LOGICAL THINKING AND LOCALITY AS THE DETERMINANTS OF ACADEMIC ACHIEVEMENT AMONG SCHOOL STUDENTS

Dr. Madhu Gupta*

Ms.Kavita**

ABSTRACT

The power of thinking and reasoning considered the essential tools for the welfare and meaningful existence of the individual as well as society. Logical thinking plays fundamental role in construction of the concept and a requirement for success in course& training. Keeping this in view, the present study was designed to examine empirically the effect of logical thinking on the academic achievement of rural and urban school students. A research was conducted on sample of 250 school students (118 rural & 132 urban) studying in X^{th} class CBSE affiliated private schools that were randomly selected from different institutions of Rohtak district of Haryana State. Descriptive survey method was used to elicit opinion of rural and urban school students about their logical thinking and their scholastic achievement at school. The Logical thinking of the sample was assessed by using Kumar & Tiwari's Logical-thinking test (LTT-KSTS) (2005) & for the academic achievement of students, the school record i.e. a marks obtained by the students in previous class was considered. The data was analyzed statistically by using 3×2 ANOVA supplemented by t-test. The findings of the study revealed that logical thinking had a significant impact on the academic achievement of student whereas significant difference was observed in academic achievement of the students studied in rural and urban school. However, the significant interaction effect of logical thinking and locality on the academic achievement of students was found.

Keywords: Logical Thinking, Academic Achievement, Locality etc.

* **Professor, Department of Education, MDU, Rohtak**

** **Department of Education, Rohtak**

INTRODUCTION

Enduring the survival of civilization in the planet and improving their quality of life depends on many factors and the basic factor is the ability of human kind as a thinking creature to develop outlook and behavior skills in agreement with environment. Such a characteristic exists in only human kind who has thinking and learning skills. Beyond these abilities bestowed by the nature, they could not have had any of the acquisitions obtained and attained today. On the other hand, human kind used learning and teaching concept as a primary and indispensable tool in order to provide their continuances in the planet they live, facilitate their lives and improve their quality of life thanks to their thinking ability. Learning and teaching concepts have stylistically changed and differentiated throughout time. Academic development of the pupil is the primary concern and the most important goal of education. 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 most general sense, academic achievement means the level of attaining aims predicted in a certain educational process. Wikipedia: The Free Encyclopedia (2011) [15] also defines educational or academic achievement as specified level of attainment proficiency in academic work as evaluated by the teacher, by standardized tests or by combination of both. Literature includes studies explaining, predicting and controlling academic achievement concept with different parameter and variables (Crosnoe, Johnson & Elder, 2004[6];Akçay et al., 2007[1]; Bayrak, 2007[2]). One of these perceptions is explaining and predicting academic achievement with cognitive and affective variables. Bloom(1976)[4] stated that there are three key areas contribute to academic success; (1) Cognitive entry skills and IQ (50%), (2) Quality of instruction (25%); and (3) Affective characteristics (25%).

Regarded as a universal human trait, the ability to think logically, follow the rules of logic inference, traditionally has been defined as higher cognition skill. Cognitive is concerned with thinking and development is about change overtime. Therefore, cognitive development is about

how children thinking are changes overtime. It also encompasses learning and intelligence. Children are often thought of being less intelligent and knowing less than adults are. A major shift in thinking about cognitive development came with the move these quantitative beliefs to more qualitative approaches. Piaget's contribution to stages of cognitive development was profound, as the researches followed were aimed at testing his ideas. Logical thinking, in Piaget's development scheme, is operational, which means that it does not appear before the concrete operational stage. Logical thinking includes the abilities of using numbers effectively, providing scientific solutions to problems, detecting the separations between the concepts, classifying, generalizing, representing with a Mathematical formula, computing, providing a hypothesis, testing and simulating (Demirel, 2003)[7]. Logical thinking process has been followed sequences that help thinker to reach at the solution .A clear goal; systematic planning; using information; logical reasoning and checking conclusion are steps of logical thinking process.

