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TYPE OF SCHOOL, LOCALITY AND GENDER AS DETERMINANT OF ACHIEVEMENT IN MATHEMATICS AMONG SECONDARY SCHOOL STUDENTS

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Abstract: *The present study was undertaken to examine the achievement in mathematics among secondary school students in relation to type of school, locality and gender. Achievement in mathematics was treated as dependent variable whereas type of school (Govt. & Private), locality (Rural & Urban) and gender (Male & Female) were treated as independent variables. Descriptive survey method was employed for the present study. A sample of 400 students was taken using multi-stage stratified random sampling technique. Mathematics Achievement Scale by Imam and Khatoon (2012) [9] was used to collect the data. Three-Way ANOVA with 2×2×2 factorial design was used to analyze the data. Levene's Test of Homogeneity of Variance was also applied to test the assumption of homogeneity of variance for ANOVA. Main effect of type of school, locality and gender on mathematics achievement among secondary school students was found to be significant. Further, significant interaction effects of type of school & locality; and type of school & gender and locality & gender were reported on achievement in mathematics among secondary school students. On the other side, Triple interaction effect of type of school, locality and gender on mathematics achievement among secondary school students was found insignificant.*

Keywords: *Achievement in mathematics, Locality, Type of school and Gender.*

INTRODUCTION

Education is universally recognized as one of the most fundamental building blocks for a country's progress as it develops the inner abilities and power of an individual. It involves the cultivation of an innocent mind, by instilling values and principles. It also includes the development of skills along with the achievement of one's physical, mental and social development. To put it in technical terms, education consists of defined phases starting from formal education i.e. primary, secondary, higher education and ideally it never ends. If simply stated, it means the process of gaining knowledge, inculcating forms of proper conduct and acquiring technical competency. The process of education is believed to begin

in the womb that continues through all the phases of our life as knowledge is oceanic and one can never claim to have acquired all of it. Education is a purposefully designed process aiming at fostering the harmonious and healthy development of an individual as productive, successful and well adjusted person in the society. It imbibes moral and ethical values in the individuals and their education, in turn, helps in the creation of a healthy society that bears a deep understanding of principles and the philosophy of life. It is concerned with ever-growing man in ever growing society as it teaches us the right behavior, the good manners and making us civilized. Thus education, in real sense, is to humanize humanity and to make life progressive, cultured and civilized. In Fact, there are many factors that affect the academic achievement of the students. These factors include the knowledge and skill of teachers, locality, and gender, type of school and intelligence of the students.

Odiri (2015) [17] revealed that study habits influence students' achievement in mathematics. In some studies no significant difference was found between male and female students (Njubi & Githua, 2013) [15].There were researches who have significant difference between male and female students in mathematics (Ding, Song and Richardson, 2007 [4]). Gallaghar & Kaufman (2005) [6] suggested that gender differences are still prevalent and required attention from researches. Most studies reported that personal and environmental factors can influence students' mathematics achievement. Two key personal factors are math anxiety (Richardson & Suinn, 1972[20]; Tobias, 1978[22]) and attitude towards mathematics (Ma & Kishor, 1997[12]; Nicolaidou & Philippou, 2003) [13]. Environmental factors include the role of teacher (Cheseboro, 2003[2]; Olatunde , 2009[18]) , Teaching streategy (Tyanck & Cuban , 1995[23]) and parental role (Cruz , 2012[2] ; Fan & Chen , 2001[5] ; Kleanthous & Williams , 2010[10]). Bhowmik and Banerjee (2015) [1] examined that a statistical relation was found between achievements in mathematics and anxieties towards mathematics in terms of gender. Mousoulides and Philippou (2005) [14] examined the relationships between motivation beliefs, self regulation strategies use and mathematics achievement. A very few researches available in Indian context do not focus on achievement in mathematics among secondary school students. Hardly any research has been done to know the main effects and interaction effects of type of school, locality and gender on achievement in mathematics among secondary school students. Thus, the present study is an endeavor to investigate the achievement in mathematics among secondary school students with reference to type of school, locality and gender.

VARIABLES USED

- Dependent Variable: Achievement in Mathematics
- Independent Variables: (a) Type of School (b) Locality and (c) Gender.

