

CHAPTER- 4

ANALYSIS AND

INTERPRETATION

OF DATA

4.1 Introduction

There are eleven hypotheses in this study. All these hypotheses are tested and the results are interpreted as per the problem under investigation.

4.2 Results Pertaining to Influence of Achievement

In order to know the influence of achievement in mathematics on ability in fundamental operations, all the sampled students were categorized into three groups viz. high, moderate and low on the basis of their mathematics achievement. The groups were made by establishing ranges using $M \pm 1\sigma$. The significance of difference between categories is found by carrying out analysis of variance (ANOVA). The analysis of variance is carried out by taking into consideration achievement as independent variable and ability in fundamental operations- awareness and application as dependent variables, There are three hypotheses pertaining to influence of achievement in mathematics. The results on verification of hypothesis are presented in the following pages.

4.2.1 Ability in Fundamental Operations

The first hypothesis of the study states that there is no significant influence of academic achievement in mathematics on ability in fundamental operations. This hypothesis is verified and results are shown in Table – 8

TABLE-8

Significance of 'F' between categories of Mathematics Achievements in respect of Ability of fundamental operations

Sources of variation	Sum of squares	Mean square	d.f.	F	Remarks
Between groups	1283.08	641.54	2	17.08	Significant at 0.01 level
Within groups	6124.06	37.57	163		
Total	7407.14				

The value of 'F' is found to be significant at 0.01 level of significance & hence the hypothesis is rejected. This shows that there is significant difference between different categories of achievement in mathematics in respect of ability in fundamental operations. This indicates that academic achievement in mathematics do influence ability in fundamental operations of class VI standard.

As 'F' is significant, in order to know the significance of difference of means between categories Post Hoc is carried out. The results of Post Hoc are presented in Table 9.

TABLE-9

Significance of mean difference between categories of achievement in mathematics in respect of ability in fundamental operations

Category-1	Category-2	Mean Difference	Remarks
Low (AM=16.26)	Moderate	3.01	Not significant
Low	High	9.15	Significant at 0.01 level.
Moderate (AM = 19.27)	High (AM = 25.41)	6.15	Significant at 0.01 level.

A significant mean difference is noticed between students belonging to High & Low, and High & Moderate achievement in mathematics in respect of ability in fundamental operations. This shows that students with high achievement in mathematics do differ significantly from their counterparts belonging to low and moderate categories in respect of their ability in fundamental operations when means are compared it is found that the students belonging to high achievement group in mathematics (A.M. = 25.41) are superior to their counterparts in low (AM = 16.26) and moderate (AM = 19.27) groups in respect of their ability in fundamental operations This indicates that students with high achievement in mathematics do possess high ability in fundamental operations Further researcher is interested to explore whether these differences hold good in respect of awareness and application of fundamental operations.

4.2.2 Awareness of Fundamental Operations

The second hypothesis of the study states that there is no significant influence of academic achievement in mathematics on awareness in fundamental operations of class VI students. This hypothesis is verified and results are shown in Table-10.

TABLE-10

Significance of 'F' between categories of mathematics achievement in respect of awareness of fundamental operations

Sources of Variation	Sum of Squares	Mean Square	D.F.	F.	Remarks
Between groups	202.36	101.18	2	7.482	Significant at 0.01 Level
Within Group	2204.13	13.52	163	-	
Total	2406.48	-	165		

The value of 'F' is found to be significant at 0.01 level of significance and hence the hypothesis is rejected. This shows that there is significant difference between different categories of achievements in mathematics in respect of awareness in fundamental operations. This indicates that academic achievement in mathematics do influence awareness in fundamental operations of class-VI students. As 'F' is significant in order to know the significance of difference of means between categories post hoc is carried out. The result of post hoc are presented in Table 11.

TABLE-11

Significance of mean difference between categories of achievement in mathematics in respect of awareness in fundamental operations

Category 1	Category 2	Mean Difference	Remarks
Low (AM = 8.02)	Moderate	1.39	Not significant
Low	High	3.71	Significant at 0.01 level
Moderate (AM = 9.41)	High (AM = 11.72)	2.32	Not significant at 0.05 level

No significant mean differences is noticed between students belonging to low & Moderate; and Moderate & high achievements in mathematics in respect of awareness in fundamental operations. This shows that students with moderate achievement in mathematics do not differ significantly from their counterparts belonging to low & high categories in respect of their awareness in fundamental operations. Although significant difference is noticed between low & high students'

group of achievement in mathematics in respect of awareness in fundamental operations.

