



ACADEMIC ACHIEVEMENT IN RELATION TO METACOGNITION AND PROBLEM SOLVING ABILITY AMONG SECONDARY SCHOOL STUDENTS

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Abstract

The study investigated the academic achievement in relation to metacognition and problem solving ability among secondary school students. The sample constituted of 200 students studying in XI grade both boys and girls adolescents belonging to science stream from CBSE as well as PSEB of Amritsar District were randomly selected. The metacognition (Meta-cognition inventory by Govil, 2011) and problem solving ability (Problem solving ability test by Dubey, 2011) tests were used for collecting the data. The findings of the study revealed that there exists no significant difference in metacognition and problem solving ability among girls and boys of CBSE and PSEB school students belonging to medical stream. But there exists significant difference in problem solving ability among students of CBSE and PSEB schools belonging to medical stream. There exists no relationship among metacognition, problem solving ability and achievement of secondary school students belonging to medical stream. However no significant interaction effect of metacognition and problem solving ability on achievement of secondary school students belonging to medical stream was found.

Keywords: Metacognition, Problem Solving Ability and Academic Achievement.



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INTRODUCTION

Education is the most important invention by man. Education makes a person rational, capable and responsible. Education helps the people to become more knowledgeable about the world, more sensitive and understanding of their relationship to it, and more eager to contribute to the civilising process. The formation of educational aspiration is an integral part of education enabling students to better understand who they are and how they can function effectively for their own well being and for the betterment of the society (Kozol, 1984). 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 and aptitude, positive statements, good values and attitudes. It is a life long process. In its technical sense, education is a process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to another generation. Thus,

Education is a process which enables him to acquire virtues and to become a better human being. In this sense education is that constructive process, which drags a person out from the darkness, poverty and misery and lead him on the path of enlightenment, prosperity and happiness by developing his individually in all its aspects i.e. physical, mental, emotional and social (Sodhi, Suri & Sodhi 2012). Classroom teaching practice becomes more effective, when it is well informed by an understanding of how students learn and learning will be more successful if students are given the opportunity to explain or clarify their ideas. So in terms of pedagogy, the development of education now requires teaching strategies that emphasize student involvement in their learning, where focus is on knowledge construction rather on knowledge transformation. Researchers have shown that learning strategy in classroom can be very effective in encouraging student interaction and consequently enhanced student's academic achievement.

ACADEMIC ACHIEVEMENT

Academic achievement means knowledge attained and skills developed in the school subjects usually designed by the teachers or by both. Since academic achievement is the criterion for selection, promotion or recognition in various walks of life. The importance of academic achievement cannot be ignored. Academic achievement is more important for learning and personality development of a pupil and to assess student's progress by means of identifying what he /she achieved. Academic achievement is commonly measured by examinations or continuous assessment but there is a general agreement on how it is best or which aspect is most important procedural knowledge such as skills or declarative knowledge such as facts. Academic achievement in general at all stages of education is a matter of deep concern for educationists as well as for others. In fact the whole program of education is geared to the achievement of high scholastic standards and the structure of the education system is carefully planned with this target in mind. Achievement tests are usually used to determine the degree of mastery of subject matter, content or skills. The present educational system is aimed at, besides providing knowledge to the learner, to teach them learning how to learn, to organize their thinking processes to solve different problems and to develop competencies to meet future challenges. In the context of present education system, a student needs to acquire information, application of knowledge, judging ability, critical thinking, analytical skills, problem solving, creativity and innovative attitude, aptitude for research, quantitative ability, multidisciplinary knowledge, computer skills, communication skills, soft

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skills, leadership, working in a team, positive attitudes, broader world view etc. A student develops these competencies and skills with the help of metacognitive skills.