OBJECTIVES OF THE STUDY

1. To study the main effect of (a) type of school (b) locality and (c) gender on achievement in Mathematics among secondary school students.
2. To study the interaction effect of (a) type of school & locality; (b) locality & gender and (c) type of school & gender on achievement in Mathematics among secondary school students.
3. To study the interaction effect of type of school, locality and gender on achievement in Mathematics among secondary school students.

HYPOTHESES OF THE STUDY

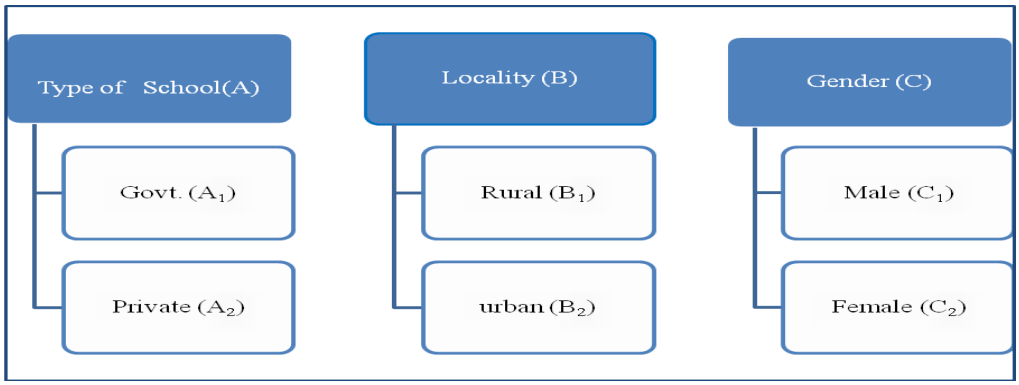
H_{01} There exists no significant effect of (a) type of school (b) locality and (c) gender on achievement in Mathematics among secondary school students.

H_{02} There exists no significant interaction effect of (a) type of school & locality; (b) locality & gender and (c) type of school & gender on achievement in Mathematics among secondary school students.

H_{03} There exists no significant interaction effect of type of school, locality and gender on achievement in Mathematics among secondary school students.

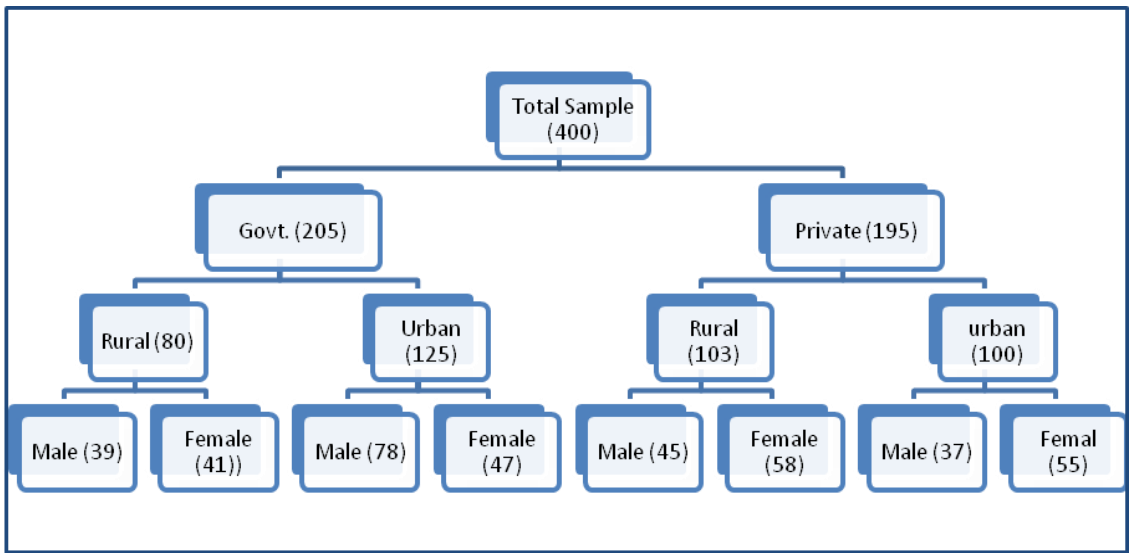
DESIGN AND METHODOLOGY

In the present study, descriptive survey method was used. The 2×2×2 factorial randomized group design was used to analyze the data. All the independent variables i.e. type of school (Govt. & Private), locality (Rural & Urban) and gender (Male & Female) were varied at the two levels which have been shown below in the schematic design:



SAMPLE

A sample of 400 secondary school students was taken using multi-stage stratified random sampling technique. Distribution of sample, on the basis of type of school, locality and gender has been depicted below:



TOOL USED

Mathematics Achievement Scale by Imam and Khatoon (2012) was used to assess the achievement in mathematics among students. This scale consists of 60 statements to measure the achievement. Test-retest reliability of the scale was 0.92.