When means are compared it is found that the students belonging to high achievement group in mathematics (AM = 11.72) are superior to their counterparts in low (AM = 8.02) groups in respect of their awareness in fundamental operations. This indicates that students with high achievement in mathematics do possess high awareness in fundamental operations.

Besides testing the hypothesis, researcher is interested to find out the influence of achievement in mathematics on awareness of different properties of fundamental operations. For this purpose ANOVA is carried out for all the properties of fundamental operations. The value of 'F' are provided in Table-12.

TABLE-12

Value of 'F' between achievement categories in respect of awareness of different properties of fundamental operations

S.No.	Property	F	Remarks
1.	Closure	2.92	Not significant
2.	Commutative	3.79	Significant at 0.05 level
3.	Associative	3.43	Significant at 0.05 level
4.	Distributive	6.96	Significant at 0.01 level
5.	Identity	0.14	Not Significant

The value of 'F' is found to be significant for distributive commutative and associative properties. This shows that there is significant difference between students belonging to different categories of achievement in mathematics in respect of awareness of the three properties only viz. commutative, associative and distributive. There is no significant difference between students belonging to different categories of achievement in mathematics for the awareness of properties- Identity and closure.

4.2.3 Application of Fundamental Operations

The third hypothesis of the study states that there is no significant influence of academic achievement in mathematics on application in fundamental operations of class VI students. This hypothesis is verified and results are shown in Table-13

TABLE-13

Significance of 'F' between categories of Mathematics Achievement in respect of Application of fundamental operations

Sources of variation	Sum of squares	Mean square	d.f.	F	Remarks
Between groups	468.88	234.44	2	14.87	Significant at 0.01 level
Within Groups	2569.46	15.76	163		
Total	3038.34		165		

The value of 'F' is found to be significant at 0.01 level of significance and hence the hypothesis is rejected. This shows that there is significant difference between different categories of achievement in mathematics in respect of application in fundamental operations. This indicates that academic achievement in mathematics do influence application in fundamental operations of class VI students. As 'F' is significant, in order to know the significance of difference of means between categories. Post Hoc is carried out. The results of post hoc are presented in Table-14

TABLE-14

Significance of mean difference between categories of Achievement in Mathematics in respect of Application in fundamental operations

Category 1	Category 2	Mean Difference	Remarks
Low (A.M. = 8.24)	Moderate	1.62	Not significant
Low	High	5.45	Sig. at 0.01 level
Moderate (A.M. = 9.86)	High (13.69 = A.M.)	3.83	Sig. at 0.01 level

A significant mean difference is noticed between students belonging to High & Low; and High & Moderate achievements in mathematics in respect of application in fundamental operations. This shows that students with high achievement in mathematics do differ significantly from their counterpart belonging to low & moderate categories in respect of their application in fundamental operations. When means are compared it is found that the students belonging to high achievement group in mathematics (A.M. = 13.69) are superior to their counterparts in low (A.M. = 8.24) and Moderate (A.M. = 9.86) groups in respect of their ability in fundamental operations. This indicates that students with high achievement in mathematics do possess high application fundamental operations.

Besides testing the hypothesis, researcher is interested to find out the influence of achievement in mathematics on application of different properties of fundamental operations. For this purpose ANOVA is carried out for all the properties of fundamental operations. The values of 'F' are provided in Table-15

TABLE-15

Values of 'F' between achievement categories in respect of application of different properties of fundamental operations

S.No.	Property	F	Remarks
1.	Closure	6.96	Significant at 0.01 level
2.	Commutative	2.05	Not Significant
3.	Associate	8.73	Significant at 0.01 level
4.	Distributive	3.79	Significant at 0.05 level
5.	Identity	11.24	Significant at 0.01 level

The value of 'F' is found to be significant for closure, associative and identity properties. This shows that there is significant difference between students belonging to different categories of achievement in mathematics in respect of application of the three properties only viz. closure, associative and identity. There is no significant difference between students belonging to different categories of achievement in mathematics for the application of properties of commutative and distributive.