Theoretical Background

Previous research studies have concluded that the ability of logical thinking had a fundamental role in students' performance and their concept's construction (Lawson et. al., 2006 [12]; Bayram & Comek, 2010 [3]; Jeotee, 2012 [13]). Some studies like (Fah, 2009[8]; Kıncal & Yazgan, 2010 [10]) indicated that student's achievement is related to logical thinking abilities. Moreover, they pointed that there were significant differences in the students' formal operational thinking abilities based on the variables of types of the school, academic success, socio-economic and socio-cultural background. Literature points out that among the priorities of the Mathematics and Science education was developing students' logical thinking abilities (Lawson, 1982) [11]. (Chand & Sharma, 2012 [5]) Improving the ability of logical thinking is a key factor for conceptual learning since constructivist process that forms the conceptual knowledge requires logical thinking operations. Reasoning abilities were related to students' achievement (Yilmaz & Alp, 2006) [16]. Fah (2009) [8] revealed that there were differences in the logical thinking abilities based on the gender variable. Most of the studies given above have been carried out to assess the logical thinking with different variables. However, no study has been carried out to study the effect of logical thinking on academic achievement of rural and urban students.

Therefore, the present study has been designed to study the effect of logical thinking and locality on academic achievement of school students.

OBJECTIVES OF THE STUDY

The present study is designed to meet the following objectives:

1. To study the effect of logical thinking on academic achievement of school students.
2. To study the effect of locality on academic achievement of school students.
3. To study the interaction effect of logical thinking and locality on academic achievement of school students.

DESIGN OF THE STUDY

Method: Descriptive survey method was used in this study.

Sample

In the present study, random sampling technique was employed to select the sample of 250 students of X^{th} class studying in private secondary schools affiliated to CBSE of Haryana State. These were further classified on the basis of locality i.e. rural (118) and urban (132) and on the basis of logical thinking i.e. high logical thinking (40), Average logical thinking (179) & Low logical thinking (31). The systematic layout of factorial design along with break up detail of sample of study is shown in fig.1

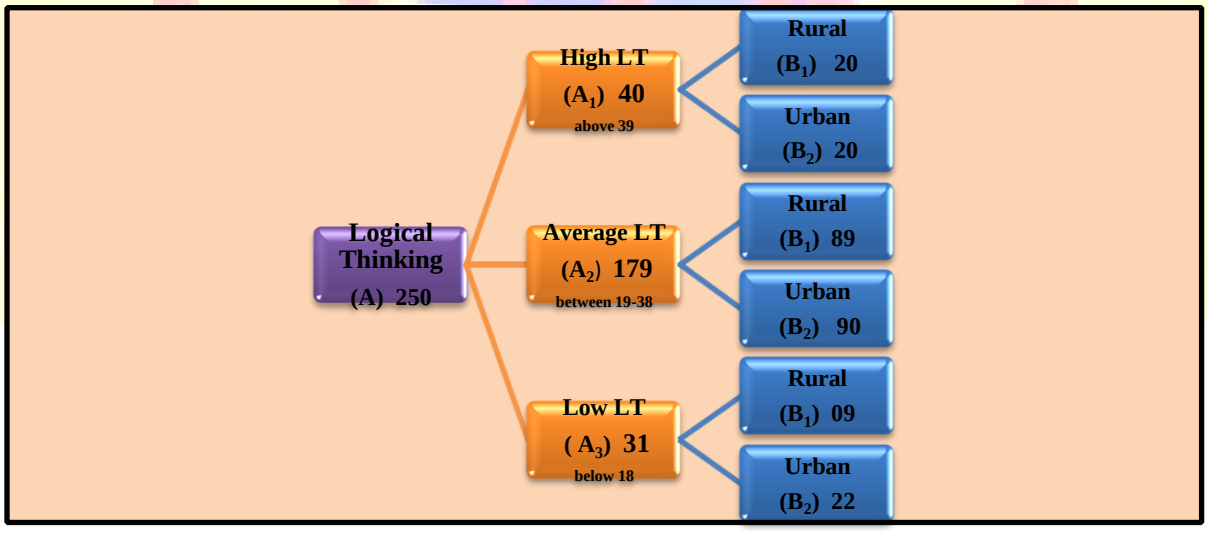

Fig 1: Schematic Layout of 3×2 Factorial Designs along with breakup detail of Sample for the study