METACOGNITION

Metacognition plays an important role in communication, reading comprehension, language acquisition, social cognition, attention, self-control, memory, self-instruction, writing, problem solving, and personality development. Metacognition includes knowledge and regulation of one's thinking processes. Metacognition is a special type of knowledge and ability that develops with personal experience and with schooling. Metacognition refers to a level of thinking that involves active control over the process of thinking that is used in learning situations. Planning the way to approach a learning task, monitoring comprehension, and evaluating the progress towards the completion of a task: these are skills that are metacognitive in their nature. In the present study, Metacognitive ability is the knowledge concerning one's own cognitive process and product. Metacognition literally means knowing about knowing or thinking about thinking. It is an appreciation of what one already knows, together with a correct comprehension of the learning task. Metacognition enables us to become successful learners and it has been associated with intelligence. Activities such as planning how to approach a given learning task, monitoring, comprehension and evaluating progress towards a completion of task are metacognitive in nature. Metacognition plays an important role during each level of problem solving ability. Rezvan, Ahmadi and Abedi (2007) concluded that training in metacognition have positive effects on the academic achievement and increases students' happiness. The findings of the studies also revealed that there is a positive and moderate relationship between the metacognitive reading strategies and scholastic achievement in science. It is also revealed from the findings that female students are better in metacognitive strategies than male students (Khan and Khan,2013).

PROBLEM SOLVING ABILITY

With advancement in socio- economic and technological fields, the life of the individual is becoming more and more complex fraught with a number of problems which the individual and the society have to face in near future. The responsibility of school becomes increasingly important to develop scientific attitude in students so that they may solve their problems independently for better adjustment in the future complex society. Problem solving is the highest level of learning in the hierarchy proposed by Gagne which depends on the mastery of next lower types of learning. It involves the application of principles and facts to

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explain and solve new phenomena or predict consequences from known conditions. The task of problem solving requires prediction, analysis of facts and principles to develop cause-effect relationship in physical phenomena of the environment. Generally, our daily life activities are followed in routine and we do not face any problem to perform our routine duties. But it is not always so, sometimes we are confronted with a problem situation where we have to think and find out solution to reach the goal. Problem situation occurs when there is an obstacle to reach the goal. Problem solving ability is known as the climax of the human abilities. Successful problem solving capabilities plays an important role in the person and academic performance of the students. Failure in problem solving is generally resulted from failing to organize the mathematical operation, to choose the most effective method, to analyze, to understand the point of the problem to monitor and to control operation carried out (Victor, 2004). It is a known fact that students with high metacognitive skills perform better in problem solving (Desoete, Roeyers & Berysse, 2001). It has been observed that during problem solving process they are more controlled; they try to break the complex problem into simple parts and they ask question themselves for clarifying their thoughts. Gakhar (2003) found that problem solving ability was significant and positively correlated with mathematical achievement. Gupta and Pasrija (2015) pointed out that problem solving ability had a significant effect on academic achievement of high school students. Problem-solving is the key to success and has been regarded as the most significant aspect of human behaviour. Problem solving ability plays an important role in the academic achievement of students and has been received broad public interest as an important competency in modern societies. Since metacognition is an important and appropriate approach to problem solving and it shows that metacognitive instruction reinforces the student ability to better solve the problem because metacognitive strategies enhance their attempt to solve problems.

EMERGENCE OF THE PROBLEM

Learning plays a vital role in social progress. But learning process is a complicated and multidimensional process. As society changes the skills that students need to be successful in life also change. Basic literacy skills of reading, writing, and arithmetic are no longer sufficient. A successful student must be adept at managing information, finding, evaluating and applying new content understanding with great flexibility. The academic achievement has great importance. Now a days, the student academic achievement is considered as an important indicator in the assessment of educational systems. So, *Copyright © 2017, Scholarly Research Journal for Interdisciplinary Studies*

metacognition is essential to successful learning because it enables individuals to better manage their cognitive skills and to determine weaknesses that can be corrected by constructing new cognitive skills. Since metacognition is an important and appropriate approach to problem solving. So, the present study will be conducted to examine-study academic achievement of secondary school students in relation to metacognition and problem solving ability.

STATEMENT OF THE PROBLEM

ACADEMIC ACHIEVEMENT IN RELATION TO METACOGNITION AND PROBLEM SOLVING ABILITY AMONG SECONDARY SCHOOL STUDENTS

DELIMITATION OF THE STUDY

The present study was delimited to 200 (XI class) secondary school students (91 boys and 109 girls) belonging to medical stream and affiliated to CBSE and PSEB of Amritsar district only.

