

Problem Solving Ability & Locality as The Influential Factors of Academic Achievement Among High School Students

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Abstract: Academic achievement of the pupil is the prime concern of educational process. The problem solving ability has been playing a significant role in determining student's academic achievement. Keeping this in view, the present study was designed to examine empirically the effect of problem solving ability on the academic achievement of rural and urban school students. The research was conducted on 250 school students (118 rural & 132 urban) studying in 10th class CBSE affiliated private schools that were randomly selected from Rohtak district of Haryana State. Descriptive survey method was used to elicit opinion of rural & urban school students about their problem solving ability and their academic achievement at school. The problem solving ability of sample was assessed by using Dubey's Problem Solving Ability Test (2006) & for academic achievement of students, the school records i.e. marks obtained by the students in previous (IXth) class was considered. The data was analyzed statistically by using ANOVA supplemented by t-test. The findings of the study revealed that problem solving ability had significant effect on the academic achievement of the students whereas significant difference was observed in the academic achievement of students studied in urban and rural schools. However, the significant interaction effects of locality and problem solving ability on the academic achievement of the students had been found.

Keywords: Problem Solving Ability, Academic Achievement, Locality etc.

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1. INTRODUCTION

The progress of a nation in the world of today is more than ever depend upon the quantity as well as quality of the education received by the people of the country. Education has been considering the hallmark of a progressive society for ancient time. Education is closely linked to a person's life chances, income and well-being [3]. The focus of educational process is to improve performance of the students. A good academic achievement record of students is an index of an effective educational system. One of the major features of contemporary educational thinking has been a growing concern about the development of effective personality and efficiency of teaching learning outcomes that can be assessed in terms of students' achievement. Not that other aspect of educational objectives are to be ignored but the fact remains that academic achievement is the unique responsibility of all educational institutions established by the society to promote a wholesome scholastic development of pupil. In the common terminology, academic achievement refers to marks or grade obtained after an examination, is it written or oral in subject taught in school or the attained level of students functioning in school task such as Language, Mathematics, Science etc. as shown by school marks evaluated by the teachers by standardized tests or by a combination of both. Academic achievement is a multidimensional and multifaceted phenomenon. There are many factors which affect academic achievement viz. intelligence, personality, motivation, school environment, heredity, home environment, learning, experiences at school, interests, aptitudes, family background, socio economic status of the parents and many more other factors influenced the academic achievement. However, the success, efficiency and happiness in life largely depend upon their cognitive abilities like problem solving ability, logical thinking etc. Among these, problem-solving ability plays an important role in the academic achievement of school students. Enhancing students' problem solving capacity is one of the greatest educational challenges and is a major demand placed on any educational institution [14].

Problem solving involves application of thinking and reasoning to various kinds of problems encountered in life. Problem solving is an integral part of developmental activities and provides opportunities for children to practice by applying their learning in different situations that they have learned in classroom. PoPya [16] defined problem solving as "finding a way out of a difficulty, a way around an obstacle, attaining an aim that was not immediately attainable. Problem solving is a process of overcoming difficulties that appear to infer with the attainment of a goal. In spite of inference, it is also a procedure of making adjustment. Thus, problem solving is cognitive processing directed

at transforming a problem from the given state to the goal state when the problem solver is not immediately aware of a solution method. Problem solving is also related to other terms such as thinking, reasoning, decision making, critical thinking, and creative thinking. The ability of problem solving has a fundamental role in students' academic performance and their construction of the concepts. Many researches [7]; [17]; [12] showed that problem solving ability is a key factor for content learning and academic performance. The result of the studies show that sometimes problem solving ability is successful with particular task of students but sometime is not. Researchers have come out with varied results sometimes complementary to each other and sometimes contradictory to each other. Thus, in the present study attempt has been made in the direction of exploring the impact of problem solving ability on academic achievement of students belonging to different locality i.e. urban & rural.

