Chapter – V

SUMMARY AND CONCLUSIONS

5.1 Introduction

Every citizen of the modern world sees the countless manifestations of science all around him. There is no aspect of man’s life today which has not been influences by science one way or the other. The modern science is no longer confined to the surface of this globe, its sphere of achievements reached beyond the earth.

Each and every student needs to achieve optimally in Science. Each part of the science curriculum such as physics, chemistry and Biology needs careful planning. The objectives determine what students are to achieve. In addition to reading and Mathematics which is presently being emphasized in testing student achievement.

Within the frame work of problem solving students need to develop needed skills in thinking critically. To think critically the student needs to be able to analyze subject matter in terms of being factual v/s opinion, accurate v/s inaccurate and relevant v/s irrelevant.

In addition to critical thought, the student also needs to think creatively. Unique ideas are necessary in many cases to solve problems. The ‘Tried and True’ may not work as solutions. Thus novelty and Originality of decisions must be made. Flexibility of ideas is then needed in the decision making arena.

Students achievement in science is an important area of personal development. The world of science surrounds the individual with technological improvements, innovations in ideas and the natural environment. Thus in
medical practices and human health in agriculture, in transportation, in communication, the individual perceives what science has accomplished for the individual.

A rapidly advancing technology was calling for a large number of highly trained manpower. Individuals who possess science potential can come only from our schools and colleges. It takes time and experience to educate them. We must identify students with science potential at least at the secondary school stage, encourage need stimulate them to continue their education. So as to become trained scientists and technologists of tomorrow.

Science has contributed to bringing about changes in our ways of thinking, attitude, aptitude, creativity, interest and outlook. Hence the science education imparted in our school plays a vital role in the development of individual and in turn the nation. Now a days it has become very difficult to impart meaningful science education due to explosion of scientific knowledge. So it will become worse, if we fail to take into account the explosion of knowledge in this age.

5.2 Need and Importance of the Study

Cognitive Style encompasses the higher mental processes of human beings including how people know and understand the world, process information, make judgements and decisions and described their knowledge and understanding to others. The cognitive style includes mental activities like thinking, memory, reasoning and intelligence.

Much of the previous investigations focuses on the differences in cognitive styles, creativity, personality and scientific aptitude of students pursuing different majors in their secondary education. It is assumed that the
cognitive style which was different than their own for more likely to change to a major which completed their cognitive style.

The need of the study was to find out the impact of cognitive styles, creativity, personality, intelligence and scientific aptitude on science achievement as the above said variables are directly correlated with in fostering the achievement of science. In turn these variables help in increasing the rate of achievement in science of all abled children such as underachievers, low achievers, average achievers and high achievers at secondary school level. It is very important that there is an attention required to students who come from rural backgrounds with less infrastructural facilities in schools.

It is a matter of common experience of many teachers of science that the actual achievement of most of the students in the science subject is generally less when compared with their abilities. Hence the present study is undertaken with a view to identify the impact of cognitive styles, creativity, personality, intelligence and scientific aptitude on science achievement of high achievers, average achievers, low achievers and underachievers of tenth standard students.

Hope that the findings of the study would help the educational system, classroom instruction, teachers teaching techniques and parents and students learning abilities. The present study has high significant importances in improving the total academic performance of different levels of students in science.
5.3 General Statement of the Problem

“A Study of Cognitive Styles, Scientific Aptitude, Creativity and Personality in Relation to Science Achievement of High, Average, Low and Underachievers in Secondary Schools” – is the problem selected for research.

5.4 Objectives of the Study

- To study the significant difference between male and female students of secondary school with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).
- To study the significant difference between male and female students of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).
- To study the significant difference between male and female students of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).
- To study the significant difference between male and female students of secondary school with respect to scientific aptitude scores.
- To study the significant difference between male and female students of secondary school with respect to achievement in science scores.
- To study the significant difference between urban and rural school students of secondary school with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).
- To study the significant difference between urban and rural school students of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).
• To study the significant difference between urban and rural school students of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

• To study the significant difference between urban and rural school students of secondary school with respect to scientific aptitude scores.