STATISTICAL TECHNIQUES USED

The data was analyzed using descriptive as well as inferential statistics. The Three-Way Analysis of Variance (ANOVA) with 2×2×2 factorial design was computed using SPSS version 20 to study the main effect and interaction effects of the independent variables i.e. type of school, locality and gender on Achievement in mathematics of secondary school students. Levene's Test of Homogeneity of Variance was used to test the assumption of homogeneity of variance before applying Three-Way ANOVA. Wherever F-value was found significant, 't'-test was employed for further investigation.

DATA ANALYSIS AND DISCUSSION

The objectives of the present study were to find out the main and interaction effects of type of school, locality and gender on mathematics achievement among secondary school students. For this, the data was subjected to analysis of variance (ANOVA) of a (2x2x2) factorial study with a randomized group design. The independent variables type of school;

locality and gender were coded as A, B, C respectively and were varied into two ways as: Govt. (A_1) & Private (A_2); Rural (B_1) & Urban (B_2); and Male (C_1) & Female (C_2). The Mean and S.D of different sub-samples have been presented in the Table-1 and Fig.1. The summary of ANOVA (2×2×2) has also been presented in Table-2, which is analyzed in terms of main effects and interaction effects.

Table-1 Means and SDs of Sub Samples of 2×2×2 Design for Achievement in Mathematics in relation to Type of School (A), Locality (B) and Gender (C)

Type of school (A)	Locality(B)	Male(C_1)	Female (C_2)
Govt. (A_1)	Rural (B_1)	N=39 Mean=15.82 S.D=3.21	N=41 Mean=20.29 S.D=5.66
	Urban(B_2)	N=78 Mean=22.71 S.D=6.16	N=47 Mean=32.89 S.D=6.69
Private (A_2)	Rural(B_1)	N=45 Mean=28.91 S.D=7.27	N=58 Mean=38.51 S.D=7.72
	Urban(B_2)	N=37 Mean=44.27 S.D=5.81	N=55 Mean=55.27 S.D=3.39