Theoretical Background/ Literature

Previous studies have concluded that Problem solving ability is a requirement for success in mathematics and science course [5], [1]. Moreover, [4], [8] and [13] pointed towards the students' problem solving ability of different groups of the categorical variables such as types of the school, academic success, socio-economic and socio-cultural background. While on the other hand, study showed that students' ability has significant influence on problem-solving task. [2]. However, the effect of caste & gender was also found on problem solving ability and academic achievement of students [8]. Some studies showed that the problem solving ability affected the achievement of the male and female secondary students [9] and significant difference in problem solving ability of the students residing in rural and urban area was found [15]. Most of the studies given above carried out to assess the problem solving ability with science and mathematics and different others variables. However, no study has been carried out to assess the effectiveness problem solving on academic achievement of rural and urban school students. Under the light of above mentioned information, the present study has been designed to assess the effect of problem-solving ability & locality on academic achievement of school students.

2. OBJECTIVES OF THE STUDY

1. To study the effect of problem solving ability on academic achievement of 10th class students.

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2. To study the effect of locality on academic achievement of 10th class students.
3. To study the interaction effect of problem solving ability and locality on academic achievement of 10th class students.

3. DESIGN OF THE STUDY

Method: Descriptive survey method was used in this study.

Sample: In the present study, stratified random sampling technique was used to select the sample of 250 students of 10th class (mean age-14.5 years) studied in private secondary schools affiliated to CBSE located at rural & urban area of Rohtak city. The sample was further stratified based on location i.e. rural school students (118) & urban school students (132) and on the basis of problem-solving ability i.e. high problem solving ability students (62), average problem solving ability students(75) and low problem solving ability students(113). The schematic layout of factorial design used in the study along with the break up details of sample of this study has been presented in Fig. 1.

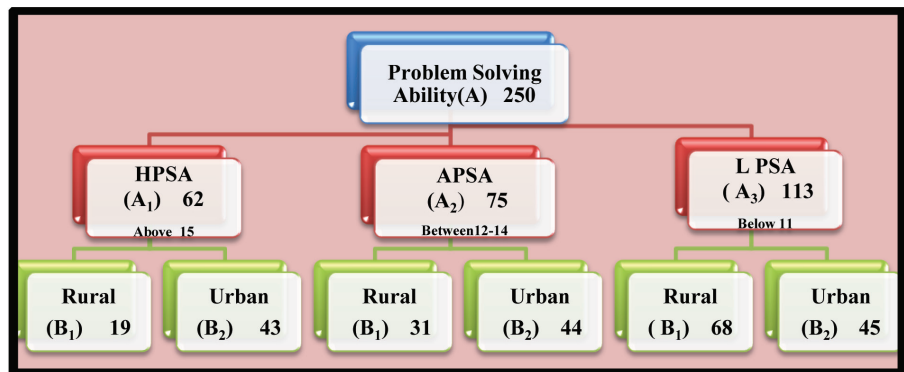


Figure 1: Schematic Layout of 3x2 Factorial Designs with breakup Details of the Sample Selected for the Study.

Tool used:

Problem Solving Ability Test (PSAT) developed by [6] with 20 questions was used to determine the level of problem solving ability among high school students. The reliability calculated through split-half reliability coefficient was found to be 0.78 and the reliability also calculated through rational equivalence method was found to be 0.76. The validity of this scale was determined by finding correlation of scores with standardized test.

Statistical Techniques Employed

Means and S.Ds. were used on the scores of achievement of school students under study. Analysis of Variance (ANOVA) with 3×2 factorial design was employed to study the main effects and interactional effects of independent variables (Problem solving ability & locality) on dependent variable (Academic Achievement) supplemented by t-test. To test the assumption of homogeneity of variance for ANOVA, Levene's Test of homogeneity of variance was employed. The data was analyzed through SPSS.

4. DATA ANALYSIS AND DISCUSSION

This section explores the effect of problem solving ability and locality on academic achievement of 10th class students. In the present study, the value of homogeneity of variance was calculated by Levene's test and it was 1.705 which is not significant at 0.05 level. It means that variance of all the six groups were similar.

In order to study the main and interaction effects of problem solving ability and locality on academic achievement of the school students, data was subjected to analysis of variance of (3×2) factorial study with a randomized group design. In this section, the first independent variable i.e. problem solving ability coded as (A) was varied into three group high problem solving ability (A_1), average problem solving ability (A_2) and low problem solving ability (A_3). The second independent variable i.e. locality coded as (B) was varied at two levels rural (B_1) and urban (B_2). A schematic layout of the factorial design used in the study for the variables problem solving ability and locality has been presented in Fig.1. The means and S.D.'s of different sub-samples have also been presented in the Table-1. Mean achievement scores of school students in relation to problem solving ability and locality has been presented graphically in Fig. 2.

