CHAPTER VI

SUMMARY AND CONCLUSIONS

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6.1 Study in Retrospect

The main focus of this was to find out a relationship between Multiple Intelligences and achievement in Mathematics of secondary school students in Kerala. In this Chapter the investigator narrates the summary of the study and recommendations for future study. The main educational implications are also given in this chapter.

6.1.1 Statement of the problem

This is a study about the relationship between the Multiple Intelligences and achievement in mathematics. The study is entitled as “Relationship between Multiple Intelligences and Achievement in Mathematics of Students at Secondary Level”.

6.1.2 Variables of the study

1. Verbal\Linguistics intelligence
2. Logical -mathematical intelligence
3. Visual-spatial intelligence
4. Interpersonal intelligence
5. Intrapersonal intelligence
6. Achievement in mathematics

6.1.3 Objectives of the study

1. To find out the selected components of Multiple Intelligences of secondary level students for the total sample and relevant sub samples
2. To find out the mathematics achievement of secondary level students for the total sample and relevant subsamples
3. To find out whether there is any significant relationship among the achievement in mathematics and selected components of Multiple Intelligences for the total sample.

4. To find out whether there is any significant relationship between the achievement in mathematics and selected components of Multiple Intelligences for relevant subsamples.

5. To find out whether there is any association between levels of achievement in mathematics and different levels of the selected components of Multiple Intelligences such as 1) Linguistic intelligence, 2) Logical-mathematical intelligence, 3) Spatial intelligence, 4) Interpersonal Intelligence and 5) Intrapersonal intelligence for the total sample.

6. To find out whether the selected components of Multiple Intelligences are significantly effective to predict the achievement in mathematics for the total sample.

6.1.4 Hypotheses of the Study

1. (H₁) There is significant difference in the selected components of Multiple Intelligences of secondary level students for the relevant subsamples based on
   1. Gender
   2. Locality
   3. Management

2. (H₂) There is significant difference in the mathematics achievement of secondary level students for relevant subsamples based on
   1) Gender
   2) Locality
3) Management

3. (H₃) There is significant relationship between the achievement in mathematics and selected components of Multiple Intelligences such as
   a) Verbal/Linguistic intelligence
   b) logical/mathematical intelligence
   c) Visual/spatial intelligence
   d) Interpersonal intelligence,
   e) Intrapersonal intelligence

4. (H₄) There is significant relationship between the achievement in mathematics and selected components of Multiple Intelligences for the subsamples based on
   1) Gender
   2) Locality
   3) Management

5.(H₅) There is an association between levels of achievement in mathematics and different levels of the selected components of Multiple Intelligences such as
   1) Linguistic intelligence
   2) Logical-mathematical intelligence,
   3) Spatial intelligence,
   4) Interpersonal Intelligence,
   5) Intrapersonal intelligence

6.(H₆) The selected components of Multiple Intelligences are significantly effective to predict the achievement in mathematics

6.1.5. Methodology in Brief

For collection of data the investigator used normative survey method. The study aims at finding relationship between Multiple Intelligences and achievement in
Mathematics of high school students in Kerala. Secondary school students in Kerala are the population. The sample consisted of 1500 students from three districts namely Alappuzha, Kottayam and Pathanamthitta which are the representatives of coastal area, middle area and hilly area respectively.

The tools used for the study are standardized by the investigator namely the scale of linguistic intelligence, the scale of logical-mathematical intelligence, the scale of spatial intelligence, the scale of interpersonal intelligence, the scale of intrapersonal intelligence and achievement in Mathematics.

The collected data is tabulated and statistical techniques were used for analysis.

6.2 Major Findings of the Study
6.2.1 Findings based on 1st Objective

Conclusions based on Descriptive Statistics of the selected components of Multiple Intelligences

6.2.1.1 The mean linguistic intelligence is 71.61 with standard deviation 24.48. The skewness of linguistic intelligence is -0.83 which is slightly negatively skewed and the kurtosis is -0.21, which is slightly platykurtic. The linguistic intelligence can be considered almost symmetric in nature.

6.2.1.2 The mean logical mathematical intelligence is 80.54 with standard deviation 16.13. The skewness of logical mathematical intelligence is -1.14 which is slightly negatively skewed and the kurtosis is 2.30, which is highly leptokurtic. Thus with respect to the logical mathematical intelligence, students clustered about the mean score 80.54 and the frequency curve elongated to the left side.