OPERATIONAL DEFINITION OF THE TERMS USED

Metacognition

Metacognition means an individual's awareness of his own thinking processes and his ability to control these processes. It refers to higher order thinking which involves active control over the cognitive processes engaged in learning.

Problem Solving Ability

Problem solving is a process which requires analyzing the given information about the problem, organizing the processed information, preparing an action plan and assessing all the operation carried out. It also tries to break the complex problem into simple parts.

Academic Achievement

Academic achievement is the learned or acquired abilities from lessons or academic issues which are measured by tests.

OBJECTIVES OF THE STUDY

1. To study metacognition among secondary school students belonging to medical stream with respect to gender.
2. To study metacognition among secondary school students belonging to medical stream with respect to the type of school.
3. To study problem solving ability among secondary school students belonging to medical stream with respect to gender.

4. To study problem solving ability among secondary school students belonging to medical stream with respect to the type of the school.
5. To study the relationship between metacognition and achievement of secondary school students belonging to medical stream.
6. To study the relationship between problem solving ability and achievement of secondary school students belonging to medical stream.
7. To study the interaction of metacognition and problem solving ability on achievement of secondary school students belonging to medical stream.

HYPOTHESES OF THE STUDY

1. There exists no significant difference in metacognition among girls and boys of secondary schools belonging to medical stream.
2. There exists no significant difference in metacognition among student of CBSE and PSEB schools belonging to medical stream.
3. There exists no significant difference in problem solving ability among girls and boys of secondary schools belonging to medical stream.
4. There exists no significant difference in problem solving ability among students of CBSE and PSEB schools belonging to medical stream.
5. There exists no relationship between metacognition and achievement of secondary school students belonging to medical stream.
6. There exists no relationship between problem solving ability and achievement of secondary school students belonging to medical stream.
7. There exists no significant interaction effect of metacognition and problem solving ability on achievement of secondary school students belonging to medical stream.

METHOD AND PROCEDURE

DESIGN OF THE STUDY

The present study was descriptive in the sense that it aims at describing the nature and distributions of variables under study i.e. academic achievement, meta-cognition and problem solving ability. The survey research is one of the most important areas of measurement in applied social research.

SAMPLE USED

A sample of about 200 students studying in XI grade both boys and girls adolescents from CBSE as well as PSEB of Amritsar District were randomly selected. The metacognition and problem solving ability tests were used for collecting the responses.

TOOLS USED

The following tests were used for assessing meta- cognition and problem solving ability of senior secondary school students.

1. Meta-cognition inventory (MCI) (Govil, 2011)
2. Problem solving ability (PSA) (Dubey, 2011)

ANALYSIS AND INTERPRETATION

HYPOTHESIS-1

"There exists no significant difference in metacognition among girls and boys of secondary schools belonging to medical stream"

In order to test this hypothesis, mean and S.D of metacognition among girls and boys of secondary schools belonging to medical stream was calculated. The scores of girls and boys have been described in terms of mean, S.D and t-value in the table (1).

Table 1 Mean, S.D and t-value of metacognition among girls and boys of secondary schools belonging to medical stream.

Gender	N	Mean	S.D.	SE _D	t-value
Girls	109	90.33	9.13		
Boys	91	89.36	9.92	1.35	0.72

(Critical value 1.96 at 0.05 level and 2.58 at 0.01 level, df = 198)

The table 1 revealed that the mean score and S.D of girls are 90.33 and 9.13 respectively and mean score and S.D of boys are 89.36 and 9.92 respectively. The t-value comes out to be 0.72 which is insignificant at both 0.01 and 0.05 level of significance. Hence, the hypothesis no.1, " There exists no significant difference in metacognition among girls and boys of secondary schools belonging to medical stream" is not rejected.

HYPOTHESIS-2

"There exists no significant difference in metacognition among students of CBSE and PSEB schools belonging to medical stream"

In order to test this hypothesis, mean and S.D of metacognition among students of CBSE and PSEB schools belonging to medical stream was calculated. The scores of CBSE and PSEB have been described in terms of mean, S.D and t-value in the table (2).