Table 1: Means and S.D's of Sub Samples for Mean Achievement Scores of School Students with respect to Problem Solving Ability & Locality.

Groups	Locality	N	Mean	S. D.
High PSA (A_1)	Rural(B_1)	19	87.43	6.507
	Urban(B_2)	43	69.40	13.78
Average PSA (A_2)	Rural(B_1)	31	67.12	9.85
	Urban(B_2)	44	69.83	13.95
Low PSA (A_3)	Rural (B_1)	68	68.70	11.37
	Urban(B_2)	45	59.65	11.21

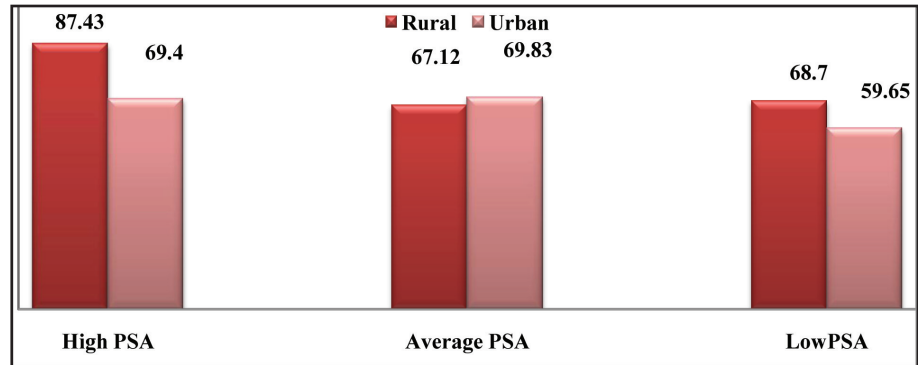


Figure 2: Mean Achievement Scores of Sub Samples of School Students with respect to Problem Solving Ability (PSA) & Locality.

Table 2: Summary of Two-way ANOVA for Mean Achievement Scores of School Students with respect to Problem Solving Ability and locality.

Sources of variation	DF	SS	MS	F-ratio
PSA(A)	2	7199.72	3599.85	25.70**
Locality (B)	1	3535.29	3535.29	25.23**
PSA*Locality(A*B)	2	3421.74	1710.87	12.21**
Between cell	5	10505	
Within subjects	244	34183.93	140.098	
Total	249	44688.93		

**Significant at 0.01 level

Main Effect

Problem Solving Ability (A)

It is evident from Table-2 that F-ratio for the effect of problem solving ability on academic achievement of school students is 25.70 which is significant at 0.01 level leading to the inference that problem solving ability is one of the main influential factors in determining academic achievement. It means that the students having the problem solving approach showed much better academic achievement. The reason behind may be that problem solving ability helps students to think and find the solutions more systematically and logically. This result is supported by [12] who revealed that problem solving ability was a true determinant of academic achievement. In order to investigate further, the

't'-test has been further employed to find out the significance of difference in mean scores of academic achievement for different groups and has been given in Table 3

Table 3: 't'-values for the Mean Achievement Scores of School Students with respect to Problem Solving Ability.

Groups of PSA	N	Mean	S.D.	t-values			
HPSA vs. APSA	62	75	74.93	68.71	14.6	12.4	2.64**
APSA vs. LPSA	75	113	68.71	65	12.4	12	2.04*
LPSA vs. HPSA	113	62	65	74.93	12	14.6	4.48**

** Significant at 0.01 level

* Significant at 0.05 level

HPSA=High Problem Solving Ability; APSA=Average Problem Solving Ability; LPSA=Low Problem solving Ability