Tools Used

Logical Thinking Test (LTT-KSTS) developed by Kumar and Tiwari (2005) [9] was used to determine the logical thinking among school students. There were 50 items from the five areas Series/ Sequence, Completing the analogous pair, Classification, Coding-decoding, Relationship i.e.10 items from each area. Each question consisted of four options was awarded one mark for correct response. The reliability of the test was calculated through split half reliability coefficient & it was 0.827. The present test was validated by finding correlation & it was 0.7277.

Statistical Techniques Employed

Means and S.Ds were used to analyze the data of achievement scores 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 (logical thinking & 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 by using SPSS.

DATA ANALYSIS & DISCUSSION

This section investigates the effect of logical thinking and locality on academic achievement of the school students. The value of homogeneity of variance calculated by Levene's test was fund to be 0.11 which does not fall in critical region. Therefore, it means that the variances of six groups are homogenous.

In order to study the main and interaction effects logical thinking and locality on academic achievement of the school students, data was subjected to analysis of variance of a (3×2) factorial study with a randomized group design. The first independent variable i.e. logical thinking coded as A was varied into three groups of logical thinking –High logical thinking (A_1), Average logical Thinking (A_2) and Low logical thinking (A_3). The second independent variable i.e. locality coded as B was categorized as Rural (B_1) and urban (B_2). A layout of the factorial design used in the study for the variables logical thinking and locality has already been presented in Fig. 1.The means and SDs of different sub-samples have also been presented in the Table-1.

Mean achievement scores of school students in relation to logical thinking and locality have been presented graphically in Fig. 2.

Table–1: Means and S.D's of Sub Samples for Academic Achievement of School Students with respect to Logical Thinking

Logical Thinking	Locality	N	Mean	S. D.
High LT (A_1) (40)	Rural (B_1)	20	77.87	14.33
	Urban(B_2)	20	70.86	14.90
Average LT (A_2) (179)	Rural(B_1)	89	70.86	11.66
	Urban(B2)	90	64.69	12.32
Low LT (A_3) (31)	Rural (B1)	9	60.9	8.42
	Urban(B2)	22	68.25	17.3

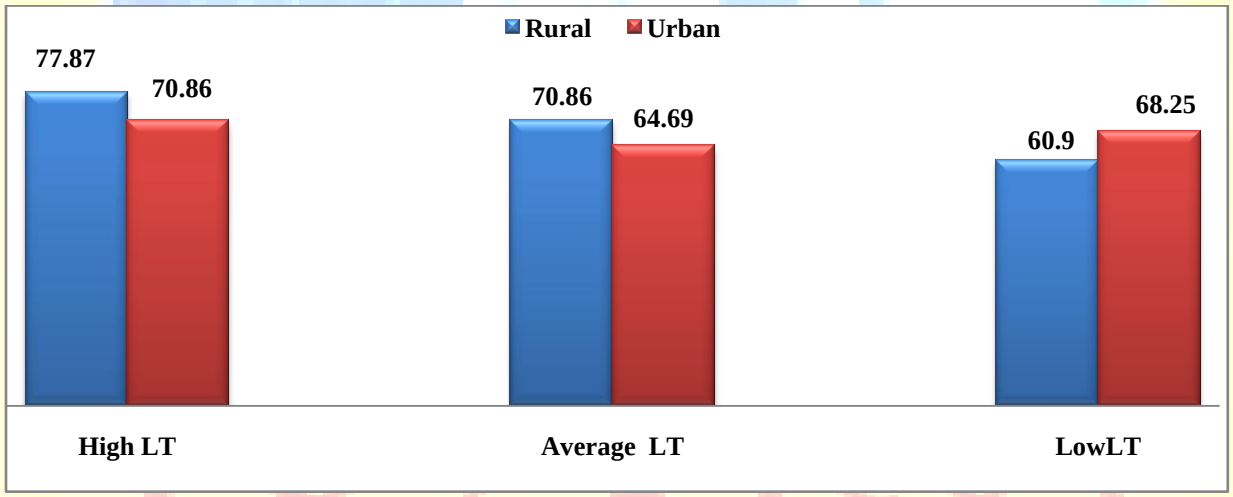

Fig.2: Mean Achievement Scores of Sub Samples of School Students with respect to Logical Thinking (LT) and Locality