Table 2 Mean, S.D and t-value of metacognition among students of CBSE and PSEB schools belonging to medical stream.

Type of school	N	Mean	S.D.	SE _p	t-value
CBSE	105	88.12	8.72	1.32	2.82
PSEB	95	91.84	9.96		

(Critical value 1.96 at 0.05 level and 2.58 at 0.01 level, df = 198)

It may be noted from table 2 that the mean score and S.D of CBSE is 88.12 and 8.72 respectively and mean score and S.D of PSEB is 91.84 and 9.96 respectively. The t-value comes out to be 2.82 which is significant at 0.01 and 0.05 level of significance. Hence, the hypothesis no.2 "There exists no significant difference in metacognition among student of CBSE and PSEB schools belonging to medical stream" is rejected.

The above result was supported by Jagadeeswari and Chandrasekaran (2013) who found that there is significant difference in the metacognitive awareness based on girls and boys, type of school management.

HYPOTHESIS-3

"There exists no significant difference in problem solving ability among girls and boys of secondary schools belonging to medical stream".

In order to test this hypothesis, mean and S.D of problem solving ability among girls and boys of secondary schools belonging to medical stream was calculated. The scores of girls and boys have been described in terms of mean, S.D and t-value in the table (3).

Table 3 Mean, S.D and t-value of problem solving ability among girls and boys of secondary schools belonging to medical stream.

Gender	N	Mean	S.D.	SE _p	t-value
Girls	109	8.34	4.25	0.58	0.19
Boys	91	8.23	3.86		

(Critical value 1.96 at 0.05 level and 2.58 at 0.01 level, df = 198)

It may be observed from table 3 that the mean score and S.D of girls is 8.34 and 4.25 respectively and mean score and S.D of boys is 8.23 and 3.86 respectively. The t-value comes out to be 0.19 which is insignificant at 0.01 and 0.05 level of significance. Hence, the hypothesis no.3 "There exists no significant difference in problem solving ability among girls and boys of secondary schools belonging to medical stream" is not rejected.

The above result was supported by Matemba, Awinja and Otiew (2013), Bala and Shaafiu (2016) who found that there is no significant relationship between problem solving approaches and academic performance while gender had no affect on problem solving.

Bala and Shaafiu (2016) who found that there is no significant difference between male and female students in academic achievement, problem solving ability and examination anxiety.

HYPOTHESIS-4

"There exists no significant difference in problem solving ability among students of CBSE and PSEB schools belonging to medical stream".

In order to test this hypothesis, mean and S.D of problem solving ability among student of CBSE and PSEB schools belonging to medical stream was calculated. The scores of CBSE and PSEB have been described in terms of mean, S.D and t-value in the table (4).

Table 4 Mean, S.D and t-value of problem solving ability among students of CBSE and PSEB schools belonging to medical stream.

Type of school	N	Mean	S.D.	SE _D	t-value
CBSE	105	10.43	4.12	0.48	9.35
PSEB	95	5.93	2.35		

(Critical value 1.96 at 0.05 level and 2.58 at 0.01 level, df = 198)

The table 4 revealed that the mean score and S.D of CBSE is 10.43 and 4.12 respectively and mean score and S.D of PSEB is 5.93 and 2.35 respectively. The t-value comes out to be 9.35 which is significant at 0.01 and 0.05 level of significance. Hence, the hypothesis no.4" There exists no significant difference in metacognition among student of CBSE and PSEB schools belonging to medical stream" is rejected.

HYPOTHESIS-5

"There exists no relationship between metacognition and achievement of secondary school students belonging to medical stream".

In order to test this hypothesis, coefficient of correlation of metacognition and achievement of secondary school students belonging to medical stream was calculated. The scores of coefficient of correlation of metacognition and achievement of secondary school students has been shown in the table (5).

Table 5 Coefficient of correlation of metacognition and achievement of secondary school students belonging to medical stream.