It is clear from Table-3 illustrates that 't'-value 2.64 for the mean scores of academic achievement between the high PSA and average PSA of school students is significant at 0.01 level. The 't'-value 2.04 for the mean scores of academic achievement between the average PSA and low PSA of school students is significant at 0.05 level. The 't'-value 4.48 for the mean scores of academic achievement between the high PSA and low PSA of school students is significant at 0.01 level. In the context of mean scores, it was found that the mean score of academic achievement of school students of high PSA (74.93) is higher than those students of average PSA (68.71) and low PSA students (65). The reason is that high problem solving ability helps in developing critical thinking in students, which helps in concept formation that is pre- condition for the good academic performance. This result is in agreement with the findings of [9] who reported that the students who are high achievers in problem solving showed superior academic achievement. This result is in agreement with the findings of [11] who reported that the high problem solving ability students showed higher academic achievement. The mean achievement scores for the main effect corresponding to problem solving ability on academic achievement have been presented in Fig. 3

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Locality (B)

It can further be inferred from the Table-2 that F-ratio for the effect of locality on academic achievement is 25.23 which is significant at 0.01 level. It indicates that locality has also play significant role in determining academic achievement of school students. This finding is in agreement with the findings of [7]; [11]; [15] who found that rural and urban differ significantly on academic achievement and problem solving ability. In order to investigate further, the 't'-value was computed and has been given in Table-4.

Table 4: 't'-values for the Mean Achievement Scores of School Students with respect to Locality.

Group	N	Mean	S.D.	't'- value
Rural	118	71.30	12.5	3.06**
Urban	132	66.22	13.76	

**Significant at 0.01 level

It can be inferred from Table-4, 't'-value 3.06 for the mean scores of academic achievement between the rural and urban school students is significant at 0.01 level. In the context of mean scores, it is found that the mean score of academic achievement of rural school students (71.30) is higher than urban school students (66.22). The present finding is in agreement with the findings of [7] and [10] who revealed that rural students had higher academic achievement in relation to problem solving ability than urban one. The mean scores for main effect of locality on academic achievement have been presented in Fig. 3.

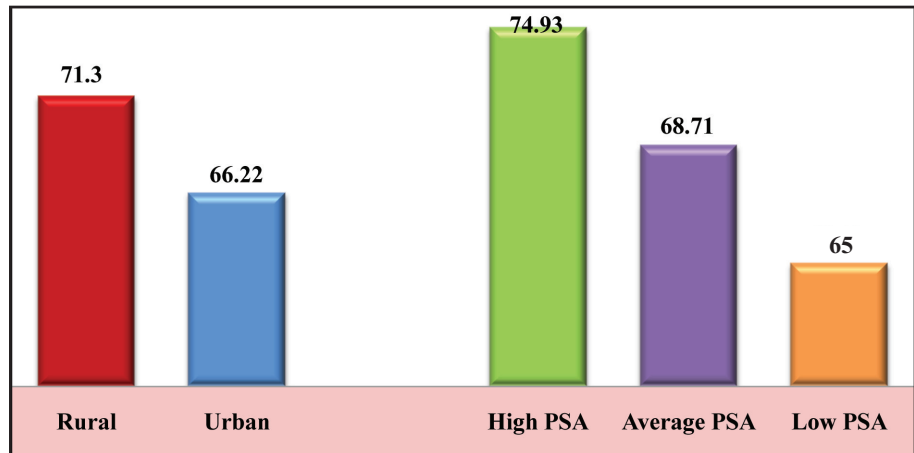


Figure 3: Mean Achievement Scores for main effect of Locality & Problem Solving Ability on Academic Achievement of School Students

Interaction Effects of Problem Solving Ability (A) and Locality (B) on Academic Achievement of School Students (A×B)

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It can further be seen from Table-2, that F-ratio for the interaction effect of problem solving ability & locality on academic achievement of school students is 12.21 which is significant at 0.01 leading to inference that the interaction of problem solving ability and locality has played considerable role in determining academic achievement. The ‘t’ test was further employed to find out the significance of difference in mean scores of academic achievement for different group of problem solving ability and locality. The results for the same have been presented in the Table-5.

