



Academic Achievement among Senior Secondary School Students in the Context of Problem Solving Ability & Meta Cognition

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Abstract

“The current study investigated the academic achievement of sr. sec. school students in the context of problem solving ability & meta-cognition. In this investigation, academic achievement was taken as dependent variable and problem solving ability & meta-cognition were taken as independent variables. The current study was descriptive in nature. A sample of 600 sr. sec. school students were chosen by multi-stage random sampling technique. Meta-cognition Scale (2017) by Singh & Bali & Problem Solving Ability Test (2011) by Dubey were applied to gather the data. Mean, SD, t-test & ANOVA were employed to analyze the data. Significant difference was seen in academic achievement of sr. sec. school students on the basis of problem solving ability. Significant difference was also observed in academic achievement of sr. sec. school students on the basis of meta-cognition. Further, significant interaction effect of problem solving ability and meta-cognition was found on academic achievement of sr. sec. school students”.

Keywords: *Academic Achievement, Problem Solving Ability, Meta Cognition, Sr. sec. School Students.*

Introduction

Education plays an important role for an individual's & society's advancement. Education is the greatest legacy that each parent wants to give their children. The advancement of the nation begins from the family members. Proper and good education plays a good part in shaping our professional and future career. Education is the key factor in promoting and sustaining economic growth and technological development. “Education is the most powerful weapon which you can use to change the world” (Nelson Mandela). Education is the deliberate passing on to future generations of society's learned knowledge, abilities, and values. Education helps to shape a person's thinking, aptitude, problem-solving abilities, intelligence, reasoning, positive statements, outstanding values, and attitudes. In this sense, education is a positive process that rescues a

person from darkness, poverty & suffering and guides him toward enlightenment, prosperity, and happiness by fostering an individual's growth in all facets of his life, including his physical, emotional, mental & social development (Sodhi, Suri & Sodhi, 2012).

Academic excellence has constantly been a sign of status & pride in the society. It is the academic achievement of students which also allows them to enter into the competitive fields. As a parent, it's necessary that you should produce a proper space for your kid to flourish and succeed in life. It's for you to explore your child's strengths as well as guide him/her regarding how to improve the talents. It's not required for each kid to attain academic excellence. Success is actually unavoidable in case you get the child the essential assistance to go after their dreams in whichever area they would like,

without instilling the worry of disappointment in them. The concept of excellence and success is usually generalized by parents depending on how others are actually performing. Apart from imparting knowledge, the current educational system aims to educate students how to study, how to arrange their thought processes to solve issues & how to develop competences to meet future difficulties. In the current educational system, a student must be able to learn information, apply knowledge, judge ability, critical reasoning, analytical skills, problem-solving abilities, innovation & creative perception, aptitude for research, quantifiable potential, multidisciplinary expertise, computer literacy, effective communication, soft skills, leadership, teamwork, positive attitudes, and more.

A person's knowledge is controlled by planning, regulating, and altering. The degree to which students are conscious of their own thinking has an impact on their capacity to learn (Jayapraba & Kanmani, 2013). A person with a high level of meta-cognitive awareness has a better learning outcome in general. Meta-cognition means 'thinking about one's own thinking.' Meta-cognition refers to the monitoring as well as consequent regulation of the procedures with respect to the cognition item or maybe information on which they bear, typically in service of several concrete objectives or even goals. Controlling thinking processes and becoming more aware of one's own learning is called meta-cognition. "Meta-cognition is any kind of cognitive transaction with the human or non-human environment, where a variety of information processing activities go on," (Flavell, 1979). In simple words, meta-cognition means 'thinking about one's own thinking.' It refers to the expertise of learners regarding their personal cognition, cognitive functioning & perhaps that of others. Meta-cognition involves two main components: a) **Knowledge about cognition:** It corresponds to what pupils know about themselves, conditions & strategies under which techniques are very helpful. This type of knowledge is of 3 types: declarative, procedural & conditional. These three types of understanding may be regarded as the building blocks of conceptual awareness. b) **Regulation of cognition:** It

refers to the expertise about the manner in which where pupils plan, implement methods, monitors, right comprehension mistakes & assessed their learning. These two components of meta-cognition contribute significantly towards the academic performance of adolescents.