Variable	Metacognition	Achievement
Metacognition	-	0.12
Achievement	0.12	-

It may be observed from table 5 that the metacognition and achievement of secondary school students have positive but weak correlation hence, the hypothesis no 5" There exists no relationship between metacognition and achievement of secondary school students belonging to medical stream" is not rejected. Thus, the result reveals that there is insignificant relationship in metacognition and achievement of secondary school students belonging to medical stream.

The above result was supported by Shahri and Zadekhan (2015) who found that there is no relationship between cognitive strategies and academic achievements.

HYPOTHESIS-6

"There exists no relationship between problem solving ability and achievement of secondary school students belonging to medical stream."

In order to test this hypothesis, coefficient of correlation of problem solving ability and achievement of secondary school students belonging to medical stream was calculated .The scores of coefficient of correlation of problem solving ability and achievement of secondary school students has been shown in the table (6).

Table 6 Coefficient of correlation of problem solving ability and achievement of secondary school students belonging to medical stream.

Variable	Problem solving ability	Achievement
Problem solving ability	-	0.25
Achievement	0.25	-

The table 6 reveals that the problem solving ability and achievement of secondary school students have positive but weak correlation hence, the hypothesis no 6." There exists no relationship between problem solving ability and achievement of secondary school students belonging to medical stream" is not rejected. Thus, the result review that there is insignificant relationship in problem solving ability and achievement.

The above result was supported by Matemba, Awinja and Otiew (2013) who found that there is no significant relationship between problem solving approaches and academic performance while gender had no affect on problem solving.

HYPOTHESIS-7

"There exists no significant interaction effect of metacognition and problem solving ability on achievement of secondary school students belonging to medical stream."

In order to test this hypothesis, Analysis of Variance was employed to study the interactional effects of independent variables of metacognition and problem solving ability on the dependent variable of achievement. These values have been shown in table (7).

Table 7 Analysis of Variance of Metacognition (A), Problem solving ability (B) on achievement

Dependent Variable	Source of Variance	Sum of Square	df	Mean Square	F-value
Achievement	Metacognition(A)	293.87	1	293.87	3.67
	Problem solving ability (B)	349.65	2	174.83	2.19
	Interaction(AXB)	176.87	2	88.44	1.11
	Within group Error	8154.96	102	79.95	
	Total	578934.00	108		

It may be noted from Table 7 that F-value for interaction effect of Metacognition and Problem solving ability on achievement of secondary school students comes out to be 1.106, which is not significant at 0.05 level of confidence. Hence the hypothesis no 7." There exists no significant interaction effect of metacognition and problem solving ability on achievement of secondary school students belonging to medical stream" is not rejected. It means that there is no significant interaction of metacognition and problem solving ability of secondary school students on their achievement.

The above result was supported by Gupta and Pasrija (2015) who found that there is no interaction effect of problem solving ability and gender is found on academic achievement of high school students.

FINDINGS AND CONCLUSIONS

1. There exists no significant difference in metacognition among girls and boys of CBSE and PSEB school students belonging to medical stream.
2. There exists no significant difference in problem solving ability among girls and boys of CBSE and PSEB school students belonging to medical stream.
3. There exists significant difference in problem solving ability among students of CBSE and PSEB schools belonging to medical stream.
4. There exists no relationship between metacognition and achievement of secondary school students belonging to medical stream.

5. There exists no relationship between problem solving ability and achievement of secondary school students belonging to medical stream.
6. There exists no significant interaction effect of metacognition and problem solving ability on achievement of secondary school students belonging to medical stream.