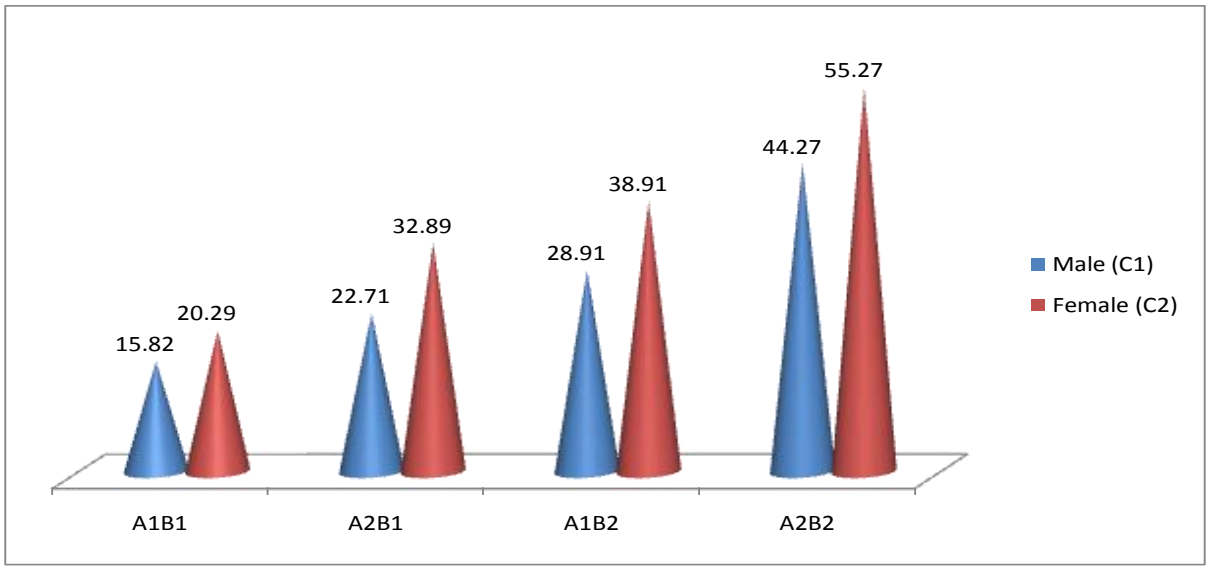


Fig. 1. Mean Scores of sub samples of 2x2x2 Design for Achievement in Mathematics among Secondary School Students in relation to Type of school, Locality and Gender

Table -2 Summary of Three - Way ANOVA (2x2x2 Factorial Design) for Mathematics Achievement among secondary School School Students in relation to Type of School , Locality and Gender

Sources of Variance	Df	Sum of squares	Mean sum of Squares (MSS)	F-ratios
A (Type of School)	1	33542.781	33542.781	**923.05****
B (Locality)	1	15781.341	15781.341	**434.28****
C (Gender)	1	7363.800	7363.800	**202.64****
AxB Interaction	1	942.948	942.948	**25.949****
BxC Interaction	1	298.621	298.621	**8.218***
CxA Interaction	1	210.488.	210.488	**5.792***
AxBxC Interaction	1	109.903	109.903	**3.024(NS)**
Between Cells **With in cells**	7. 392	60758.172 14244.828	8679.739 36.339	**238.856**

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

Main Effect of Gender, Locality and Type of School on Mathematics Achievement among secondary school students

Type of School (A)

From the Table- 2 it is clear that F – ratio (923.05) for the main effect of type of school on Mathematics Achievement among secondary school students at 0.01 levels leading to conclusion that type of school has a significant effect on Mathematics Achievement among secondary school students. Therefore, the null hypothesis $H_{01\ (A),}$ "There exists no significant effect of type of school on mathematics achievement among secondary school student" is **rejected.** The present finding is similar with the results of Khatoon and Mahmood (2011) [9] who also found that significant difference exists among secondary school students on the basis of their type of school.

Locality (B)

It is also observed from the Table -2 that F- ratio (434.28) for the main effect of locality on mathematics achievement among secondary school student is significant at 0.01 level which indicates that locality has a significant effect on mathematics achievement among secondary school students. Therefore, the null hypothesis H_{01} (b), "There exists no significant effect of locality on mathematics achievement among secondary school students" is **rejected**. The finding is similar with the results of Singh & Singh (2007[21]) who has also found that locality has a significant effect on mathematics achievement among adolescents.

Gender (C)

Further, it is clear from the Table -2 that F- ratio (202.64) for the main effect of gender on mathematics achievement among secondary school students is significant at 0.01 level which shows that gender has a significant effect on mathematics achievement among secondary school students . Therefore, the null hypothesis H_{01} (c), "There exist no significant effect of gender on mathematics achievement among secondary school students" is **rejected**. This result is in consonance with the result of Prakash & Pandey (1996) [19] found that males and females have significant difference on the Mathematics Achievement.

Double Interaction effect of Type of school, Locality, and Gender on mathematics achievement among secondary school students

Type of School (A) x Locality (B)

It is evident from Table-2 that F - ratio between type of school and locality (25.949) is significant at 0.01 level which leads to the inference that type of school (A) and Locality (B) interact with each other. Therefore, the null hypothesis H_{02} (a), "There exists no significant interaction effect of type of school and locality on mathematics achievement among secondary school students" is **rejected.** Further t- test was employed to find out the significance of difference between mean mathematics achievement scores of different groups. The results have been shown in the table- 3.

Table-3 't'- values for Mean Scores of mathematics achievement among secondary school students for Different groups of Type of School (A) x Locality (B)

Group	N		Mean		SD		t-values
A_1B_1 vs A_2B_1	80	103	18.11	34.32	5.12	8.89	**14.52***
A_1B_2 vs A_2B_2	125	92	26.54	50.84	8.04	7.04	**23.15***
A_1B_1 vs A_2B_2	80	92	18.11	50.84	5.12	7.04	**34.37***
A_1B_2 vs A_2B_1	125	103	26.54	34.32	8.04	8.89	**6.92***
A_1B_1 vs A_1B_2	80	125	18.11	26.54	5.12	8.04	**8.34***
A_2B_1 vs A_2B_2	103	92	34.32	50.84	8.89	7.04	**14.26***