Table 5: ‘t’- values for Mean Achievement Scores of School Students for different Groups of Problem solving ability (A) × Locality (B)

Sr. No.	Group		N		Mean		S.D.		‘t’ values
	I	II	I	II	I	II	I	II	
1	A ₁ B ₁	A ₂ B ₁	19	31	87.43	67.12	6.50	9.85	8.75**
2	A ₁ B ₂	A ₂ B ₂	43	44	69.4	69.83	13.78	13.91	0.078(NS)
3	A ₁ B ₁	A ₂ B ₂	19	44	87.43	69.83	6.50	13.91	6.85**
4	A ₂ B ₁	A ₁ B ₂	31	43	67.12	69.40	9.86	13.78	0.83 (NS)
5	A ₁ B ₁	A ₁ B ₂	19	43	87.43	69.40	6.50	13.78	6.70**
6	A ₂ B ₁	A ₂ B ₂	31	44	67.12	69.8	9.86	13.91	0.98 (NS)
7	A ₂ B ₁	A ₃ B ₁	31	68	67.12	68.7	9.86	11.37	0.70 (NS)
8	A ₂ B ₂	A ₃ B ₂	44	45	69.83	59.65	13.91	11.21	3.68**
9	A ₃ B ₁	A ₃ B ₂	68	45	68.7	59.65	11.37	11.21	4.18**
10	A ₂ B ₁	A ₃ B ₂	31	45	67.12	59.65	9.86	11.21	3.08**
11	A ₂ B ₂	A ₃ B ₁	44	68	69.83	68.7	13.91	11.37	0.44 (NS)
12	A ₁ B ₁	A ₃ B ₁	19	68	87.43	68.7	6.50	11.37	9.27**
13	A ₁ B ₂	A ₃ B ₂	43	45	69.40	59.65	13.78	11.21	3.64**
14	A ₁ B ₁	A ₃ B ₂	19	45	87.43	59.65	6.50	11.21	12.40**
15	A ₁ B ₂	A ₃ B ₁	43	68	69.40	68.7	13.78	11.37	0.28 (NS)

** = Significant at 0.01 level

NS = Not Significant

A₁ = High PSA, A₂ = Average PSA, A₃ = Low PSA, B₁ = Rural B₂ = Urban

It is evident from a close perusal of the Table-5 that with respect to effect of problem solving ability and locality on academic achievement of school students, all the groups were found to be significant except the six groups i.e. (A₁B₂ vs. A₂B₂), (A₂B₁ vs. A₁B₂), (A₂B₁ vs. A₂B₂), (A₂B₁ vs. A₃B₁), (A₂B₂ vs. A₃B₁) & (A₁B₂ vs. A₃B₁). The mean achievement scores of school students

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for different groups of problem solving ability and locality have also been presented through histograms in the Fig. 4

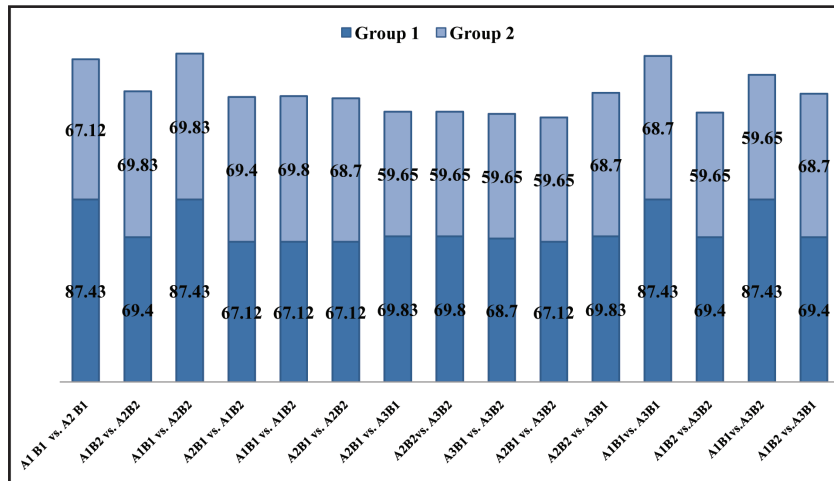


Figure 4: Mean Achievement scores of School Students for different groups of Problem Solving Ability (A) × Locality (B).

The interaction effect of problem solving ability and locality on academic achievement has been shown in Fig. 5. The graphical presentation for A×B interaction indicates that there is a significant interaction effect problem solving ability and locality factors on academic achievement as the three lines of different Problem solving abilities intersect each other.