• To study the significant difference between urban and rural school students of secondary school with respect to achievement in science scores.

• To study the significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).

• To study the significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).

• To study the significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

• To study the significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to scientific aptitude scores.

• To study the significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with
respect to achievement in science scores.

- To study the significant difference between different achievers (High, Average, Under and Low) of secondary school students in Science with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).

- To study the significant difference between different achievers (High, Average, Under and Low) of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).

- To study the significant difference between different achievers (High, Average, Under and Low) of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

- To study the significant difference between different achievers (High, Average, Under and Low) of secondary school with respect to scientific aptitude scores.

- To study the significant relationship between Cognitive styles and its dimensions (i.e. Embedded figure test, Paper Folding, intelligence) with achievement of secondary school students in Science as a whole.

- To study the significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of secondary school students in Science as a whole.

- To study the significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of secondary school students in Science as a whole.

- To study the significant relationship between Scientific aptitude and achievement of secondary school students in Science as a whole.
• To study the significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of high achievers in Science.

• To study the significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of high achievers in Science.

• To study the significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of high achievers in Science.

• To study the significant relationship between Scientific aptitude and achievement of high achievers in Science.

• To study the significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of average achievers in Science.

• To study the significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of average achievers in Science.

• To study the significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of average achievers in Science.

• To study the significant relationship between scientific aptitude and achievement of average achievers in Science.

• To study the significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of under achievers in Science.
• To study the significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of under achievers in Science.

• To study the significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of under achievers in Science.

• To study the significant relationship between scientific aptitude and achievement of under achievers in Science.

• To study the significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of low achievers in Science.

• To study the significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of low achievers in Science.

• To study the significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of low achievers in Science.

• To study the significant relationship between scientific aptitude and achievement of low achievers in Science.

• To study the significant relationship among dimensions of Cognitive styles i.e. embedded figure test, Paper Folding, intelligence.

• To study the significant relationship among dimensions of Personality i.e. Psychotism, Neuroticism, Extroverts, Lie score

• To study the significant relationship among dimensions of Creativity i.e. Fluency, Flexibility, Originality sores
To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school students in Science (Total).

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school high achievers in Science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school average achievers in Science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school under achievers in Science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school low achievers in Science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school male students in Science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school female students in Science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school students of rural schools in science.
To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Science achievement of secondary school students of urban schools.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school students of government schools in science.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Science achievement of secondary school students of aided schools.

To study the Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Science achievement of secondary school students of unaided schools.

To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students as a total.

To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in high achievers.

To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in average achievers.

To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in under achievers.
• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in low achievers.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school male students.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school female students.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school rural school students.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school urban school students.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students of government schools.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students of aided schools.

• To study the significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students of unaided schools.
5.5 Hypotheses of the Study

**H$_1$** There is no significant difference between male and female students of secondary school with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).

**H$_2$** There is no significant difference between male and female students of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).

**H$_3$** There is no significant difference between male and female students of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

**H$_4$** There is no significant difference between male and female students of secondary school with respect to scientific aptitude scores.

**H$_5$** There is no significant difference between male and female students of secondary school with respect to achievement in science scores.

**H$_6$** There is no significant difference between urban and rural school students of secondary school with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).

**H$_7$** There is no significant difference between urban and rural school students of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).

**H$_8$** There is no significant difference between urban and rural school students of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

**H$_9$** There is no significant difference between urban and rural school students of secondary school with respect to scientific aptitude scores.
H₁₀ There is no significant difference between urban and rural school students of secondary school with respect to achievement in science scores.

H₁₁ There is no significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).

H₁₂ There is no significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).

H₁₃ There is no significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

H₁₄ There is no significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to scientific aptitude scores.