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

A_1= Govt. School; A_2= Private School **B_1= Rural; B_2= Urban**

Table – 3 discloses that't'-values have been found to be significant at 0.01 level leading to the conclusion that these groups are differ significantly on mathematics achievement among secondary school students. From the mean scores it can be concluded that private urban students (A_2B_2) have high mathematics achievement as compare to Govt. rural (A_1B_1) students. It was further concluded that private urban students (A_2 B_2) have high mathematics achievement as compared to Govt. Urban School (A_1B_2) Students.

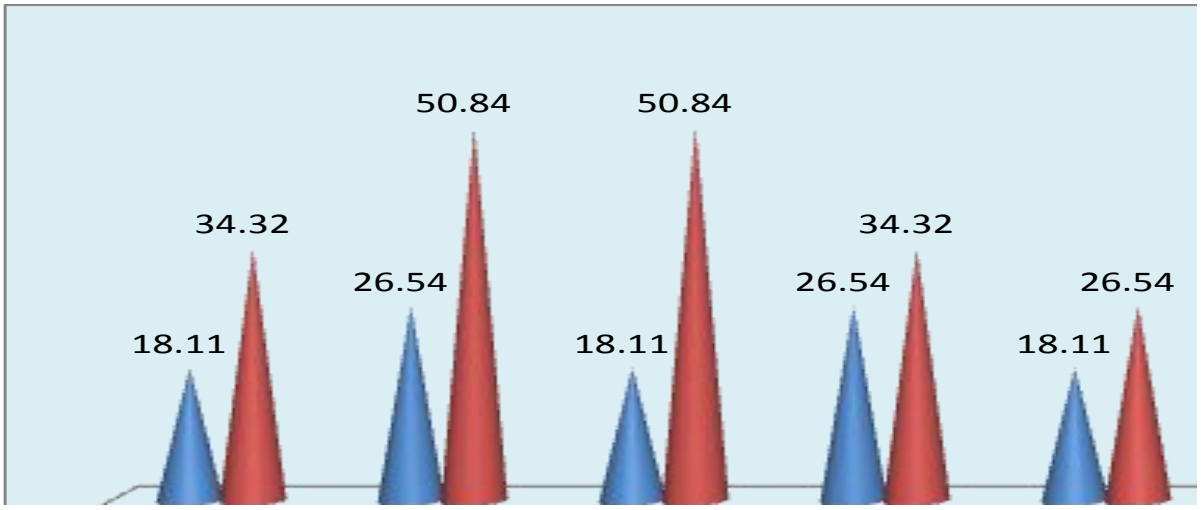


Fig: 2 Mean Scores for interaction Effect of Type of School & Locality on Mathematics Achievement among Secondary School Students

Locality (B) x Gender (C)

Table - 2 further concludes that F - ratio between locality and gender (8.218) has been found to be significant 0.05 level which leads to the inference that locality (B) and gender (C) interact with each other. Therefore, the null hypothesis H_{02} (b), "There exists no significant interaction effect of locality and gender on mathematics achievement among secondary school students" is rejected. Further t- test was employed to find out the significance of difference mean mathematics achievement scores for different groups. The results have been shown in the Table - 4

Table -4 't' values for Mean mathematics achievement scores among secondary school students for Different groups of Locality (B) x Gender (C)

Group	N		Mean		SD		t-values
B_1C_1 vs B_2C_1	84	115	22.82	29.65	8.71	11.77	**4.48***
B_1C_2 vs B_2C_2	99	102	30.96	44.96	11.36	12.34	**8.35***
B_1C_1 vs B_2C_2	84	102	22.83	44.96	8.71	12.34	**13.83***
B_1C_2 vs B_2C_1	99	115	30.96	29.65	11.36	11.77	**0.82(NS)**
B_1C_1 vs B_1C_2	84	99	22.83	30.96	8.71	11.36	**5.35***
B_2C_1 vs B_2C_2	115	102	29.65	44.96	11.77	12.34	**9.34***

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

B_1- Rural; B2- Urban; C_1- Male; C_2- Female

Table 4 discloses that't'- values 4.48, 8.35, 13.83, 5.35 and 9.34 for the groups (B_1C_1vs B_2C_1); (B_1C_1vs B_2C_1); (B_lC_l vs. B_2C_2); (B_1C_1vs B_1C_2); and (B_2C_1vs B_2C_2) respectively have been found significantly on mathematics achievement. Table - 4 further indicates that the t - value of 0.82 has not found to be significant which means rural female (B_2C_1) secondary school

students and urban male (B_2C_1) secondary school students do not differ significantly. From the mean scores it can be concluded that rural female B_2C_1) have high mathematics achievement as compared to urban male (B2C1) students.