EDUCATIONAL IMPLICATIONS

1. From the findings it is reported that there exists no significant difference in metacognition and problem solving ability among girls and boys of secondary schools belonging to medical stream. So, Teachers can administer pedagogies of teaching to improve the metacognition among students without giving any special treatment to any group in the classroom. Promoting metacognitive awareness and skills could be a valuable method for improving learning and performance at all ages. The learner learns or rather constructs his knowledge through experiences, therefore, the task of the teacher is to provide rich and authentic problem-solving environment. So that, the learner, while solving the problem may construct his gamut of learning
2. The task of the teacher is to provide a variety of experiences to the learner. If a learner is well acquainted with his own concept of knowledge i.e. existing knowledge, acquiring knowledge, study habits etc. along with the regulation of his cognitive processes, he can achieve success.
3. It is reported in the findings that there exists significant difference in metacognition and problem solving ability among student of CBSE & PSEB Schools belonging to medical stream. The current research revealed that metacognitive skills and problem solving ability should be developed more to maximize learning and memory and to becomes increasingly important to develop scientific attitude in students so that they may solve their problems independently for better adjustment in the future complex society. Hence, an educational course is recommended to be designed in order to strengthen metacognitive strategies and consequently to enhance problem solving ability in students. Further, metacognitive training workshops are suggested to be held for teachers to develop their understanding of important component of teaching-learning process.
4. Students should be encourage to ask questions themselves because effective questioning contribute to problem solving, trigger the thinking process and stimulate the imagination.

5. Seminars, refresher courses, workshops and practical in laboratories in different ways should be organized in secondary schools for students to help in developing their cognitive styles and problem solving ability.
6. There should be use of new technology in schools to improve the academic achievement of the students.

SUGGESTIONS

The suggestions for the further studies have been given below :

1. The present study was conducted on XI class students, a study may be replicated on students at other level of education and students belonging to other stream also.
2. The study can be conducted in relation to other variables like thinking and learning styles, self- regulated learning, scholastic achievements etc.

REFERENCES

- Bala, P & Shaffiu, K. Q. (2016). *Academic achievement of secondary school students in relation to their problem solving ability and examination anxiety. The International Journal of Indian Psychology*,3(4),138-154.
- Desoete, A., Roeyers, H. & Buysse, A. (2001). *Metacognition and mathematical problem solving in grade 3. Journal of Learning Disabilities*, 34, 435-449.
- Dubey, L. N. (2011). *Problem Solving Ability Test*. Agra: National Psychological Corporation.
- Gakhar, S. C. (2003). *Effect of creativity, problem solving ability on academic achievement of students at secondary level. Journal of Indian Education*, 29 (3), 100-106.
- Govil, P. (2003). *Metacognitive Inventory (MCI)*.Agra: National Psychological Corporation.
- Gupta, M., & Pasrija, P. (2015). *Effect of problem solving ability on academic achievement of high school students: A comparative study. International Journal of Research & Education*, 4 (2), 45- 59.
- Jagadeeswari, A. S & Chandrasekaran, V. (2013). *Promoting metacognitive awareness among higher secondary student. An International Journal for Interdisciplinary Studies*,2(24), 1888-1897.
- Khan, F. A., & Khan, S. A. (2013). *Metacognitive reading strategies in relationship with scholastic achievement in science of IX standard students of english medium schools in Aurangabad city. MIER Journal of Educational Studies, Trends & Practices*, 3(1),119-129.
- Kozol, J. (1984). *The night is dark and I am far from home: a political indictment of the U.S. Public schools*. New York: Continuum Publishing Company.
- Matemba K. C., Awinja. J & Otiew K. O. (2014). *Relationship between problem solving approaches and academic performance: A case of Kakamega municipality, Kenya. International Journal of Human Resource Studies*, 4(4), 2162-3068.
- Rezvan, S., & Ahmadi, S. A., & Abedi, M. R. (2007). *The effects of metacognitive training on the academic achievement and happiness of Esfahan university conditional students. Journal of Counselling Psychology*, 19(4), 415-428.
- Shahri, R. J. K., Zadeghan, A. I., Monii, M. F & Kalshani, Z, A. (2015). *The role of cognitive predictors in academic achievement of high school students in Salmas. Biological Forum- An International Journal*, 7(2), 50-60.

- Sodhi, T. S., Suri, A. & Sodhi, H. K. (2012). Philosophical and Sociological Foundation of Education .Patiala: Bawa Publications.*
- Victor, A. M. (2004). The effects of metacognitive instruction on the planning and academic achievement of first and second grade children. (Doctoral Thesis). Chicago, IL: Graduate college of the Illinois Institute of Technology.*