Success depends on being able to solve problems, which is why it's been called the most important part of human conduct. The capacity to solve problems has a significant impact in students' academic success & is often regarded as a crucial skill in contemporary civilizations. One of educational psychology's biggest concerns is improving students' problem-solving skills and is a key demand made on every educational institution. In order to properly handle the challenges they encountered every day, Problem solving ability can be developed among pupils. The ability requires students to use their critical thinking, analytical, creative, & logical reasoning abilities to a challenge that is presented in their everyday lives. According to Gupta, Pasrija, and Kavita (2015) high school students' academic success was significantly impacted by their capacity to solve problems. The process of problem-solving calls for forecasting, fact analysis, and the development of general principles to establish causal relationships in environmental physical events. According to Gagne's suggested hierarchy, which is based on the mastery of the following lower levels of learning, problem solving is the highest level of learning. It entails the use of principles & facts to clarify and resolve novel occurrences or forecast outcomes from previously understood circumstances. In general, we follow a pattern for our everyday activities, therefore carrying out our daily tasks is never a problem. But this isn't always the case; occasionally, we face difficulties that require us to strategize and come up with solutions in order to overcome. Problems arise when there is a barrier in the way of achieving the objective. The process of problem-solving calls for forecasting, fact analysis, and the development of general principles to establish causal relationships in environmental physical events. Problem solving ability is known as the climax of the human abilities. Successful problem-solving skills are critical to a student's overall

personality & their academic success. It is well recognised that pupils who possess strong meta-cognitive abilities excel in problem-solving tasks (Roeyers, Desoete & Berysse, 2001).

In this 21st century, it is important for every individual to possess problem-solving abilities because it relates to all areas of human life (Danju & Uzunboylu, 2016; Haryono et al., 2017). Problem solving occurs when an organism or an artificial intelligence system needs to move from a given state to a desired goal state which is the frame work or pattern within which creative thinking and reasoning takes place. It is the key to success and has been regarded as the most significant aspect of human behavior. With the use of meta-cognitive abilities, a learner can build these competences & talents. It has been noticed that when people are solving problems, they are more controlled, try to break the problem down into manageable pieces & ask themselves questions to help them understand what they are thinking. The secret to success is problem solving, which has been called the most important part of human conduct. Since meta-cognition is a significant and useful way to problem solving, it demonstrates that meta-cognitive teaching strengthens students' abilities to solve issues more effectively because meta-cognitive techniques improve their problem-solving efforts.

Objectives Of The Study

1. To compare the academic achievement of sr. sec. school students on the basis of problem solving ability.
2. To compare the academic achievement of sr. sec. school students on the basis of meta-cognition.
3. To find out the double interaction effect of problem solving ability & meta-cognition on academic achievement of sr. sec. school students.

Hypotheses Of The Study

H₀₁ There is no significant difference in the academic achievement of sr. sec. school students on the basis of problem solving ability.

H₀₂ There is no significant difference in the academic achievement of sr. sec. school students on the basis of meta-cognition.

H₀₃ There is no significant double interaction effect of problem solving

ability & meta-cognition on academic achievement of sr. sec. school students.

Method

For the current analysis, the **Descriptive Survey Method** was used since it's viewed as one of the vital methods in education & it explain the present placement of the research work. This method is widely used method in the field of research. It analyzes the existing situation and makes generalization on every important aspect of the prevalent phenomenon. It involves classification, comparison, measurement, interpretation, evaluation & generalization.

Population And Sample

All the students studying in 11th class of all private secondary schools affiliated to C.B.S.E. of Haryana state were constituted the target population for the present study. Multi-stage Random Sampling technique was used for the selection of the unit of information. Haryana state is divided into four divisions namely Ambala, Gurugram, Hisar, & Rohtak and in these four divisions there are 22 districts. Then all the districts of these four divisions were written on separate chits and folded. Then these chits were put in a box and selected three districts i.e. Rohtak, Bhiwani and Ch. Dadri. After that the list of schools under these districts prepared by the Directorate of Education was procured through Internet. Thereafter, 30 schools were selected randomly and from each school 20 students of 11th class were selected. In this way, 600 sr. sec. school students constituted the final sample for the present study.