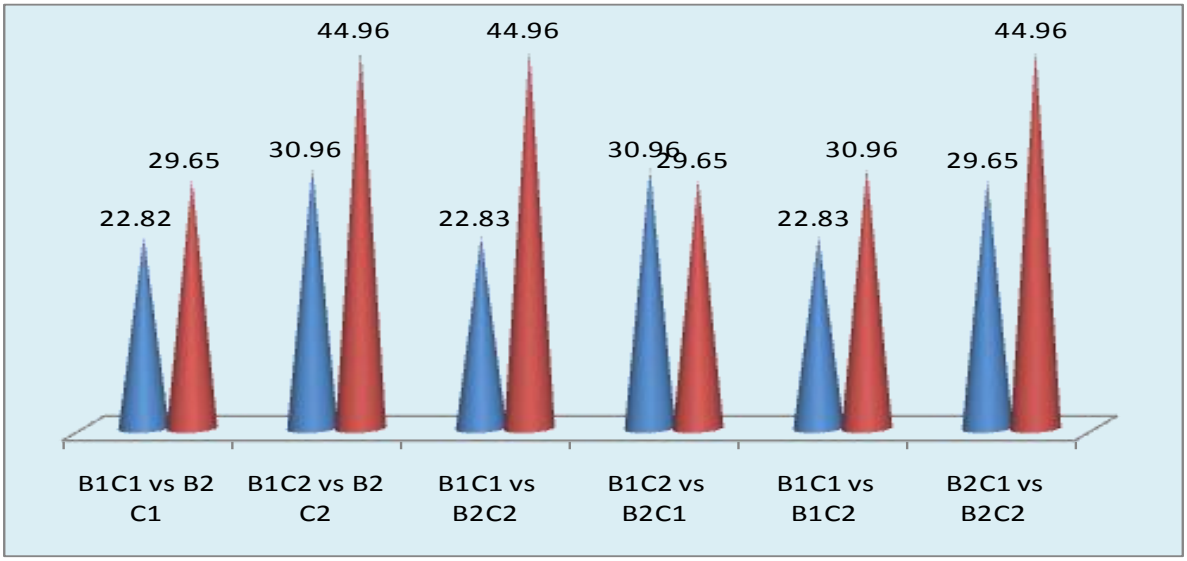


Fig. 3: Mean Scores for interaction Effect of Locality & Gender on mathematics achievement among secondary school students.

Type of School (A) x Gender (C)

A glance at Table – 2 indicates that F – ratio between type of school and gender is (5.792) which has been found to be significant at 0.05 level which leads to the inference that type of school (A) and Gender (C) interact with each other. Therefore, the null hypothesis H_{03} (C), "There exists no significant interaction effect of type of school and gender on mathematics achievement among secondary school students" is rejected. Further t-test was employed to find out the significance of difference between mean mathematics achievement scores for different groups. The results have been shown in the Table – 5

Table- 5 't' values for Mean mathematics achievement scores among secondary school students for Different groups of Type of school (A) x Gender (C)

Group	N		Mean		SD		t-values
A_1C_1vs A_2C_1	117	82	20.41	35.84	6.27	10.14	**13.23***
A_1C_2 vs A_2C_2	88	113	27.02	46.6	8.85	10.33	**14.22***
A_1C_1 vs A_2C_2	117	113	20.41	46.6	6.27	10.33	**23.38***
A_1C_2 vs A_2 C_1	88	82	27.02	35.84	8.85	10.14	**6.04***
A_1C_1 vs A_1C_2	117	47	20.41	32.89	6.27	6.69	**11.29***
A_2C_1 vs A_2C_2	82	113	35.84	46.67	10.14	10.33	**7.28***

Significant at 0.01 level

A_1 = Govt. School A_2= Private School **C_1= Male** **C_2 = Female**

Table - 5 discloses that't' - values have been found significant at 0.01 level leading to the conclusion that these groups differ significantly on mathematics achievement among secondary school students . From the mean scores it can be concluded that Govt. Male (A_1C_1) students have high level of mathematics achievement as compare to (A_2 C_2) private Female.