4.3 Descriptive Statistics

4.3.1 Comparison of Properties

Researcher intends to know the ability of students in respect of various properties of fundamental operations. For this purpose the possible range of scores have been compared to the obtained ranges of scores in various properties and maximum percentage scored is calculated as given in the following table-16

TABLE-16
Comparison of Properties

	Range of Scores				Maximum % obtained
	Possible		Obtained		
	Min.	Max.	Min.	Max.	
Closure	0	16	0	10	62.5%
Commutative	0	33	0	19	57.6%
Associative	0	19	0	6.5	34%
Distributive	0	20	0	10	50%
Identity	0	22	1	10	45%

From the above table we can say that students are average in closure, commutative and distributive properties and below average in the remaining two properties viz. associative and identity. However, it is not possible to make any generalization in the absence of frequency of students who obtained these maximum percentage.

4.3.2 Comparison of Achievement and Ability

There is a significant difference between students of high, moderate and low achievements in respect of ability in fundamental operations. However, when means of ability in fundamental operations are observed, it is found that they are below average. In the analysis of variance carried out and in subsequent post hoc treatment it is observed that the supremacy of high achievers in ability of fundamental operations is but relative or proportionate. Researcher intends to know the exact position of students in ability of fundamental operations. For this purpose the possible range of scores have been compared to the obtained ranges of scores on mathematics achievement and ability in fundamental operations

including awareness and application. Means and standard deviations have also been computed for comparing mathematics achievement and ability in fundamental operations. The results are provided in table-17.

TABLE-17
Range of Scores, Means and Standard Deviation for
Comparing Ability and Achievement

	Range of Scores				Mean	S.D.
	Possible		Obtained			
	Min.	Max.	Min.	Max.		
Awareness	0	50	0	23	9.59	3.82
Application	0	60	2	30	10.23	4.29
Ability	0	110	4	46	19.85	6.7
Achievement	0	100	4	100	55.27	21.03

The possible range of scores on awareness is 0 to 50 whereas the range obtained is 0 to 23. This means that students level of awareness about the properties of fundamental operations is below average. The possible range of scores on application is 0 to 60 whereas the range obtained is 2 to 30. This means that students level of application is also below average. The possible range of scores on ability is 0 to 110 whereas the range obtained is 4 to 46. This means that students level of ability about the properties of fundamental operations is below average.

As regards achievement in mathematics students could able to get the maximum scores possible. This indicates that students could achieve 100% marks in mathematics. On comparing the maximum score obtained in mathematics achievement and ability in fundamental operations, it is evident that the performance of students in ability of fundamental operations is far below to that of mathematics achievement. However, it is not possible to make any generalization in the absence of frequency of students who obtained these maximum scores. Exploring these frequencies counts is beyond the ambit of this study and hence these issues may be addressed in future researches. From the above table it is clear that there is a substantial difference in means of achievement in mathematics and ability in properties of fundamental operations are far below the

maximum scores obtained. This further substantiates the fact that ability in fundamental operations among class-VI students is below average.

4.4 Results pertaining to relationships

There are two major variables of the study viz., achievement in mathematics and ability in fundamental operations. The objective of this study is also to know the relationship between achievement and ability in fundamental operations. For this inter and intra correlations are calculated and results are presented here under:

4.4.1 Achievement and Ability in fundamental operations

The fourth hypothesis of the study states that there is no significant relationship between achievement in mathematics and ability in fundamental operations. This hypothesis is tested and results are presented in table-18.

TABLE-18

Significance of 'r' between Achievements in Mathematics and Ability in fundamental operations

Variables	N	d.f.	r	Remarks
Achievement in Maths	166	164	0.48	Significant at 0.01 level
Ability in Fundamental Operations				

The value of 'r' is found to be significant at 0.01 level of significance and hence null hypothesis is rejected. This indicates that there is a significant positive relationship between achievement in mathematics and ability in fundamental operations among VI class students. This reveals that higher the achievement in mathematics greater will be the ability in fundamental operations. Students with higher achievement in mathematics do possess higher degree of ability in properties of fundamental operations.