Tool Used

Academic Achievement: "Academic achievement of the students was determined on the basis of their previous examination marks i.e. 10th class. For the purpose of the study, the investigator obtained 10th class examination total marks of the students from their school records".

Problem Solving Ability Test (PSAT) by Dubey (2011).

Meta-cognition Scale by Singh and Bali (2017).

Statistical Techniques

To study the significance difference in academic achievement of sr. sec. school students with respect to their problem solving ability & meta-cognition statistical technique like Mean, SD & t-test were

employed. Analysis of Variance (ANOVA) was applied to examine the interaction effect among variables.

Data Analysis And Interpretation

“In order to see the significance difference between the independent and dependent variables mean, standard deviation, t-value & their significance level was computed. ANOVA was applied to examine the interaction effect among variables. The collected data was analyzed both quantitatively as well as qualitatively. In order to verify the objectives and to test the null hypotheses, the present study has been analyzed into three phases that are described below”:

Objective 1: “To compare the academic achievement of sr. sec. school students on the

basis of problem solving ability”.

“For the purpose of studying the significance difference in academic achievement of sr. sec. school students on the basis of problem solving ability, the following null hypothesis was formulated:

H₀₁ There is no significant difference in the academic achievement of sr. sec. school students on the basis of problem solving ability.

To test the null hypothesis, Mean, Standard Deviation, df, t-value and level of significance of the scores obtained from academic achievement with respect to problem solving ability were calculated.” The outcome of the study are given in Table 1.

Table 1

“Descriptive statistics related to the Academic Achievement of Sr. sec. School Students on the basis of Problem Solving Ability”

Dependent Variable	Groups (Problem Solving Ability)	N	Mean	SD	df	t' value	Level of Significance
Academic Achievement	High	215	71.59	15.81	413	3.14	Significant at 0.01
	Low	200	66.87	14.93			

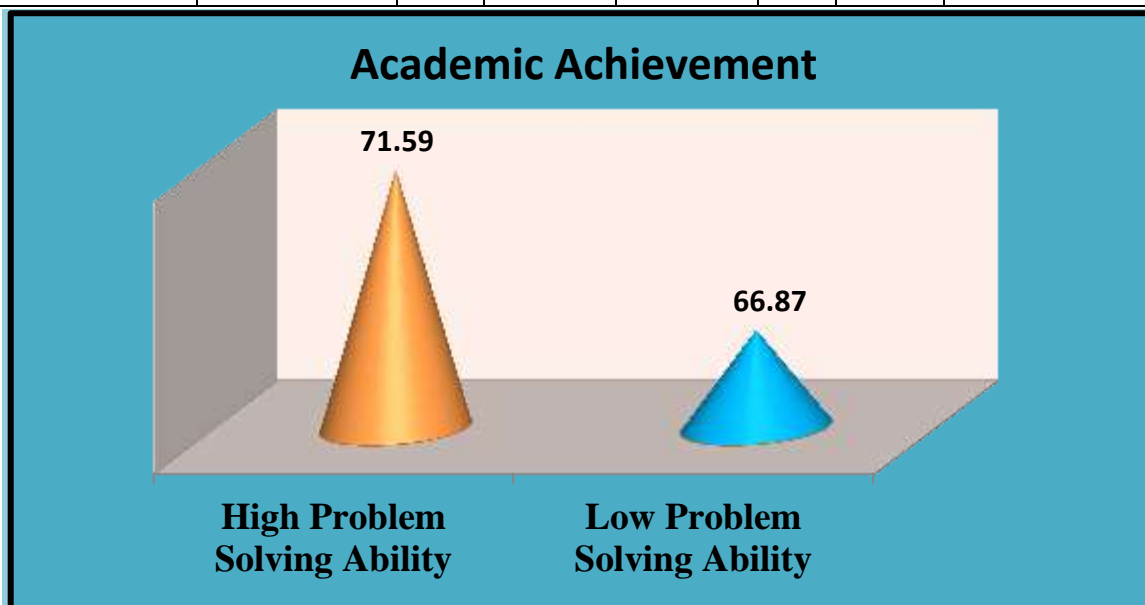


Fig. 1: “Mean Academic Achievement Scores of Sr. sec. School Students on the basis of Problem Solving Ability”