H₁₅ There is no significant difference between different types of management (Government, Aided and Unaided) school students of secondary school with respect to achievement in science scores.

H₁₆ There is no significant difference between different achievers (High, Average, Under and Low) of secondary school students in Science with respect to cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence).
H₁₇ There is no significant difference between different achievers (High, Average, Under and Low) of secondary school with respect to Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score).

H₁₈ There is no significant difference between different achievers (High, Average, Under and Low) of secondary school with respect to Creativity scores and its dimensions (i.e. Fluency, Flexibility, and Originality).

H₁₉ There is no significant difference between different achievers (High, Average, Under and Low) of secondary school with respect to scientific aptitude scores.

H₂₀ There is no significant relationship between Cognitive styles and its dimensions (i.e. Embedded figure test, Paper Folding, intelligence) with achievement of secondary school students in Science as a whole.

H₂¹ There is no significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of secondary school students in Science as a whole.

H₂² There is no significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of secondary school students in Science as a whole.

H₂₃ There is no significant relationship between Scientific aptitude and achievement of secondary school students in Science as a whole.

H₂₄ There is no significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of high achievers in Science.
H25 There is no significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of high achievers in Science.

H26 There is no significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of high achievers in Science.

H27 There is no significant relationship between Scientific aptitude and achievement of high achievers in Science.

H28 There is no significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of average achievers in Science.

H29 There is no significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of average achievers in Science.

H30 There is no significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of average achievers in Science.

H31 There is no significant relationship between scientific aptitude and achievement of average achievers in Science.

H32 There is no significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of under achievers in Science.

H33 There is no significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of under achievers in Science.
H₃₄ There is no significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of under achievers in Science.

H₃₅ There is no significant relationship between scientific aptitude and achievement of under achievers in Science.

H₃₆ There is no significant relationship between Cognitive styles and its dimensions (i.e. embedded figure test, Paper Folding, intelligence) with achievement of low achievers in Science.

H₃₇ There is no significant relationship between Personality and its dimensions (Psychotism, Neuroticism, Extroverts, Lie score) with achievement of low achievers in Science.

H₃₈ There is no significant relationship between Creativity and its dimensions (i.e. Fluency, Flexibility, Originality) with achievement of low achievers in Science.

H₃₉ There is no significant relationship between scientific aptitude and achievement of low achievers in Science.

H₄₀ There is no significant relationship among dimensions of Cognitive styles i.e. embedded figure test, Paper Folding, intelligence.

H₄₁ There is no significant relationship among dimensions of Personality i.e. Psychotism, Neuroticism, Extroverts, Lie score

H₄₂ There is no significant relationship among dimensions of Creativity i.e. Fluency, Flexibility, Originality scores

H₄₃ Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school students in Science (Total).
H44 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school high achievers in Science.

H45 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school average achievers in Science.

H46 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school under achievers in Science.

H47 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school low achievers in Science.

H48 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school male students in Science.

H49 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school female students in Science.

H50 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school students of rural schools in science.

H51 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Science achievement of secondary school students of urban schools.
H52 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Achievement of secondary school students of government schools in science.

H53 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Science achievement of secondary school students of aided schools.

H54 Cognitive styles, Creativity, Personality and Scientific aptitude would not be significant predictors of Science achievement of secondary school students of unaided schools.

H55 There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students as a total.

H56 There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in high achievers.

H57 There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in average achievers.

H58 There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in under achievers.

H59 There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students in low achievers.
H₆₀ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school male students.

H₆₁ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school female students.

H₆₂ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school rural school students.

H₆₃ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school urban school students.

H₆₄ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students of government schools.

H₆₅ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students of aided schools.

H₆₆ There is no significant direct and indirect effect of Cognitive styles, Creativity, Personality and Scientific aptitude scores on achievement in science of secondary school students of unaided schools.

5.6 The Variables Considered in the Study

The following are the variables considered for the present study.