4.4.2 Achievement and Awareness

The fifth hypothesis of the study states that there is no significant relationship between achievement in mathematics and awareness in fundamental operations. This hypothesis is tested and results are presented in table-19

TABLE-19

**Significance of 'r' between Achievement in Mathematics
and Awareness in fundamental operations**

Variables	N	d.f.	r	Remarks
Achievements in Mathematics Awareness in fundamental operations	166	164	0.37	Significant at 0.01 level

The value of 'r' is found to be significant at 0.01 level of significance and hence null hypothesis is rejected. This indicates that there is a significant positive relationship between achievement in mathematics and awareness in properties of fundamental operations among VI class students. This reveals that higher the achievement in mathematics greater will be the awareness in properties of fundamental operations. Students with higher achievement in mathematics do possess higher degree of awareness in properties of fundamental operations.

4.4.3 Achievement and Application

The sixth hypothesis of the study states that there is no significant relationship between achievement in mathematics and application of properties of fundamental operations. This hypothesis is tested and results are presented in table-20.

TABLE-20

**Significance of 'r' between Achievement in Mathematics and
Application of properties of fundamental operations.**

Variables	N	d.f.	r	Remarks
Achievement in Mathematics Application of properties of fundamental operations	166	164	0.43	Significant at 0.01 level

The value of 'r' is found to be significant at 0.01 level of significance and hence hypothesis is rejected. This indicates that there is a significant positive relationship between achievement in mathematics and application of properties of

fundamental operations among VI class students. This reveals that higher the achievement in mathematics greater will be the application of properties of fundamental operations. Students with higher achievement in mathematics do possess higher degree of application of properties of fundamental operations.

4.4.4 Awareness and Application

The seventh hypothesis of the study states that there is no significant relationship between awareness and application of properties of fundamental operations. This hypothesis is tested and results are presented in table-21.

TABLE-21
**Significance of 'r' between awareness and application of
 properties of fundamental operations**

Variables	N	d.f.	r	Remarks
Awareness	166	164	0.36	Significant at 0.01 level
Application				

The value of 'r' is found to be significant at 0.01 level of significance and hence the null hypothesis is rejected. This indicates that there is a significant positive relationship between awareness and application of properties of fundamental operations among VI class students. This reveals that higher the awareness of properties of fundamental operations greater will be the application of the same. Students with higher awareness of properties of fundamental operations do possess a higher degree of application of the same.

Besides testing the hypothesis, the researcher intends to find out the inter-correlation between different properties of fundamental operations. The results are presented in the following table-22.

TABLE-22

**Correlation matrix between Awareness of
properties of fundamental operations.**

	Closure	Commutative	Associative	Distributive	Identity
Closure	1.00				
Commutative	0.25**	1.00			
Associative	0.44**	0.31**	1.00		
Distributive	0.24**	0.34**	0.38**	1.00	
Identity	-0.08	0.093	0.12	-0.09	1.00

** Significant at 0.01 level of significance (2-tailed)

From the above table it is clear that all the properties have a significant positive correlation between them, except the Identity elements property. The identity property shows no significant correlation with any other property. Also, it shows negative correlation (though not significant) with the closure property and Distributive property.

TABLE-23

**Correlation matrix between Application of properties
of fundamental operations.**

	Closure	Commutative	Associative	Distributive	Identity
Closure	1.00				
Commutative	0.12**	1.00			
Associative	0.19*	0.09	1.00		
Distributive	0.16*	0.15*	0.23**	1.00	
Identity	0.22**	0.158*	0.37**	0.20**	1.00

**Correlation is significant at the 0.01 level (2-Tailed)

* Correlation is significant at the 0.05 level (2-tailed)

From the above table it is clear that commutative property do not have any significant correlation with closure and associative property. However, all other properties have significant positive correlation between them.

4.5 Results Pertaining to Background Variables

In this study two background variables are taken into consideration. They are sex and type of school. In order to know the difference between categories of these background variables, values of 't' are computed. There are four hypotheses pertaining to background variables. On verification of these hypotheses, results are presented in the following pages.