“It can be observed from table-1 and fig. 1 that the t-value (3.14 at 413 degree of freedom) indicated a significant difference in academic achievement of sr. sec. school students on the basis of problem solving

ability at 0.01 level. So, the null hypothesis, **H₀₁** stands rejected. In terms of means scores, it can be concluded that students having high problem solving ability (71.59±15.81) possess higher academic achievement as compared to

students having low problem solving ability (66.87 ± 14.93). So, it can be concluded that those students who have higher problem solving ability holds higher academic achievement than those students who have lower problem solving ability”.

Objective 2: “To compare the academic achievement of sr. sec. school students on the basis of meta-cognition”.

“For the purpose of studying the significance difference in academic achievement of sr. sec. school students on the basis of meta-

cognition, the following null hypothesis was formulated:

H₀₂ There is no significant difference in the academic achievement of sr. sec. school students on the basis of meta-cognition.

To test the null hypothesis, Mean, Standard Deviation, df, t-value and level of significance of the scores obtained from academic achievement with respect to meta-cognition were calculated.” The outcome of the study are given in Table 2.

Table 2

“Descriptive statistics related to the Academic Achievement of Sr. sec. School Students on the basis of Meta-cognition”

Dependent Variable	Groups (Meta-cognition)	N	Mean	SD	df	t' value	Level of Significance
Academic Achievement	High	203	79.32	16.89	406	9.07	Significant at 0.01
	Low	205	65.17	14.76			

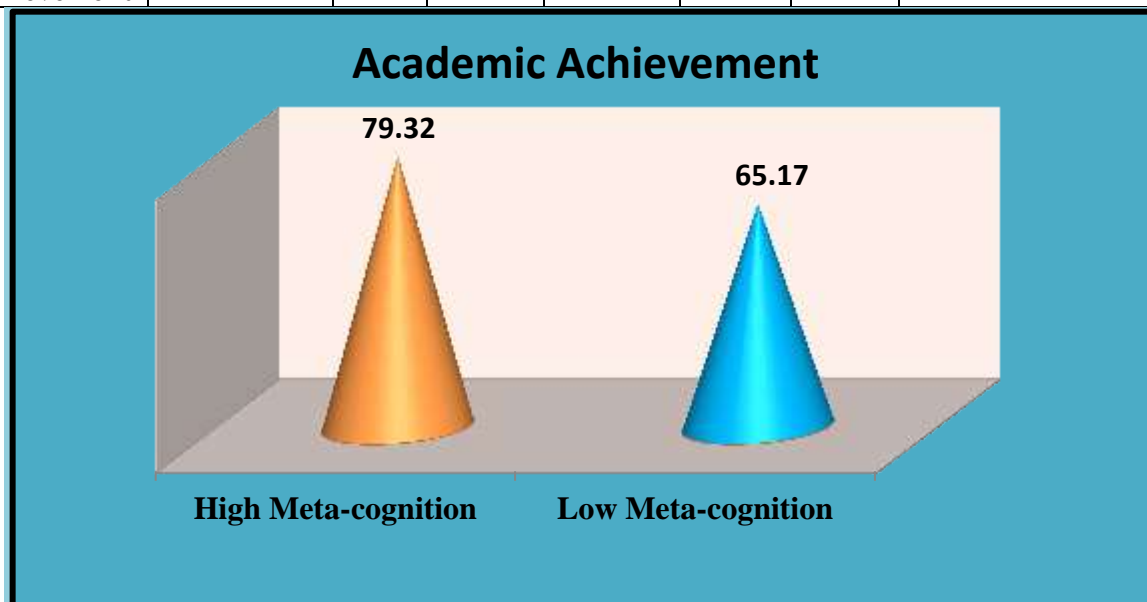


Fig. 2: Mean Academic Achievement Scores of Sr. sec. School Students on the basis of Meta-cognition