Table–2: Summary of Two Way ANOVA for Mean Achievement Scores of School Students with respect to Logical Thinking and Locality

Sources of variation	Df	SS	MS	F-ratio
LT(A)	2	1857.447	928.723	5.59**

Locality (B)	1	123.87	123.87	0.746(NS)
LT× Locality (A×B)	2	1068.479	534.235	3.22*
Between cells	5	4181.835	…..	
Within subjects	244	40507.098	166	
Total	249	44688.933		

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

Main Effect

Logical Thinking (A)

It is evident from Table-2 that F-ratio for the effect of logical thinking on academic achievement of school students is 5.59 which is significant at 0.01 leading to the inference that logical thinking is one of the main determinants of academic achievement. It means that the students having logical thinking showed much better academic achievement. This result is in agreement with the findings of Bayram and Comek (2010) [3] who reported that the logical thinking students showed higher academic achievement. In order to investigate further, 't' test was employed to find out the significance of difference in mean scores of academic achievement for different groups of logical thinking and has been given in Table-3

Table-3: 't'-values for the Mean Achievement Scores of School Students with respect to Logical Thinking

Groups of LT	**N**		**Mean**		**S.D.**		**t-value**
HLT vs. ALT	40	179	74.69	67.76	14.8	12.3	2.76**
ALT vs. LLT	179	31	67.76	66.13	12.3	15.5	0.56(NS)
LLT vs. HLT	31	40	66.13	74.69	15.5	14.8	2.38*

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

HLT=High Logical Thinking; ALT=Average Logical Thinking;

LLT=Low Logical Thinking.

It is clear from Table-3 illustrates that 't'-value 2.76 for the mean scores of academic achievement between the High LT and Average LT of school students is significant at 0.01 level. It illustrates that there is significant difference between high LT and average LT. The 't'-value 0.56 for the mean scores of academic achievement between the average LT and Low LT of school students is not significant . The 't'-value 2.38 for the mean scores of academic achievement between the high LT and low LT of school students is significant at 0.05 level. In the context of mean scores, it is found that the mean score of academic achievement of school students in High LT (74.69) is higher than those students in Average LT (67.76) and Low LT students (66.13). This result is in agreement with the findings of Bayram and Comek (2010) [3] who reported that the high logical thinking students showed higher academic achievement. The mean achievement scores for main effect corresponding to logical thinking on academic achievement have also been presented in Fig. 3.

Locality (B)

Table-2 further indicates that the F-ratio for effect of locality on academic achievement of school students is 0.746 which is not significant. It indicates that rural students and urban student do not differ in their academic achievement.

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	1.96(NS)
Urban	132	68.22	12.76	

NS = Not significant

It can be inferred from Table-4 that 't'-value 1.96 for the mean scores of academic achievement between the rural and urban school students is not significant. This finding is contrary with Ramanandanan & Naseem (2013) [14] who revealed that locality was also found to be influencing the thinking style of students. In the context of mean scores, it is found that the mean score of academic achievement of rural students (71.30) is higher than those urban students (68.22). It reveals that rural students have higher academic achievement in relation to logical

thinking than urban one but this difference is not significant statistically. The mean scores for main effect of locality on academic achievement have been presented in Fig. 3.