6.2.1.3 The mean spatial intelligence is 69.39 with standard deviation 26.34. The skewness of spatial intelligence is -0.32 which is slightly negatively skewed and the
kurtosis is -1.33, which is slightly platykurtic. Thus with respect to the spatial intelligence, the distribution of students is almost symmetric and the more scattered.

6.2.1.4 The mean interpersonal intelligence is 78.76 with standard deviation 22. The skewness of interpersonal intelligence is -1.19 which is slightly negatively skewed and the kurtosis is 0.79, which is slightly leptokurtic. Thus with respect to the interpersonal intelligence, the distribution of students is slightly negatively skewed.

6.2.1.5 The mean intra-personal intelligence is 80.41 with standard deviation 16.21. The skewness of intrapersonal intelligence is 1.16 which is positively skewed and the kurtosis is 2.48, which is highly leptokurtic. Thus with respect to the intrapersonal intelligence, the distribution of students is clustered around the mean score 80.41 and more students distributed on the right of the mean score.

6.2.1.6 The mean achievement in mathematics is 70.32 with standard deviation 20.95. The skewness of achievement in mathematics is -0.44 which is slightly negatively skewed and the kurtosis is -0.40, which is slightly platykurtic. Thus with respect to the achievement in mathematics, the distribution of students is almost symmetric.

6.2.2 The level of significance of the selected components of Multiple Intelligences for the total sample

6.2.2.1 The results of the analysis shows the linguistic intelligence s significantly above 50 at 1% level of significance (t = 4.18, sig. <0.01)

6.2.2.2 The test of the logical mathematical intelligence shows which is significantly above 50 at 1% level of significance (t = 73.32, sig. <0.01).

6.2.2.3 The spatial intelligence is significantly above 50 at 1% level of significance (t = 28.50, sig. <0.01).

6.2.2.4 The test of the interpersonal intelligence shows that it is significantly above 50 at 1% level of significance (t = 50.64, sig. <0.01).
6.2.2.5 The test of the intrapersonal intelligence shows that it is significantly above 50 at 1% level of significance ($t = 72.62$, sig. <0.01)

Thus all the selected components of Multiple Intelligences were obtained significantly above the satisfactory level at 1% level of significance among the students.

6.2.3 The level of significance of the selected components of Multiple Intelligences for the relevant sub-samples

6.2.3.1 The selected components of Multiple Intelligences such as linguistic, logical mathematical, spatial, interpersonal, and intrapersonal intelligences are significantly different with respect to gender.

A comparison of the mean scores of the selected components of Multiple Intelligences shows that with respect to all the selected components of Multiple Intelligences female students scored more than male students.

Analysis of the study shows the mean score of linguistic intelligence for male is 71.01 and standard deviation 24.65. The mean score of linguistic intelligence for the female is 72.31 and standard deviation 24.31. The t-test shows that variable linguistic intelligence is not significantly different in between male and female at 0.01 level of significance.

The mean score of logical mathematical intelligence for male is 79.46 and standard deviation 16.62. The mean score of logical mathematical intelligence for female is 81.66 and standard deviation 15.54. The t-test shows that the mean score of the variable logical -mathematical intelligence for female is higher than that of male at 0.01 level of significance.
The mean score of spatial intelligence for male is 67.55 and standard deviation 28.57. The mean score of spatial intelligence for female is 71.29 and standard deviation 25.99. The t-test shows that the mean score of the variable spatial intelligence for female is higher than that of male at 0.01 level of significance.

The mean score of interpersonal intelligence for male is 79.14 and standard deviation 20.77. The mean score of inter-personal intelligence for female is 78.37 and standard deviation 23.20. The t-test shows that the mean score of the variable inter-personal intelligence is not significantly different in between male and female at 0.01 level of significance.

The mean score of intra-personal intelligence for male is 79.19 and standard deviation 16.79. The mean score of intra-personal intelligence for female is 81.66 and standard deviation 15.48. The t-test shows that the mean score of the variable intrapersonal intelligence for female is higher than that of male at 0.01 level of significance.

6.2.3.2 The selected components of Multiple Intelligences such as linguistic, logical mathematical, spatial, inter-personal, and intra-personal intelligences are significantly different with respect to locality

A comparison of the mean scores of the selected components of Multiple Intelligences shows that with respect to the components of Multiple Intelligences linguistic intelligence and inter-personal intelligence rural students scored more than urban students. In the case of logical mathematical intelligence, spatial intelligence, and intra-personal intelligence urban students scored more than that of rural students.

