to measure this ability. Previous studies using stroop task posited females to perform better than male<sup>(21)</sup>.

There is not any precise or specific research on gender difference in metacognitive ability. But there are some relevant researches that indicate that gender is also a variable on which metacognitive ability may vary<sup>(22-24)</sup>. The gender differences also play an important role in educational achievement<sup>(25-26)</sup>.

Although there are some researches, these studied these three variables separately but there is no study that observed the combine relationship among these three variables which was the core reason that served as prime ground for conduction of the present study. Besides, there are different metacognitive strategies such as, self questioning, PQ4R (Preview, Question, Read, Reflect, Recite and Review, K-W-L (Know-Want to know-Learn). There are also some physical and mental training available for improving selective attention. By incorporating these strategies students can be helpful to follow a wise course of action in the process of learning which may improve their academic achievement. The significance of the present study was to serve as a ground work for the students to motivate them to practice these strategies and also for the teachers and parents to help the students to practice these strategies.

The objectives of the present study were – (a) To determine effects of selective attention and metacognitive ability on academic achievement, (b) To find out the relationship between selective attention ability and metacognitive ability, and (c) To investigate the gender difference in selective attention ability, metacognitive ability and academic achievement.

## Materials and Methods

A cross-sectional survey design was followed to carry out the current research. Three hundred school going adolescents (13 to 16 years of age) participated in the present study. Among them 150 (50%) were male and rest of them (50%) were female students. They were selected conveniently since close to hand adolescents were selected and purposively according to the specific age group (adolescents), and gender (male, female).

Data were collected using following materials:

*Demographic data sheet* : Necessary personal information, included in demographic sheet, were participants' age, gender and previous year academic achievement score which is generally defined as their GPA (grade point average).

*Metacognitive skill scale (MSS)*: The metacognitive ability of the participants was measured using a Bangla translated version of a scale named Metacognitive Skill Scale (MSS)<sup>(27)</sup>. It is a 5-point Likert-type scale, consisting of 30 items. This scale contains 30 items divided into favorable and unfavorable (items: 6, 7, 12, 13, 15, 25, 29) categories. Responses to the favorable items were scored according to the following scale of agreement level: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. Reversed scoring was used for the unfavorable items. For each item, these levels of agreements were presented in five separate boxes. Participants required to put a tick (✓) mark to a particular appropriate box represents the level of agreement with the item. The minimum obtainable score on the scale is 30 and maximum is 150. The higher score indicates the higher metacognitive ability. The original scale explained 35.74% of its total variance and its Cronbach's alpha coefficient reliability was 0.94. In the present study the scale was translated into Bangla by the researchers. Cronbach's coefficient alpha was found 0.97 for the translated version which indicates that the scale has high internal consistency reliability. The inter-item statistics for each item ranged from 0.049 to 0.968. Item-total correlation for all the items (ranged from 0.534 to 0.834) were also found to be acceptable since the exclusion of any item did not increase the level of internal consistency.

*Academic achievement*: Students' academic achievements were recorded in a form of Grade Point Average (GPA) that they obtained in their immediate previous class. For example, if the student is from class IX, his/her GPA (Grade Point Average) that he/she obtained in class VIII was collected.

*Selective attention*: The present measurement of selective attention ability was based on the concept of stroop effect<sup>(28)</sup>. The present study has followed a phase of a previous study<sup>(29)</sup> to measure the selective attention ability. The participants were presented a color verification card consisting of rows of Xs to screen out the color blinded participants. Each of the rows indicated one of the six colors used in the present study (Fig. 1).

If the participants correctly responded the names of the colors of each row, they were given the Bangla version of Word-Color card containing names of colors printed in conflicting color inks. The measurement consisted of three cards (a-c), with 30 stimuli on each card, arranged in three columns of 10 items each (Fi. 2 (a-c)).



Fig. 1. Color verification card.

নীল	লাল	সবুজ
হলুদ	সবুজ	গোলাপী
লাল	হলুদ	সবুজ
বাদামী	নীল	বাদামী
নীল	গোলাপী	নীল
লাল	বাদামী	লাল
গোলাপী	হলুদ	হলুদ
বাদামী	লাল	গোলাপী
সবুজ	নীল	বাদামী
হলুদ	গোলাপী	সবুজ

**a**

বাদামী	গোলাপী	লাল
হলুদ	নীল	গোলাপী
লাল	গোলাপী	বাদামী
গোলাপী	হলুদ	লাল
নীল	লাল	সবুজ
বাদামী	বাদামী	হলুদ
সবুজ	হলুদ	গোলাপী
বাদামী	নীল	সবুজ
লাল	সবুজ	নীল
নীল	হলুদ	সবুজ

**b**

লাল	হলুদ	নীল
নীল	সবুজ	লাল
হলুদ	গোলাপী	সবুজ
সবুজ	লাল	বাদামী
গোলাপী	নীল	হলুদ
হলুদ	বাদামী	লাল
সবুজ	গোলাপী	নীল
গোলাপী	বাদামী	সবুজ
বাদামী	নীল	গোলাপী
লাল	হলুদ	বাদামী

**c**

Fig. 2 (a-c): Bangla version of Word-Color Card.

The stimuli were the names of the six colors (red, blue, green, yellow, pink, brown) used in the study which were written in the contrasting colors. The colors did not appear successively on the cards and there was no relationship between successive stimuli on the card. The task of the participants was to identify the color of the each printed word as soon as possible. The participants were instructed to start from the top of the each column. After finishing identifying the color of the first column, they had to respond to the next column in the same manner without skipping any of the stimuli. The time between participants' response to the first stimuli of the first card to the last stimuli of the third card was recorded in second. The smaller reaction time indicates the greater selective attention ability.