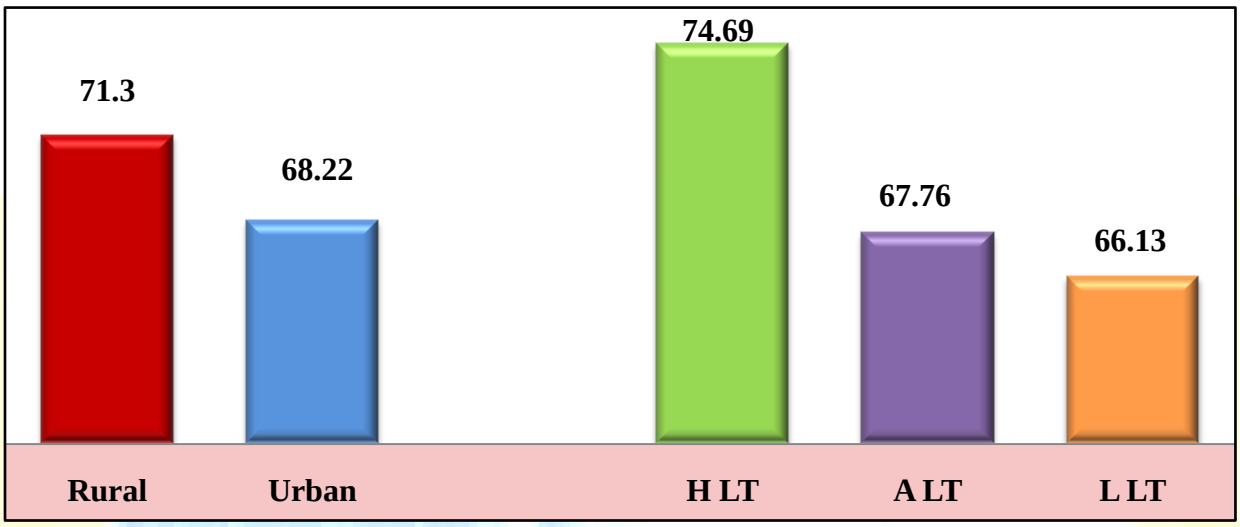

Fig. 3: Mean Achievement Scores for Main Effect of Logical Thinking and Locality on Academic Achievement of School Students

Interaction Effect of Logical Thinking (A) and Locality (B) on Academic Achievement of School Students (A×B)

The F- ratio vide Table-2, for interaction between logical thinking and locality on academic achievement is 3.22 which is significant at 0.05 level leading to inference that the interaction of logical thinking 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 groups of logical thinking 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 Logical thinking (A) × Locality (B)

S.NO.	Group		N		Mean		S.D.		't' value
	I	II	I	II	I	II	I	II	

1	**A_1B_1**	**A_2B_1**	20	89	77.8	70.87	14.3	11.6	2.02 *
2	**A_1B_2**	**A_2B_2**	20	90	70.86	64.69	14.9	12.3	1.73 (NS)
3	**A_1B_1**	**A_2B_2**	20	90	77.8	64.69	14.3	12.3	3.81**
4	**A_2B_1**	**A_1B_2**	89	20	70.87	70.86	11.6	14.9	.003 (NS)
5	**A_1B_1**	**A_1B_2**	20	20	77.8	70.86	14.3	14.9	2.03*
6	**A_2B_1**	**A_2B_2**	89	90	70.87	64.69	11.3	12.3	3.45 **
7	**A_2B_1**	**A_3B_1**	89	9	70.87	60.94	11.6	8.42	3.25**
8	**A_2B_2**	**A_3B_2**	90	22	64.69	68.25	12.3	17.36	0.91 (NS)
9	**A_3B_1**	**A_3B_2**	9	22	60.94	68.25	8.42	17.36	1.58 (NS)
10	**A_2B_1**	**A_3B_2**	89	22	70.87	68.25	11.6	17.36	0.671(NS)
11	**A_2B_2**	**A_3B_1**	90	9	64.69	60.94	12.3	8.42	1.21 (NS)
12	**A_1B_1**	**A_3B_1**	20	9	77.8	60.94	14.3	8.42	3.96 **
13	**A_1B_2**	**A_3B_2**	20	22	70.86	68.25	14.9	17.36	0.52 (NS)
14	**A_1B_1**	**A_3B_2**	20	22	77.8	68.25	14.3	17.36	1.95 (NS)
15	**A_1B_2**	**A_3B_1**	20	9	70.86	60.94	14.9	8.42	2.28*