“It can be seen from table-1.2 and fig. 2 that the t-value (9.07 at 406 degree of freedom) indicated a significant difference in academic achievement of sr. sec. school students on the basis of meta-cognition at 0.01 level. So, the null hypothesis, **H₀₂** stands rejected. In the context of means scores, it can be concluded that students having high meta-cognition

Objective 3: “To find out the double interaction effect of problem solving ability & meta-cognition on academic achievement of sr. sec. school students”.

(79.32 ± 16.89) possess higher academic achievement as compared to students having low meta-cognition (65.17 ± 14.76). So, it can be concluded that those students who have high meta-cognition hold higher academic achievement than those students who have low meta-cognition”.

“For the purpose of studying the double interaction effect of Problem Solving Ability (A) and Meta-cognition (B) on academic achievement of sr. sec. school students, the following null hypothesis was formulated”:

H₀₃ “There is no significant double interaction effect of problem solving ability & meta-cognition on academic achievement of sr. sec. school students”.

“Summary of 2 Way ANOVA (2×2 Factorial Design) for Academic Achievement of Sr. sec. School Students with respect to Problem Solving Ability & Meta-cognition”

Dependent Variable: Academic Achievement					
Sources of Variance	Df	Sum of Squares (SS)	Mean Sum of Squares (MSS)	F	Sig.
A (Problem Solving Ability)	1	2320.442	2320.442	9.948**	.002
B (Meta-cognition)	1	957.054	957.054	4.103*	.043
A x B Interaction	1	1224.494	1224.494	5.249*	.022
Between Cells	3	110950.788		
Within Cells	454	105900.379	233.261		
Total	457				

** Significant at 0.01 level * Significant at 0.05 level NS= Not Significant

“An inspection of Table-3 indicates that F-ratio between problem solving ability and meta-cognition is (8.134) which is found significant at 0.05 level leading to the inference that problem solving ability and meta-cognition (AxB) interact with each other. Therefore, the null hypothesis **H₀₃** stands rejected. Thus, it can be concluded that there is a significant interaction effect of

problem solving ability and meta-cognition on academic achievement of sr. sec. school students. For Further investigation, t-test was employed to find out the significance difference between mean scores of academic achievement for different groups”. The outcome of the study are given in the table-4 and Fig. 3.

Table-4

“Descriptive statistics related to Academic Achievement of Sr. Sec. School Students for Different groups of Problem Solving Ability x Meta-cognition (A x B)”

Groups	N		Means		SDs		t-values
A ₁ B ₁ vs A ₂ B ₁	73	134	66.61	74.63	17.04	14.68	3.39**
A ₁ B ₂ vs A ₂ B ₂	136	119	67.00	69.27	13.72	16.39	1.19 (NS)
A ₁ B ₁ vs A ₂ B ₂	73	119	66.61	69.27	17.04	16.39	1.07 (NS)
A ₁ B ₂ vs A ₂ B ₁	136	134	67.00	74.63	13.72	14.68	4.41**
A ₁ B ₁ vs A ₁ B ₂	73	136	66.61	67.00	17.04	13.72	0.168 (NS)
A ₂ B ₁ vs A ₂ B ₂	134	119	74.63	69.27	14.68	16.39	2.32*