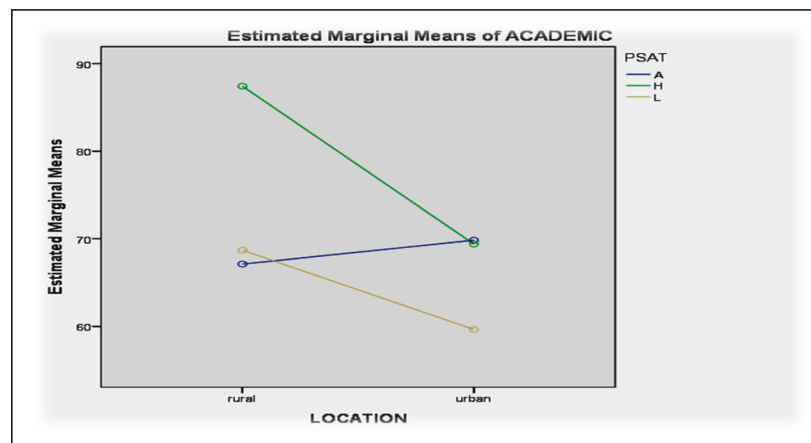


Figure 5: The Interaction Effect of Problem Solving Ability & Locality on the Mean Achievement Scores of School Students.

5. FINDINGS OF THE STUDY

- Problem solving ability had a significant effect on the academic achievement of school students leading to the inference that students of high problem solving ability have highest academic achievement to the students with average problem solving ability and low problem solving ability.
- Locality was found to have a significant effect on academic achievement of school students. There was a significant difference in academic achievement between rural and urban school students. In the context of mean achievement scores, it was revealed that rural school students found high academic achievement as compare to urban school students.
- As significant interaction effect of problem solving ability and locality was found on academic achievement of school students. Further investigations with the help of t- test revealed that
 - The rural school students having high problem solving ability were reported to have significant highest academic achievement than average and low problem solving ability students. While rural school student with average problem solving ability possessed high academic achievement than students with low problem solving ability.
 - The urban school students having high problem solving ability & average problem solving ability were reported to have higher academic achievement than low problem solving ability. While no significant difference was found in academic achievement of urban school students with high problem solving ability and average problem solving ability.
 - It was found that the rural school students with high problem solving ability also possessed higher academic achievement than the urban school students with average problem solving ability. The rural school students having average problem solving ability were found to have higher academic achievement than urban school students with low problem solving ability. While no significant difference was found in academic achievement of rural students with average problem solving ability and urban school students with high problem solving ability.
 - The rural school students with high problem solving ability were reported to have significant higher academic achievement than the students of urban area with high problem solving ability. It was also found that the rural & urban area having average problem solving ability were same academic achievement. The rural school students

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having low problem solving ability reported to have significant higher academic achievement from urban school students having low problem solving ability.

- No significance differences was found in academic achievement of urban school students with average problem solving ability and rural area having low problem solving ability as well as urban school students with high problem solving ability and rural school students with low problem solving ability.

6. EDUCATIONAL IMPLICATIONS

In the present study, it was found that there is very much influence of problem solving ability on the academic achievement of students. Problem solving is an individualized process, which requires various strategies to tackle. The classroom teacher can develop a scientific approach to solve problems that the students are expected to face in social life. The implication of this study is that all pupils can be provided an environment, which is suitable according to their behaviour so that their creativity may be flourished. Moreover, home & school can play important roles in developing a positive attitude for the development of creativity among students. Teacher can use pedagogical strategies for foster problem solving ability. The low level of problem solving ability is a pointer towards “learning deficiency syndrome” and needs attention of school authorities. So school authorities need to take steps to diagnose the crucial difficulty areas in basic education. For this purpose, the school teachers are required to be trained for use of diagnostic and criterion based evaluation procedures to make teaching-learning process more effective as well as child centered to enhance level of problem solving ability. Teaching methodology and techniques may need to be revised to increase the problem solving ability. It is the responsibility of the teachers to identify such students who have low problem solving abilities and try to modify their learning and thinking power through various audio-visual aids. Teachers must encourage students to adopt a reasonable risk-taking attitude while solving problems. Risk-taking attitude leads the students to overcome mental fixation while solving problems. The finding of the study also exhibited demographic variable such as locality has significant effect on the academic achievement of school students. The rural students possess significantly higher academic achievement than the urban counterparts does. Studies such as this one can assist with the understanding of student’s problem solving ability of different locality from an empirical point of view. In brief, it has been concluded that problem solving ability of the students help them building strong cognitive ability which is needed for high achievement and enrolled in reliable future career choice.