The mean score of linguistic intelligence for rural is 71.65 and standard deviation 25.16. The mean score of linguistic intelligence for the urban is 71.57 and
standard deviation 23.85. The t-test shows that the variable linguistic intelligence is not significantly different in between rural and urban at 0.01 level of significance.

The mean score of logical mathematical intelligence for rural is 79.18 and standard deviation is 16.82. The mean score of logical mathematical intelligence for urban is 81.79 and standard deviation is 15.37. The t-test shows that variable logical mathematical intelligence of urban students are significantly higher than that of rural students at 1% level of significance.

The mean score of spatial intelligence for rural is 67.86 and standard deviation 28.38. The mean score of spatial intelligence for Urban is 70.80 and standard deviation 28.25. The t-test shows that spatial intelligence of urban students is significantly higher than that of the rural students at 0.05 level of significance.

The mean score of inter-personal intelligence for rural is 79.15 and standard deviation is 21.29. The mean score of inter-personal intelligence for Urban is 78.41 and standard deviation is 22.64. The t-test shows that mean score of the variable interpersonal intelligence is not significantly different between rural and urban students.

The mean score of intrapersonal intelligence for rural is 79.03 and standard deviation is 16.92. The mean score of intrapersonal intelligence for Urban is 81.67 and standard deviation is 15.42. The t-test shows the variable intrapersonal intelligence of urban students is significantly higher than that of rural students at 1% level of significance.
6.2.3.3 The selected components of Multiple Intelligences such as linguistic, logical mathematical, spatial, inter-personal, and intra-personal intelligences are significantly different with respect to management

A comparison of the mean scores of the selected components of Multiple Intelligences shows that with respect to the components of Multiple Intelligences such as, logical mathematical intelligence, spatial intelligence, interpersonal intelligence and intrapersonal intelligence private school students scored more than that of Govt. school students. In the case of linguistic intelligence, the mean score of Govt. school students is more than that of private school students.

The mean score of linguistic intelligence for Govt. school students is 73.22 and standard deviation is 22.05 . The mean score of linguistic intelligence for the private school students is 69.01 and standard deviation is 27.80. The t-test shows that the variable linguistic intelligence of Govt. school students is significantly higher than that of the private school students at .05 level of significance.

The mean score of logical mathematical intelligence for Govt. school students is 80.43 and standard deviation is 14.84. The mean score of logical mathematical intelligence for private school students is 80.71 and standard deviation is 18.05. The t-test shows that the variable logical mathematical intelligence is not significantly different between Govt. and private school students.

The mean score of spatial intelligence for Govt. school students is 68.23 and standard deviation is 25.63. The mean score of spatial intelligence for private school students is 71.26 and standard deviation is 27.38. The t-test shows that the variable spatial intelligence of private school students is significantly higher than that of Govt. school students at 0.05 level of significance.
The mean score of interpersonal intelligence for Govt. school students is 77.73 and standard deviation is 20.97. The mean score of interpersonal intelligence for private school students is 80.44 and standard deviation is 23.48. The t-test shows that the variable interpersonal intelligence of private school students is significantly higher than that of Govt. school students at 0.05 level of significance.

The mean score of intra-personal intelligence for Govt. school students is 80.38 and standard deviation is 14.80. The mean score of intrapersonal intelligence for private school students is 80.44 and standard deviation is 18.26. The t-test shows that the variable logical mathematical intelligence is not significantly different between Govt. and private schools students.

6.2.4 Findings based on 2nd Objective

6.2.4.1 Descriptive statistics of scores of achievement in mathematics

6.2.4.1.1 Significant difference between the scores in Mathematics achievement for the total sample

The mean achievement in mathematics is 70.32 with standard deviation 20.95. The skewness of achievement in mathematics is -0.44 which is slightly negatively skewed and the kurtosis is -0.40, which is slightly platykurtic. Thus with respect to the achievement in mathematics, the distribution of students is almost symmetric.

The achievement in mathematics is significantly above 50 at 1% level of significance (t = 37.55, sig. <0.01).
6.2.4.1.2 Significant difference between the scores in Mathematics achievement for the relevant subsamples

6.2.4.1.2.1 Achievement in mathematics is significantly different with respect to gender.

The mean score of achievement in mathematics for male is 68.81 and that for female is 71.89. The t-test shows the mean achievement in mathematics for female is significantly more than that of male at 1% level of significance (sig. <0.01).