Before conducting research and distributing questionnaire permission of the school authority was taken and participants were also assured about the confidentiality about their responses. After the agreement, demographic information of the participants (name, gender, age, GPA that they obtained in their immediate previous class) was collected from them and their color blindness was verified by the color verification card. Participants, who passed the verification card test, were given Bangla versions of word color card and MSS. Instructions, both written and verbal, were given before each measurement. Participants' response time to the word color cards was regarded as the scoring of selective attention ability. This response time was measured in seconds. The higher the selective attention ability the lower would be their response time. Range of highest and lowest response time was between 115-1050 seconds. After measuring their metacognitive and selective attention ability, they were thanked off. The total time for collecting data from each participant was ranged from 25 to 30 minutes.

### Results and Discussion

The statistical analyses were carried out according to the study objectives: Pearson correlation, multiple regression and t-test. Results of Pearson correlation, multiple regression and t-test are presented in Table 1, 2 and 3 accordingly.

**Table 1. Pearson product-moment correlation coefficient among metacognitive ability, selective attention and academic achievement (N = 300).**

Variables	1	2	3
1. Metacognitive Ability	1		
2. Selective attention	-.470***	1	
3. Academic achievement	.508***	-.474***	1

\*\*\*  $p < 0.001$ .

Table 1, results showed that there is a positive correlation ( $r = .508$ ;  $p < .001$ ) between metacognitive ability and academic achievement which indicates that the higher the metacognitive ability the higher would be the academic performance. Again Table 1 reveals a significant negative correlation ( $r = -.474$ ;  $p < .01$ ) between selective attention and academic performance. This result indicated that smaller the time participants took to respond to the selective attention task the greater their academic performance. As in this study 'the smaller time required to complete the selective attention task' indicated the greater selective attention ability, this finding revealed that the more the students are selectively attentive the greater would be their academic performance. This result goes with that of some previous researches from which a link between these two variables can be assumed<sup>(3-5)</sup>.

In case of selective attention and metacognitive ability, according to Table 1, the result also revealed significant negative correlation ( $r = -.470$ ;  $p < .01$ ) which indicated that the greater the metacognitive ability of the students the smaller the time they needed to respond to the selective attention task. That is, the greater the metacognitive ability the more the students are selectively attentive. Though there is no previous research revealing the direct relation between these two variables, there exist many researches that suggested a connection between metacognitive ability and selective attention<sup>(12-14,17)</sup>. The present findings confirmed these indications by showing significant correlation between these two variables.

**Table 2. Regression of academic achievement on selective attention and metacognitive ability.**

Variables	B	SE B	$\beta$	t
Selective attention	.000	.000	-.301	-5.595**
Metacognition	.004	.001	.367	6.816**

Adjusted  $R^2 = .325$  ( $F_{2, 297} = 72.897$ , \*\* $p < 0.01$ ).

The regression model of Table 2 shows that selective attention and metacognitive ability together explained 32.5% variance in academic achievement. Standardized  $\beta$  values also indicate that an increase of one standard deviation in deficiency of selective attention results in a 0.301 standard deviation decrease in academic achievement and, an increase of one standard deviation in metacognitive ability results in a 0.367 standard deviation increase in academic achievement. These findings are found to be consistent with most of the previous researches<sup>(3-7, 9)</sup>.

**Table 3 Results of t-tests and descriptive statistics of selective attention, metacognitive ability, and academic achievement by gender.**

Variables	Group						95% CI for mean difference	t	df
	Male			Female					
	M	SD	n	M	SD	n			
Selective attention	393.02	304.74	150	468.49	335.26	150	2.67, 148.27	2.04*	298
Metacognitive ability	92.55	32.42	150	94.45	31.91	150	-9.22, 5.40	-.513	298
Academic achievement	4.45	.37	150	4.47	.35	150	-.09, .07	-.235	298

\* $p < .05$ .

Table 3 showed that in case of selective attention, a significant ( $t = 2.04$ ;  $p < .05$ ) gender difference has found indicating females ( $M = 468.49$ ;  $SD = 335.26$ ) are better in this ability than males ( $M = 393.02$ ;  $SD = 304.74$ ). The reason of higher selective attention

ability among females than males may be biological. Other previous studies also attributed biological factors for women's outperformance in tasks of perceptual speed, finger dexterity and verbal fluency than men<sup>(30)</sup>. However, no significant gender difference was found in metacognitive ability ( $t = -0.513$ ;  $p < 0.05$ ) and academic performance ( $t = -0.235$ ;  $p < 0.05$ ). Results regarding metacognitive ability and academic achievement are not consistent with the indication given in the previous literature<sup>(22-26)</sup>. This may be due to cultural variation which suggests further study.

There are some other variables that can also affect the studied variables such as, students' motivation level can have a profound effect on their academic performance<sup>(31)</sup>; metacognition can also be affected by their critical thinking<sup>(32)</sup>; selective attention and problem solving were also found to be correlated<sup>(33)</sup>. So, these variables can serve as mediator variables in explaining the relationships among these variables and among different aspects (age, gender) of each of these variables. Further studies can be conducted exploring other variables that can serve as mediator variables to have a precise understanding of the relationships.

In conclusion, the findings of the present study indicate that selective attention and metacognitive abilities enhancement training program or the proper learning process may be introduced for the betterment of adolescents' academic achievement, regardless sex.

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