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

A_1= High LT A_2=Average LT A_3 = Low LT B_1= Rural B_2= Urban

It is evident from a close perusal of the table-5 that with respect to effect of logical thinking and locality on academic achievement of school students, all the groups were found to be significant except the eight groups i.e. (A_1B_2 vs. A_2B_2),(A_2B_1 vs. A_1B_2), (A_2B_2 vs. A_3B_2), (A_3B_1 vs. A_3B_2), (A_2B_1 vs. A_3B_2), (A_2B_2 vs. A_3B_1),(A_1B_2 vs. A_3B_2)&(A_1B_1 vs. A_3B_2). The mean achievement scores of school students for different groups of logical thinking and locality have also been presented through histogram in the Fig. 4.

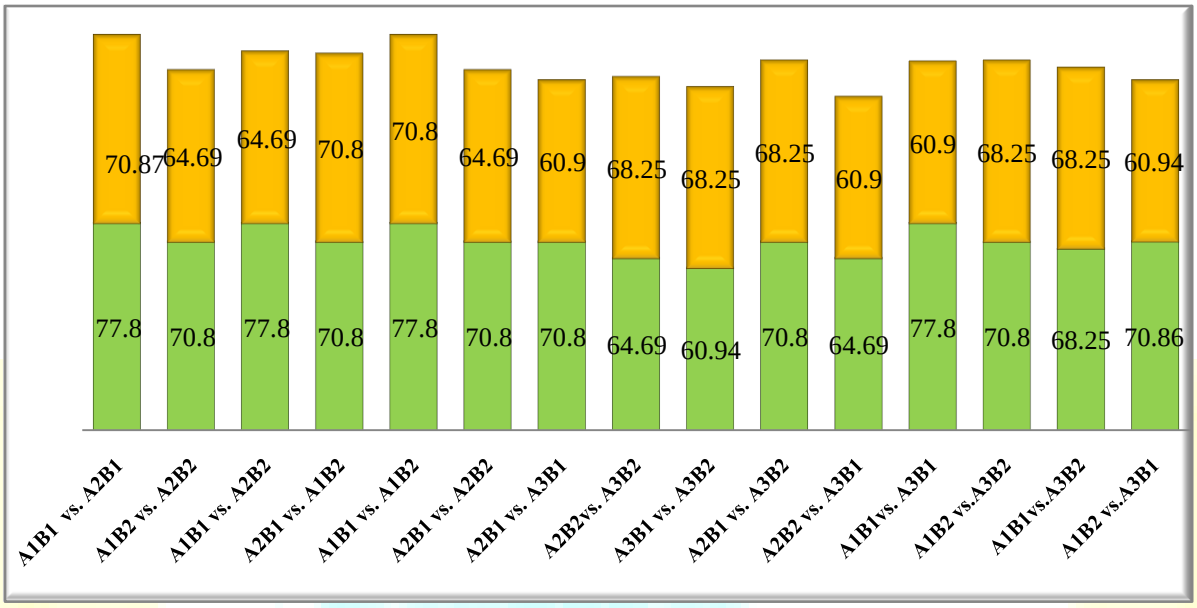

Fig. 4: Mean Achievement Scores of School Students for different groups of Logical Thinking (A) × locality (B)

The Interaction effect of Logical thinking and locality on academic achievement has been illustrated in Fig.5. The graphical presentation for A × B interaction indicates that there is a significant interaction effect logical thinking and locality factors on academic achievement as the three lines of different Logical thinking intersect each other.