6.2.4.1.2.2 Achievement in mathematics is significantly different with respect to locality.

The mean score of achievement in mathematics for rural students is 68.59 and that for urban is 71.92. The t-test shows that the mean achievement in mathematics for urban students is significantly more than that of rural students at 1% level of significance (sig. <0.01).

6.2.4.1.2.3 Achievement in mathematics is significantly different with respect to management

The mean score of achievement in mathematics for Govt. School students is 69.94 and that for private school students is 70.94. The t-test shows the mean achievement in mathematics for Govt. school students is not significantly different with the mean scores of private school students (sig. > 0.05).

6.2.5 Findings based on 3rd Objective

Relationship between the achievement in mathematics and selected components of Multiple Intelligences such as

1. Verbal/Linguistic intelligence

2. logical/ mathematical intelligence
3. Visual/spatial intelligence

4. Interpersonal intelligence,

5. Intrapersonal naturalistic intelligence.

6.2.5.1 Correlation analysis of the achievement in mathematics on selected components of multiple intelligences for the total sample

6.2.5.1.1 The correlation coefficient of achievement in mathematics and linguistic intelligence is 0.412. This shows that the relation is low. The correlation coefficient is significant at 1% level of significance.

6.2.5.1.2 The correlation coefficient of achievement in mathematics and logical mathematical intelligence is 0.969. This shows that the relation is very high. The correlation coefficient is significant at 1% level of significance.

6.2.5.1.3 The correlation coefficient of achievement in mathematics and spatial intelligence is 0.919. This shows that the relation is very high. The correlation coefficient is significant at 1% level of significance.

6.2.5.1.4 The correlation coefficient of achievement in mathematics and interpersonal intelligence is 0.553. This shows that the relation is moderate. The correlation coefficient is significant at 1% level of significance.

6.2.5.1.5 The correlation coefficient of achievement in mathematics and Intrapersonal intelligence is 0.961. This shows that the relation is very high. The correlation coefficient is significant at 1% level of significance.

The correlation analysis shows that the selected components of Multiple Intelligences are positively correlated to the achievement in mathematics and are significant at 1% level of significance (sig. <0.01). It indicates the relation between
the selected components of Multiple Intelligences and achievement in Mathematics which is significant.

**6.2.6 Findings based on 4th Objective**

Relationship between the achievement in mathematics and selected components of Multiple Intelligences for the relevant subsamples.

**6.2.6.1 Karl Pearson’s correlation coefficients between selected components of Multiple Intelligences and achievement in mathematics for male and female**

**6.2.6.1.1** The correlation coefficient of achievement and linguistic intelligence are 0.458 for male and 0.359 for female students. Both the correlation coefficients are significant at 1% level of significance.

**6.2.6.1.2** The correlation coefficient of achievement and logical mathematical intelligence are 0.979 for male and 0.956 for female students. Both the correlation coefficients are significant at 1% level of significance.

**6.2.6.1.3** The correlation coefficient of achievement and spatial intelligence are 0.932 for male and 0.904 for female students. Both the correlation coefficients are significant at 1% level of significance.

**6.2.6.1.4** The correlation coefficient of achievement and interpersonal intelligence are 0.517 for male and 0.597 for female students. Both the correlation coefficients are significant at 1% level of significance.

**6.2.6.1.5** The correlation coefficient of achievement and linguistic intelligence are 0.965 for male and 0.955 for female students. Both the correlation coefficients are significant at 1% level of significance.

**6.2.6.1.6** The z-transformation test shows that correlation coefficients between achievement in mathematics and selected components of Multiple intelligences of male and female students is significantly different at 1% level of significance.
6.2.6.2 Correlation between the selected components of Multiple Intelligences and achievement in mathematics of rural and urban school students

6.2.6.2.1 The correlation coefficients of achievement in mathematics and linguistic intelligence are 0.432 for rural and 0.395 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.2.2 The correlation coefficients of achievement in mathematics and logical mathematical intelligence are 0.965 for rural and 0.973 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.2.3 The correlation coefficients of achievement in mathematics and spatial intelligence are 0.917 for rural and 0.920 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.2.4 The correlation coefficients of achievement in mathematics and interpersonal intelligence are 0.515 for rural and 0.593 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.2.5 The correlation coefficients of achievement in mathematics and intrapersonal intelligence are 0.961 for rural and 0.961 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.2.6 The z-transformation test shows that there is significant difference in correlation coefficients between achievement in mathematics and selected Components of Multiple intelligences such as logical-mathematical Intelligence and interpersonal intelligence of Rural and Urban students. This is significantly different at 0.01 level of significance. For Linguistic intelligence, Spatial Intelligence and Intrapersonal Intelligence the correlation coefficients are not significantly different (sig. >0.05).
6.2.6.3  Correlation between the selected components of Multiple Intelligences and achievement in mathematics for private and government school students