REFERENCES

- [1] Adesoji, F. A. (2008). Students' ability levels and effectiveness of problem solving instructional strategy. *Journal of Social Sciences*, **17** (1), 5-8.
- [2] Adeyemo, S. A. (2010). Students' ability level and their competence in problem-solving task in physics. *International Journal of Education Research and Technology (IJERT)*, **1** (2), 35-47.
- [3] Battle, J. & Lewis, M. (2002). To Increasing significance of class: the relative effect of race and socioeconomic status on academic achievement. *Journal of Poverty*, **6**(2), pp.21.
http://dx.doi.org/10.1300/J134v06n02_02
- [4] Darchingpui A. (1989). A study of science achievement, science attitude and problem solving ability among school students in Aizawl. *North Eastern Hill University. In Fifth Survey of Educational Research. (1997). 2. N.C. E.R.T., New Delhi.*
- [5] Dhir, T. (2014). Problem solving ability and science process skills as the influential factors of scientific creativity. *International Journal of Research Pedagogy & Technology in Education & Movement Science (IJEMS)*, **2** (4), 11-17.
- [6] Dubey, L. N. (2006). *Manuals and consumable booklet of problem solving ability test*. Agra, National Psychological Corporation.
- [7] Gakhar & Aseema (2004). Influence of self-concept stress, locality and gender on the academic achievement and reasoning ability of adolescents. *Prachi Journal of Psycho-cultural Dimensions*, **20** (1), 25-28.
- [8] Gupta, R. (2013). Problem solving ability and academic achievement among the students belonging to scheduled tribe and scheduled caste categories. *International Journal of Research Pedagogy and Technology in Education and Movement Science*, **1**(3), 95-107.
- [9] Gupta, M., Pasrija, P. & Kavita (2015). Effect of problem solving ability on academic achievement of high school students: A comparative study. *Bhartiyam International Journal of Education & Research*, **4** (II), 46-59.
- [10] Jeotee, K. (2012) Reasoning skills, problem solving ability and academic ability: implications for study programme and career choice in the context of higher education in Thailand., *Durham Theses, Durham University. Available at Durham E-Theses Online: <http://etheses.dur.ac.uk/3380/retrived> on May14, 2014.*
- [11] Kalhotra K. S. (2014). A study of problem solving behavior of eighth class students in relation to their creativity. *International Invention Journal of Arts and Social Sciences*, **1**(1), 1-6.
- [12] Kousar P. (2010). Effect of the problem-solving approach on academic achievement of students in mathematics at the secondary level. *Contemporary Issues in Education Research*, **3**(3), 9-14.
<http://dx.doi.org/10.19030/cier.v3i3.181>
- [13] Kumar, S. and Avaradi , S. S. (2014). Problem solving ability and academic achievement among sc/st students in Gulbarga district. *Indian Streams Research Journal*, **4**(9), 1-5, Available online at www.isrj.netretrived on October 30, 2014.

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Pasrija, P.

- [14] Mayer, R. E. and Wittrock, M. C. (2006). *Problem solving*. In P. A. Alexander & P. H. Winne (Eds.) *Handbook of Educational Psychology*, 287–303. Mahwah, NJ: Lawrence Erlbaum
- [15] Nataraj P. N. and Manjula M. (2012). A study of problem solving ability among the matriculation school students. *International Journal of Teacher Educational Research (IJTER)*, **1(4)**, 44-51.
- [16] Polya G. (1981) *Mathematics and Plausible Reasoning*. Princeton, NJ: Princeton University. Press.
-
- [17] Sharma, I. (2007). Problem solving abilities and scientific attitude as determinant of academic achievement of higher secondary students. *Journal of All India Association for Educational Research*, **19(12)**, 68-69.