4.5.1 Sex

The eight hypotheses of the study states that there is no significant difference between girls and boys in respect of achievement in mathematics. This hypothesis is tested and results are presented in table-24 given below:

TABLE-24
Significance of 't' between boys and girls
in respect of achievement

Category	A.M.	S.D.	N	d.f.	t	Remarks
Girls	54.79	20.75	72	164	0.25	Not significant
Boys	55.63	21.35	94			

The value of 't' is found to be not significant and hypothesis is not rejected. This means that there is no significant difference between boys and girls in respect of their achievement, Gender difference is not evident in achievement.

The ninth hypothesis of the study states that there is no significant difference between girls and boys in respect of ability in properties of fundamental operations. This hypothesis is tested and results are presented in table-25 given below:

TABLE-25

Significance of 't' between boys and girls in respect of ability

Category	A.M.	S.D.	N	d.f.	t	Remarks
Girls	20.24	6.45	72	164	0.66	Not significant
Boys	19.55	6.91	94			

The value of 't' is found to be not significant and hypothesis is not rejected. This means that there is no significant difference between boys and girls in respect of their ability in fundamental operations. Gender difference is not evident in ability.

Besides testing the hypothesis, researcher is interested to find out if there is any significant difference between boys and girls in respect of awareness of the properties of fundamental operations and its application. The results are presented in the following tables-26 & 27.

TABLE-26

Significance of 't' between boys and girls in respect of awareness

Category	A.M.	S.D.	N	d.f.	t	Remarks
Girls	9.33	3.22	72	164	0.75	Not significant
Boys	9.78	4.23	94			

The value of 't' is not found to be significant. This means that there is no significant difference between boys and girls in respect of their awareness of the properties of fundamental operations.

TABLE-27

Significance of 't' between boys and girls in respect of application

Category	A.M.	S.D.	N	d.f.	t	Remarks
Girls	10.91	4.59	72	164	1.7	Not significant
Boys	9.77	3.99	94			

The value of 't' is not found to be significant. This means that there is no significant difference between boys and girls in respect of their application of the properties of fundamental operations. Gender difference is not evident in both awareness and application of the properties of fundamental operations.

4.5.2 Type of School

The tenth hypothesis of the study states that there is no significant difference between government and private schools in respect of achievements in mathematics. This hypothesis is tested and results are presented in table-28 given below:

TABLE-28
Significance of 't' between government and Private Schools
in respect of achievement.

Category	A.M.	S.D.	N	d.f.	t	Remarks
Govt.	46.91	19.19	90	164	6.16	Significant at 0.01 level
Private	65.16	18.79	76			

The value of 't' is found to be significant at 0.01 level so null hypothesis is rejected. This means there is significant difference between govt. and Private Schools in respect of their achievement in mathematics when means are compared it is found that students belonging to Private schools (A.M. = 65.16) are superior to their counterparts in govt. schools (A.M.=46.91) in respect of their achievement in mathematics. This shows that students of private schools have better achievement in mathematics than the students of govt. school.

The eleventh hypothesis of the study states that there is no significant difference between govt. and private schools in respect of ability in properties of fundamental operations. This hypothesis is tested and results are presented in table-29, given below.

TABLE-29

Significance of 't' between govt. and private schools in respect of ability

Category	A.M.	S.D.	N	d.f.	t	Remarks
Govt.	19.03	7.00	90	164	1.72	Not significant
Private	20.82	6.23	76			

The value of 't' is found to be not significant and hypothesis is not rejected. This means that there is no significant difference between students of govt. and private schools in respect of their ability in fundamental operations.

Besides testing the hypothesis, researcher is interested to find out if there is any significant difference between govt. and private schools in respect of awareness of the properties of fundamental operations and its application. The results are presented in the following tables.

TABLE-30

**Significance of 't' between govt. and private schools
in respect of awareness**

Category	A.M.	S.D.	N	d.f.	t	Remarks
Govt.	9.27	3.57	90	164	1.18	Not significant
Private	9.97	4.09	76			

The value of 't' is not found to be significant. This means that there is no significant difference between students of Govt. and Private School in respect of their awareness of the properties of fundamental operations.

TABLE-31

**Significance of 't' between govt. and private schools
in respect of application.**

Category	A.M.	S.D.	N	d.f.	t	Remarks
Govt.	9.77	4.56	90	164	1.64	Not significant
Private	10.86	3.89	76			

The value of 't' is not found to be significant. This means that there is no significant difference between students of govt. and private schools in respect of their application of the properties of fundamental operations.