6.2.6.3.1  The correlation coefficient of achievement in mathematics and linguistic intelligence are 0.477 for Govt. school students and 0.346 for private school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.3.2  The correlation coefficient of achievement in mathematics and logical mathematical intelligence are 0.962 for Govt. school students and 0.978 for private school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.3.3  The correlation coefficient of achievement in mathematics and spatial intelligence are 0.929 for Govt. school students and 0.907 for private school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.3.4  The correlation coefficients of achievement in mathematics and interpersonal intelligence are 0.570 for Govt. school students and 0.530 for private school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.3.5  The correlation coefficients of achievement in mathematics and linguistic intelligence are 0.857 for Govt. school students and 0.962 for private school students. Both the correlation coefficients are significant at 1% level of significance.

6.2.6.3.6  The z-transformation test shows that there is significant difference in correlation coefficients between achievement in mathematics and components of Multiple intelligence, except for interpersonal intelligence of Government and private school students at .01 level of significance. For interpersonal intelligence the correlation coefficients are not significantly different (sig. >0.05).
6.2.7 Findings based on 5th Objective

Association between levels of achievement in mathematics and different levels of the selected components of Multiple Intelligences such as 1) Linguistic intelligence 2) Logical-mathematical intelligence, 3) Spatial intelligence, 4) Interpersonal Intelligence, 5) Intrapersonal intelligence for the total sample.

6.2.7.1 Association between verbal/linguistic Intelligence and Achievement in mathematics

The study shows that 36.6% of the students who were low in linguistic intelligence is also low in achievement in Mathematics, 25.7% medium in achievement in Mathematics and 37.7% high in achievement in Mathematics. Of those medium in linguistic intelligence, 44.4% were also medium in achievement in Mathematics and 47.9% were high in achievement in Mathematics. Of those who were high in linguistic intelligence, 73.4% were also high in the achievement in Mathematics.

The chi square test shows that the linguistic intelligence and the achievement in mathematics are associated significantly at 1% level of significance.

6.2.7.2 Association between Logical mathematical Intelligence and Achievement in mathematics

95.9% of the students who were low in logical mathematical intelligence is also low in achievement in mathematics. Of those, who were medium in logical mathematical intelligence, 100% were low in achievement in mathematics. Of those who were high in logical mathematical intelligence, 68.5% were also high in the achievement in mathematics. It is to be noted that those who were medium in logical mathematical intelligence were low in achievement in mathematics. The reason is that the logical mathematical intelligence is high for 93% students but the achievement in
mathematics is high only for 64% and medium for 28%. So, those who scored low and medium in logical mathematical intelligence belonged to the low achievement in mathematics group.

The chi square test shows that the logical mathematical intelligence and the achievement in mathematics are associated significantly at 1% level of significance.

6.2.7.3 Association between spatial Intelligence and Achievement in mathematics

43.5% of the students who were low in spatial intelligence is also low in achievement in mathematics, 50.4% medium in achievement in mathematics and 6.1% high in achievement in mathematics. Of those medium in spatial intelligence, 85.5% were also medium in achievement in mathematics. Of those who were high in spatial intelligence, 99.8% were also high in the achievement in mathematics.

The chi square test shows that the spatial intelligence and the achievement in mathematics are associated significantly at 1% level of significance.

6.2.7.4 Association between interpersonal Intelligence and Achievement in mathematics

53.8% of the students who were low in Interpersonal intelligence is also low in achievement in mathematics, 18.7% medium in achievement and 27.5% high in achievement. Of those medium in Interpersonal intelligence, 57% were also medium in achievement. Of those who were high in Interpersonal intelligence, 72.9% were also high in the achievement in mathematics.

The chi square test shows that the Interpersonal intelligence and the achievement in mathematics are associated significantly at 1% level of significance.
6.2.7.5 Association between intra-personal Intelligence and Achievement in mathematics

93.5% of the students who were low in intrapersonal intelligence is also low in achievement in mathematics. Of those medium in intra-personal intelligence, 98.2% were low in achievement in mathematics. Of those who were high in intrapersonal intelligence, 68.4% were also high in the achievement in mathematics. It is to be noted that those who were medium in intrapersonal intelligence were also low in achievement in mathematics. The reason is that the intrapersonal intelligence is high for 93% students but the achievement in mathematics is high only for 64% and medium for 28%. So, those who scored low and medium in intra-personal intelligence belonged to the low achievement in mathematics group.