** Significant at 0.01 level * Significant at 0.05 level NS = Not Significant

A₁ – High Problem Solving Ability

B₁ –High Meta-cognition

A₂ – Low Problem Solving Ability

B₂ –Low Meta-cognition

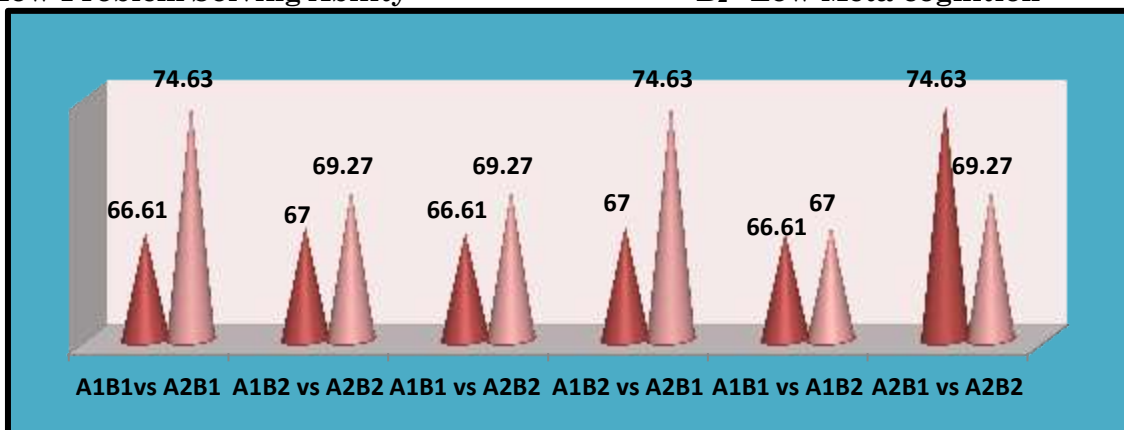


Fig. 3: “Mean Scores for Double Interaction Effect of Problem Solving Ability & Meta-cognition on Academic Achievement of Sr. sec. School Students”

“Table-4 discloses that ‘t’-value (3.39) for students having high problem solving ability with high meta-cognition (A_1B_1) and students having low problem solving ability with high meta-cognition (A_2B_1) is found significant at 0.01 level leading to the conclusion that students of these groups differ significantly with respect to academic achievement”. In terms of mean scores, it can be inferred that students having high problem solving ability with high meta-cognition (66.61) have less academic achievement as compare to students having low problem solving ability with high meta-cognition (74.63). Table-4 make it clear that the t-values (1.19, 1.07 and 0.168) for the groups (A_1B_2 vs A_2B_2 ; A_1B_1 vs A_2B_2 ; A_1B_1 vs A_1B_2) respectively are not found significant at 0.05 level leading to the conclusion that students of these groups do not differ significantly with respect to academic achievement. “Table-4 also indicated that t-values (4.41) for students having high problem solving ability with low meta-cognition (A_1B_2) and students having low problem solving ability with high meta-

cognition (A_2B_1) is found significant at 0.01 level leading to the conclusion that students of these groups differ significantly with respect to academic achievement”. While comparing mean scores, it can be indicated that students having high problem solving ability with low meta-cognition (67.00) possess lesser academic achievement students having low problem solving ability with high meta-cognition (74.63). “Finally, t-value (2.32) for students having low problem solving ability with high meta-cognition (A_2B_1) and students having low problem solving ability with low meta-cognition (A_2B_2) is found significant at 0.05 level leading to the conclusion that students of these groups differ significantly with respect to academic achievement”. With regard of mean scores, it can be seen that students having low problem solving ability with high meta-cognition (74.63) have higher academic achievement as compared to students having low problem solving ability with low meta-cognition (69.27).