1) Dependent Variable

a) Achievement in Science
2) Independent Variable
   a) Cognitive Styles
   b) Creativity
   c) Personality
   d) Intelligence
   e) Scientific Aptitude
3) Moderator Variable
   a) Gender (M/F)
   b) Locality (R/U)
   c) Type of School (G/A/UA)

The above variables were selected based on the related literature, self observation and the teaching experience of the investigator in the college of education.

5.7 Tools Used for the Study

The following tools were used for the study –

1) Minnessota paper Form Board Test (MPFBT)
2) Baqer Mehdi's Test of Creativity by Words (TCW)
3) Eysenck's Personality Questionnaire – R (EPQ-R)
4) Otis Test of Mental Ability (MA)
5) Scientific Aptitude Test (SAT)*
6) Achievement Test in Science (ATS)*

* = Constructed and Standardized by the Researcher

5.8 Sample of the Study

The study involved a sample of n=484, X standard students of two educational districts Tumkur and Madhugiri in such a way as to make
available all categories of schools. Stratified random sampling technique is used to select the sample for the study.

Table 5.1: Table showing break up of sample in terms of variables

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>Break Up</th>
<th>No. of Students</th>
<th>Total</th>
</tr>
</thead>
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<td>484</td>
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<tr>
<td></td>
<td></td>
<td>Girls</td>
<td>263</td>
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<td>1</td>
<td>Locality</td>
<td>Rural</td>
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<td>484</td>
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<td></td>
<td></td>
<td>Urban</td>
<td>250</td>
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<td>Gender</td>
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<td></td>
<td>Aided</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Unaided</td>
<td>175</td>
<td></td>
</tr>
</tbody>
</table>

5.9 Statistical Techniques Used

The data which were collected from nine secondary schools was analysed with reference to the objectives stated and hypotheses formulated, the following statistical techniques were used;

1) Descriptive statistics, such as mean and standard deviation, t-test, ANOVA, were used to study the significant difference among the mean scores of the groups.

2) Correlation analysis was used to investigate the relationship between independent variables and dependent variables. Karl Pearson correlation technique was applied and simple relationships were obtained.

3) Path analysis was used to find out the direct and indirect influence of independent variables on the dependent variables.

4) Regression analysis was used to analyse the group of data on variables.

5) ANOVA test and t-test were applied to investigate the significant and non-significant relationships among the variables.

All the statistical techniques were carried out by using SPSS 11.0 statistical software.
5.10 Major Findings of the Study

1. There is no significant difference between male and female secondary school students in cognitive styles and embedded figure ability.

2. The female secondary school students have higher paper folding ability than male students.

3. There is no significant difference between male and female secondary school students in intelligence.

4. The female secondary school students have higher personality traits than male students.

5. The male secondary school students have higher psychotism dimension than female students.

6. The female secondary school students have higher neuroticism dimension than male students.

7. There is no significant difference between secondary school male students and female students in extrovert's dimension.

8. The female secondary school students have higher lie scores than male students.

9. There is no significant difference between male and female secondary school students in creativity scores and its components such as fluency, flexibility and originality.

10. There is no significant difference between the male and female secondary school students in scientific aptitude.

11. There is no significant difference between the male and female secondary school students in academic achievement.
12. The rural secondary school students have lesser cognitive styles, ability in embedded figure and intelligence than urban students.

13. The rural and urban secondary school students have similar paper folding abilities.

14. There is significant difference between rural and urban secondary school students in personality and its dimensions.

15. Rural secondary school students have higher personality, higher neuroticism, extrovert tendencies and lie scores than urban secondary school students.

16. The rural secondary school students have less psychotism tendencies than urban school students.

17. There is significant difference between urban and rural secondary school students in creativity, scientific aptitude and academic achievement.

18. There is significant difference in cognitive styles among secondary school students belonged to Government, Aided and Unaided schools.

19. There is significant difference in the dimensions of cognitive styles and its dimensions among Government, Aided and Unaided schools.

20. The aided secondary school students have higher cognitive styles and in its dimensions, embedded figures, paper folding and intelligence than unaided and government school students.