The chi square test shows that the intrapersonal intelligence and the achievement in mathematics are associated significantly at 1% level of significance.

6.2.8 Findings based on 6th Objective

The selected components of Multiple Intelligences are significantly effective to predict the achievement in mathematics for the total sample.

The analysis shows that logical mathematical intelligence, intrapersonal intelligence, spatial intelligence, and interpersonal intelligence have positive regression coefficients but the linguistic intelligence shows negative regression coefficient. The t-test confirms that these variables are significant at 1% level of significance.

The multiple regression analysis reveals that logical mathematical intelligence, intrapersonal intelligence and spatial intelligence are important predictors of achievement in Mathematics. Also the selected components of Multiple Intelligences are effective to explain 96.6% of the variation of the achievement in mathematics.
6.3 Tenability of the Hypothesis

6.3.1 First hypothesis

There is significant difference in the selected components of multiple intelligences of secondary level students for the relevant subsamples based on

1. Gender
2. Locality
3. Management

It is found that the variables, linguistic intelligence and inter-personal intelligence are not significantly different between male and female students and for all other variables the mean scores of female is significantly higher than that of male at 1% level of significance. So the hypothesis $H_{1(1)}$ is partially accepted.

The study shows that the variables, linguistic intelligence and inter-personal intelligence are not significantly different between rural and urban. The variables logical mathematical intelligence and intra-personal intelligence of urban students are significantly higher than that of rural students at 1% level of significance. The spatial intelligence of urban students is significantly higher than that of the rural students at 5% level of significance. So the hypothesis $H_{1(2)}$ is partially accepted.

The study shows that the variables, logical mathematical intelligence and intra-personal intelligence are not significantly different between Govt. and private schools. The variables spatial intelligence and inter-personal intelligence of private school students are significantly higher than that of Govt. school students at 5% level of significance. The linguistic intelligence of Govt. school students is significantly higher than that of the private school students at 1% level of significance. So the hypothesis $H_{1(3)}$ is partially accepted.
6.3.2 Second hypothesis

There is significant difference in the mathematics achievement of secondary level students for relevant subsamples based on

1) Gender
2) Locality
3) Management

The t-test shows the mean achievement in mathematics for female is significantly more than that of male at 1% level of significance (sig. <0.01). So the hypothesis $H_{2(1)}$ is accepted.

The t-test shows the mean achievement in mathematics for urban students is significantly more than that of rural students at 1% level of significance (sig. <0.01). So the hypothesis $H_{2(2)}$ is accepted.

The t-test shows the mean achievement in mathematics for Govt. school students is not significantly different with the mean scores of private school students (sig. > 0.05). So the hypothesis $H_{2(3)}$ is accepted.

6.3.3 Third hypothesis

There is significant relationship between the achievement in mathematics and selected components of Multiple Intelligences such as

a) Verbal/Linguistic intelligence
b) logical/ mathematical intelligence
c) Visual/spatial intelligence
d) Interpersonal intelligence,

e) Intrapersonal naturalistic intelligence

The correlation coefficient of Mathematics achievement and linguistic intelligence is 0.412. This shows that the relation is low. The correlation coefficient is significant at 1% level of significance. So the hypothesis $H_{3(a)}$ is accepted.

The correlation coefficient of Mathematics achievement and logical mathematical intelligence is 0.969. This shows that the relation is very high. The correlation coefficient is significant at 1% level of significance. So the hypothesis $H_{3(b)}$ is accepted.

The correlation coefficient of Mathematics achievement and spatial intelligence is 0.932 for male and 0.919 for female. This shows that the relation is very high. The correlation coefficient is significant at 1% level of significance. So the hypothesis $H_{3(c)}$ is accepted.

The correlation coefficient of Mathematics achievement and inter-personal intelligence is 0.553. This shows that the relation is moderate. The correlation coefficient is significant at 1% level of significance. So the hypothesis $H_{3(d)}$ is accepted.

The correlation coefficient of Mathematics achievement and Intra-personal intelligence is 0.965. This shows that the relation is very high. The correlation coefficient is significant at 1% level of significance. So the hypothesis $H_{3(e)}$ is accepted.