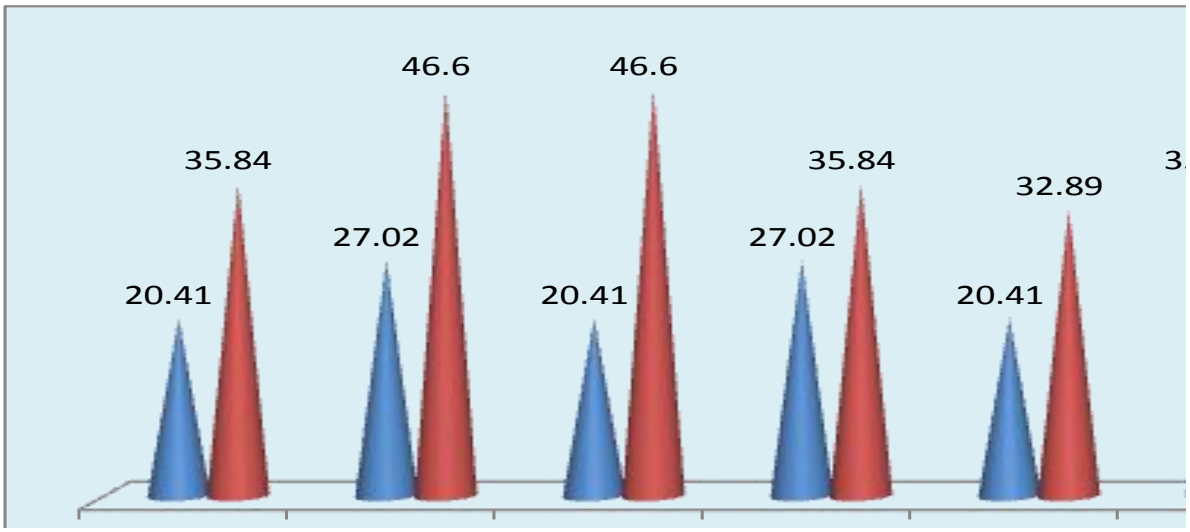


Fig. 4: Mean Scores for interaction effect of type of school & locality on mathematics achievement among secondary school students.

Triple Interaction effect of Type of School, Locality and Gender on Mathematics achievement among secondary school students.

Type of school x Locality x Gender (AxBxC)

The F- ratio (3.020) from table -2 between type of school, locality and gender is not significant at 0.01 level leading to the inference that type of school, locality and gender do not interact with each others. Therefore, the null hypothesis, "There exists no significant interaction effect of type of school, locality and gender on mathematics achievement among secondary school students" is accepted.

FINDINGS OF THE STUDY

- ✓ Main effect of type of school (A), Locality (B) and gender (C) on achievement in mathematics among secondary school students was found significant.
- ✓ Double interaction effect of locality & gender (B x C), type of school & locality (A x B) and type of school and gender (A x C) was found significant among secondary school students.

- ✓ Tripple interaction effect of type of school (A x B x C) was found insignificant on achievement in mathematics among secondary school students.

CONCLUSIONS

Any educational research is worthwhile if the results produce fruitful educational implications. As so far the present investigation is concerned, it can be claimed that useful information obtained could be useful in enhancing the achievement of the students at any level. The results of the present study reflect that type of school, gender and locality has a great impact on achievement of students. So it is highly recommended that teacher should adopt new and technological enhanced method of teaching. Moreover, teachers must re-examine traditional teaching methods that often do not match the students learning styles and teaching skills need to be productive in society. Lessons must be presented in a variety of ways. Mathematical concepts should be taught through play acting, cooperative groups, visual aids, CAI (Computer Aided Instruction). Teachers and parents should be made aware of the use of technology such as software programming for learning and doing mathematics and use of various mathematical CD's. Parents should also maintain an active role when encouraging their children to incorporate mathematics into their daily routine. Parents and teachers can also help students realize, that myths such as the general feeling that mathematics aptitude is genetic and mathematics is a male domain, is simply not true.

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