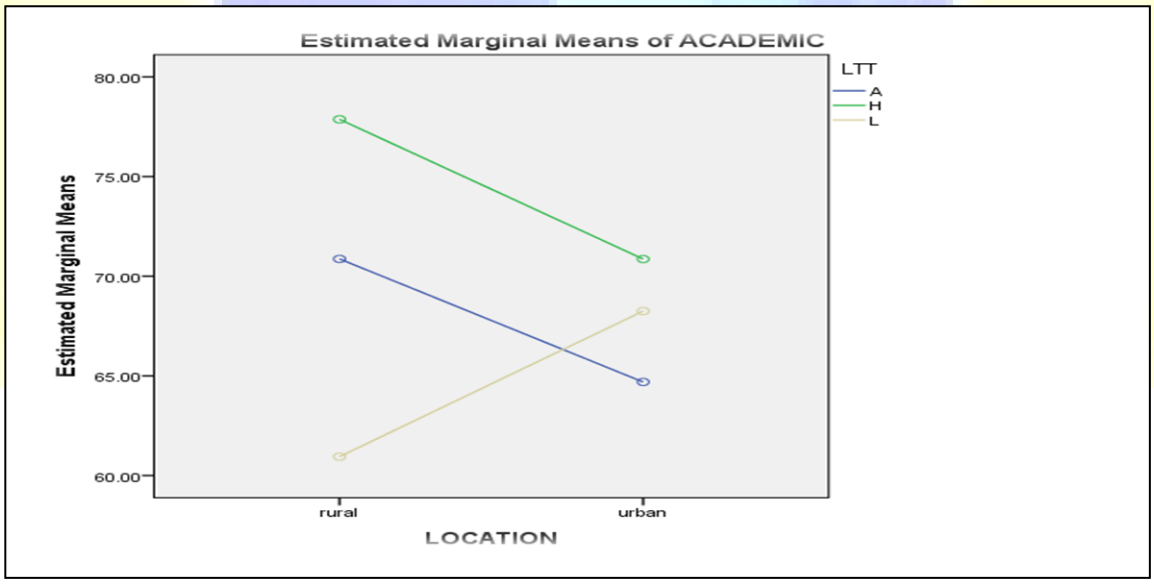

Fig.-5: The Interaction Effect of Logical Thinking and Locality on Mean Achievement Scores of School Students

FINDINGS OF THE STUDY

1. Logical thinking had a significant effect on the academic achievement of school students leading to the inference that students of high logical thinking have highest academic achievement to the students with average logical thinking and low logical thinking.
2. No significant difference was found in academic achievement between rural and urban school students.
3. As significant interaction effect of Logical thinking and locality was found on academic achievement of school students. Further investigations with the help of t-test revealed that:
4. The rural school students having high logical thinking were reported to have significant highest academic achievement than rural school students having average logical thinking and low logical thinking & also reported to have significant high academic achievement than urban school students with high, average and low logical thinking.
5. Whereas no significant difference was found when we compare academic achievement scores of urban schools students of average logical thinking and low logical thinking, leading to conclusion that average logical thinking group students and low logical thinking group students of urban area were equal in their performance.
8. No significant difference found when we compare academic achievement scores of rural school students with low logical thinking and urban area having low logical thinking, leading to conclusion that rural school students with low logical thinking ability and urban area having low logical thinking were equal in their performance.
9. There found no significant difference in the performance of rural school students having average logical thinking and urban area having low logical thinking.
10. Whereas no significant difference was found when we compared academic achievement of urban schools students of average logical thinking and rural schools students with low logical thinking, leading to conclusion that the urban area students with average logical thinking and the rural area students with low logical thinking were equal in their performance.

EDUCATIONAL IMPLICATIONS

The present study has revealed that academic achievement is an important factor contributing to the effectiveness of the education system. The more achievement of the students , the more motivated they would be and more willing to work. The Principals and the school authorities should identify resources through which the atmosphere can be provided to the students in which they may be able to enhance their logical thinking and academic achievement. It was found that there is very much influence of logical thinking on the academic achievement of students. Logical thinking is individualized processes, which require various strategies to tackle. 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 logical thinking. The demographic variables such as locality have significant effect on the academic achievement of school students.

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