The correlation analysis shows that the selected components of multiple intelligences are positively correlated to the achievement in mathematics and are significant at 1% level of significance (sig. <0.01). It indicates that the relation
between the selected components of multiple intelligences and achievement in Mathematics are significant.

6.3.4 Fourth hypothesis

There is significant relationship between the achievement in mathematics and selected components of Multiple Intelligences for the subsamples based on

1) Gender

2) Locality

3) Management

The correlation coefficients of achievement in mathematics and linguistic intelligence are 0.458 for male and 0.359 for female students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and logical mathematical intelligence are 0.979 for male and 0.956 for female students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and spatial intelligence are 0.932 for male and 0.904 for female students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and interpersonal intelligence are 0.517 for male and 0.597 for female students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and Intrapersonal intelligence are 0.965 for male and 0.955 for female students. Both the correlation coefficients are significant at 1% level of significance.
The z-transformation test shows that correlation coefficients between achievement in mathematics and selected components of Multiple intelligences of male and female students are significantly different at 0.01 level of significance. So the hypothesis $H_4(1)$ is accepted at 0.01 level of significance.

The study shows that the correlation coefficients of achievement in mathematics and linguistic intelligence are 0.432 for rural and 0.395 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and logical mathematical intelligence are 0.965 for rural and 0.973 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and spatial intelligence are 0.917 for rural and 0.920 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficient of achievement in mathematics and interpersonal intelligence are 0.515 for rural and 0.593 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and intrapersonal intelligence are 0.961 for rural and 0.961 for urban school students. Both the correlation coefficients are significant at 1% level of significance.

The z-transformation test shows that the amount of relationship between achievement in mathematics and the selected components of Multiple intelligences except Linguistic intelligence, Spatial Intelligence and Intra-personal Intelligence is significantly different between Rural and Urban students. So the hypothesis $H_4(2)$ is partially accepted at 0.01 level of significance.
The z-transformation test shows that there is significant difference in correlation coefficients between achievement in mathematics and components of Multiple intelligence, except for interpersonal intelligence of Government and private school students, is significantly different at 0.01 level of significance. For interpersonal intelligence, the correlation coefficients are not significantly different (sig. >0.05).

The study shows that the correlation coefficients of achievement in mathematics and linguistic intelligence are 0.477 for Govt. school students and 0.346 for private school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and logical mathematical intelligence are 0.962 for Govt. school students and 0.978 for private school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and spatial intelligence are 0.929 for Govt. schools and 0.907 for private schools. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and inter-personal intelligence are 0.570 for Govt. school students and 0.530 for private school students. Both the correlation coefficients are significant at 1% level of significance.

The correlation coefficients of achievement in mathematics and linguistic intelligence are 0.857 for Govt. school students and 0.962 for private school students. Both the correlation coefficients are significant at 1% level of significance.

The z-transformation test shows that there is significant difference in correlation coefficients between achievement in mathematics and components of
Multiple intelligence except for interpersonal intelligence of Government and private school students is significantly different at 0.01 level of significance. For interpersonal intelligence, the correlation coefficients are not significantly different (sig. >0.05).

Thus the amount of relationship between achievement in mathematics and the selected independent variables except interpersonal intelligence is significantly different between Govt. and private school students. So the hypothesis $H_4(3)$ is partially accepted at 0.01 level of significance.

6.3.5 Fifth hypothesis

There is an association between levels of achievement in mathematics and different levels of the selected components of Multiple Intelligences such as 1) Linguistic intelligence 2) Logical-mathematical intelligence, 3) Spatial intelligence, 4) Interpersonal Intelligence, 5) Intrapersonal intelligence for the total sample.

The chi square test shows that the linguistic intelligence and the achievement in mathematics are associated significantly at 1% level of significance. So the hypothesis $H_5(1)$ is accepted.

The chi square test shows that the logical mathematical intelligence and the achievement in mathematics are associated significantly at 1% level of significance. So the hypothesis $H_5(2)$ is accepted.

The chi square test shows that the spatial intelligence and the achievement in mathematics are associated significantly at 1% level of significance. So the hypothesis $H_5(3)$ is accepted.
The chi square test shows that the Interpersonal intelligence and the achievement in mathematics are associated significantly at 1% level of significance. So the hypothesis H₅(4) is accepted.

The chi square test shows that the Intrapersonal intelligence and the achievement in mathematics are associated significantly at 1% level of significance. So the hypothesis H₅(5) is accepted.