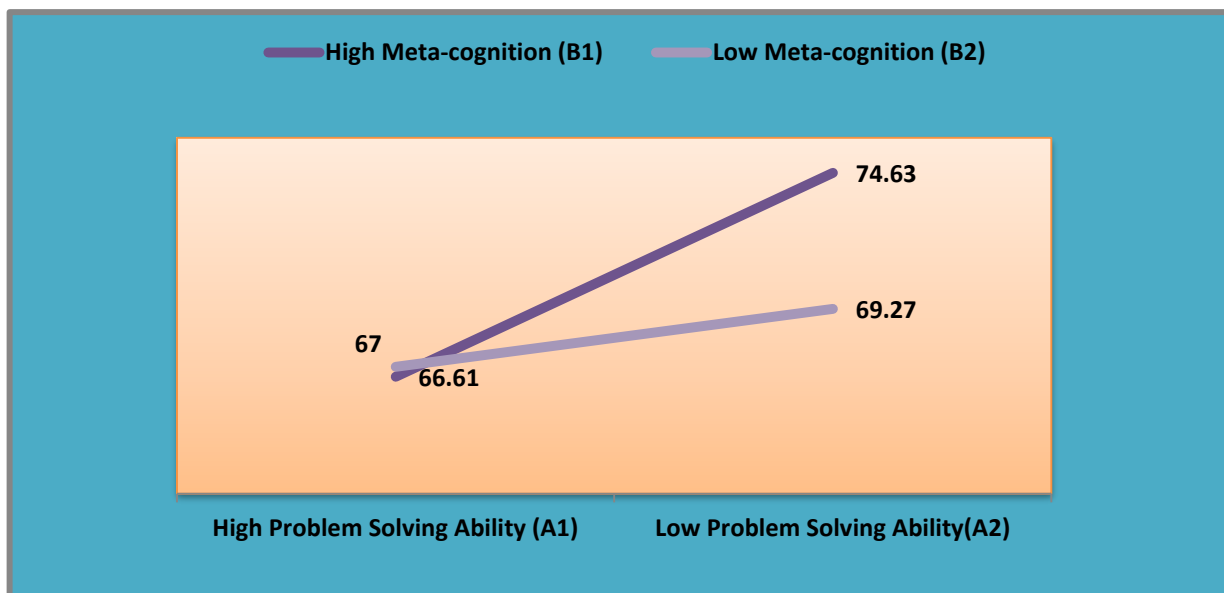


Fig. 4: “Interaction effect of Problem Solving Ability & Meta-cognition ($A \times B$) on Academic Achievement of Sr. sec. School Students”

The interaction effect of *Problem Solving Ability & Meta-cognition ($A \times B$) on academic achievement of sr. sec. school students* has been also presented in the form of line graph

in Fig.4 which shows a significant interaction effect of the two variables (Problem solving ability & Meta-cognition) on academic achievement of sr. sec. school students. In

this line graph B_1 and B_2 are marked on the X-axis at any distance and Y ordinate a scale is taken for the mean values. The mean $M_{11}=66.61$ and $M_{12}=67.00$ are marked for plotting line A_1 . Similarly, A_2 line is drawn by marking $M_{21}=74.63$ and $M_{22}=69.27$. In the Fig.4 A_1 and A_2 lines intersect at a point. The figure showed that problem solving ability (A) and meta-cognition (B) intersect at a point. Therefore, this line graph supports the inference that interaction effect between problem solving ability (A) & meta-cognition (B) is found highly significant.

Conclusion

The entire educational programme is geared toward achieving high scholastic standards, and the educational system's structure is carefully planned with this goal in mind. Exams and other forms of continuous evaluation are frequently used to assess academic success, but there is no consensus about the most effective methods or the relative importance of procedural knowledge such as skills & declarative knowledge such as facts. For educators and others, academic attainment at all educational levels is a key cause of worry. Academic achievement at all levels of education is a major source of concern for educators and others. Meta-cognition is extremely important for effective learning. It includes the understanding of an individual about their own cognitive processes as well as their ability to organise, monitor, and modify these processes as a function of learning. Learners as well as educators are influenced by meta-cognition. This means that meta-cognition helps learners to be more involved with the learning process. It is a strong predictor of academic achievement. As a result, it is the responsibility of educational institution administration to create a favourable, conducive, and congenial environment in the school and college campus in order to use and develop students' and teachers' meta-cognitive abilities by providing all necessary human and physical resources. "Problem solving ability is the highest level of learning in the hierarchy proposed by Gagne". Learners those have differential levels of problem solving ability are supposed to have different levels of academic achievement and has a great impact on it. Therefore, it is the duty of the teachers to recognise the kids

with poor problem-solving abilities & make an effort to change their learning & cognitive capacities using various audiovisual aids. In order to solve challenges, teachers must motivate pupils to take appropriate risks. Thus educational planners & politicians must take some effort in this regard. In the modern world, education shouldn't just be about getting good grades or degrees. It is more important to be able to use newly gained skills in the actual world.

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