6.3.6 Sixth hypothesis

The selected components of multiple intelligences are significantly effective to predict the achievement in mathematics.

The multiple regression analysis reveals that the selected components of multiple intelligences are effective to explain 96.6% of the variation of the achievement in mathematics. Also logical mathematical intelligence, intrapersonal intelligence and spatial intelligence are important predictors of achievement in mathematics.

There is significant relationship between components of multiple intelligences that discriminate students of various achievement levels. So the hypothesis H₆ is accepted.

6.4 Implications Based on the Study

1. It is a fact that students are using Multiple Intelligences with or without the awareness. So find the most dominant component of Multiple Intelligences inherited in a student by the use of these standardized tests. Then encourage the student to practice the fields in which he has to use the most dominant component of Multiple Intelligences. This helps him to become an expert in the corresponding field. Also it will be very good if Kerala school syllabus is
to be reconstructed so that more activities based on the inculcation of different Multiple Intelligences become possible.

2. This study suggests that all the selected components of Multiple Intelligences are present in secondary school students of Kerala in varied form. So those who lack some components of Multiple Intelligences must be given special training for attaining more ability.

3. The study shows the necessity of giving special programs inculcating logical-mathematical intelligence, spatial intelligence and intrapersonal intelligence in rural schools. So a special branch of subject based on Multiple Intelligences should be implemented in rural schools as an elective subject.

4. The study shows that the govt. school students in secondary level have more interpersonal intelligence than private school students. So programs should be conducted for inculcating interpersonal intelligence among private school students also. Various community programs like interschool debates, interschool seminars and state seminars are to be implemented in private schools and encourage the students to participate in these.

5. The study suggests that linguistic intelligence and achievement in mathematics have low correlation among secondary school students of Kerala. So teachers of mathematics should take necessary steps to make these students more alert in using linguistic intelligence. Without language, the conveyance of ideas of Mathematics is not so effective. So initiatives should be taken to impart an optimum level of Linguistic intelligence to the students.

6. The study suggests that one of the basic reasons for low achievement in mathematics is low logical mathematical intelligence for secondary school students of Kerala. So for getting more achievement in mathematics much
training in using logical mathematical abilities is essential. Special programs are to be arranged for the students having low Logical-mathematical Intelligence. School should arrange Mathematical quiz competitions, logic based debates, Mathematical exhibitions for capturing the interest of students.

7. This is an age of specialization. The world around is looking for students having special abilities. A separate curriculum can be constructed for motivating those students who are interested in the selected components of Multiple Intelligences. By this the growth of special qualities in students can be improved.

8. All the developed nations have established Multiple Intelligences based schools as a part of their educational development. In Kerala also it is desirable to establish such schools.

9. Teachers in secondary schools in Kerala should know about different Multiple Intelligences. The training colleges must arrange activities based on Multiple Intelligences for their trainees. Only through this the future teachers become efficient in the subject of Multiple Intelligences.

10. Special workshops and classes of experts should be arranged in the subject of psychology especially in the branch of Multiple Intelligences for teachers of secondary schools in Kerala.

11. It is desirable to provide students of Kerala schools with more logic based textbooks.

12. The entrance examinations for Engineering, Medicine etc. must include different items measuring Multiple Intelligences.
6.5 Suggestions for Further Research

1. A similar study can be done by including all other components of Multiple Intelligences.

2. A study can be conducted for finding the effectiveness of multiple Intelligences on achievement in mathematics as an experimental study.

3. A study on the relationship between Multiple Intelligences and achievement in mathematics can be done by taking a large sample.

4. A study on the relationship between Multiple Intelligences and achievement in mathematics can be done in different subjects also.

5. A study on the relationship between Multiple Intelligences and achievement in mathematics can be done by taking a sample of primary school students or upper primary school students or in higher secondary school students.

6. A study can be done on a sample of school teachers for finding the attitude towards implementing multiple intelligences based classrooms in secondary schools of Kerala.

7. An investigation can be done for finding the presence of selected components of Multiple Intelligences of teacher trainees in B.Ed colleges.

8. A study about the effect of selected components of Multiple Intelligences on achievement motivation can be done.

9. An investigation about finding the relationship between selected components of Multiple Intelligences and teacher effectiveness can be conducted.

10. A study on the relationship between selected components of Multiple Intelligences and teaching attitude of teacher-educators can be conducted.

11. A study on the effect of selected components of Multiple Intelligences on competency based education can be conducted.