21. There is significant different in personality and its dimensions psychotism, neuroticism, extrovert’s and lie scores among secondary schools of Government, Aided and Unaided schools.
22. The unaided secondary school students have higher personality, extrovert's and high lie scores than aided and government secondary school students.

23. The government secondary school students have higher psychotism than unaided and aided secondary school students.

24. The aided secondary school students have higher neuroticism scores than unaided and government secondary school students.

25. The unaided secondary school students have higher creativity and flexibility scored than aided and government secondary school students.

26. The aided secondary school students have higher fluency scores than unaided and government secondary school students.

27. There is significant difference among high, average, low and underachievers in cognitive style and its dimensions, embedded figure test, paper folding and intelligence.

28. The high achievers have higher cognitive style and intelligence than average, under and low achievers.

29. The average achievers have higher embedded figure and paper folding abilities than high, low and underachievers.

30. There is significant difference among high, average, low and underachievers in personality scores and its dimensions psychotism, neuroticism, extrovert's and lie scores.

31. The high achievers have higher personality scores, psychotism, neuroticism and extrovert's scores than average, low and underachievers.
32. The high achievers have higher lie scores than high, low and underachievers.

33. There is a significant difference among high, average, low and underachievers in creativity and its dimensions fluency, flexibility and originality.

34. The high achievers have higher creativity, fluency, flexibility and originality scores than average, low and underachievers.

35. There is significant correlation or relationship between cognitive styles and achievement of secondary school students in science.

36. There is significant and positive correlation or relationship between embedded figures test scores, paper folding test scores and intelligence scores and achievement of secondary school students in Science.

37. There is a positive and significant correlation between personality scores, psychotism, neuroticism and lie scores and achievement of secondary school students in science.

38. There is a positive and non-significant correlation or relationship between extrovert’s scores and achievement of secondary school students in science.

39. There is a positive and significant correlation or relationship between creativity, fluency, flexibility and originality scores and achievement of secondary school students in science.

40. There is no significant correlation or relationship between scientific aptitude and achievement of secondary school students in science.

41. There is a positive and non-significant correlation or relationship between cognitive style and achievement of high achievers in science.
42. There is a negative and non-significant correlation or relationship between embedded figure test scores and achievement of high achievers in science.

43. There is a negative and significant correlation or relationship between paper folding ability scores and achievement of high achievers in science.

44. There is a positive and significant correlation or relationship between intelligence scores and achievement of high achievers in science.

45. There is a positive and non-significant correlation or relationship between personality scores and achievement of high achievers in science.

46. There is a positive and non-significant correlation or relationship between psychotism scores, neuroticism scores, extrovert's scores and lie scores and achievement of high achievers in science.

47. There is a positive and non-significant correlation or relationship between creativity scores, fluency scores, flexibility scores and achievement of high achievers in science.

48. There is a negative and non-significant correlation or relationship between originality scores and achievement of high achievers in science.

49. There is a negative and non-significant correlation or relationship between scientific aptitude and achievement of high achievers in science.

50. There is a negative and non-significant correlation or relationship between cognitive style scores, embedded figure ability and intelligence and achievement of average achievers in science.
51. There is a positive and significant correlation or relationship between dimension of cognitive style i.e. paper folding scores and achievement of average achievers in science.

52. There is a negative and non-significant correlation or relationship between personality scores, extrovert's scores and achievement of average achievers in science.

53. There is a positive and non-significant correlation or relationship between psychotism, neuroticism and lie scores and achievement of average achievers in science.

54. There is a positive and non-significant correlation or relationship between creativity, originality dimension scores and achievement of average achievers in science.

55. There is a negative and non-significant correlation or relationship between fluency scores and achievement of average achievers in science.

56. There is a negative and significant correlation or relationship between scientific aptitude scores and achievement of average achievers in science.

57. There is a positive and non-significant correlation or relationship between cognitive style scores, embedded figure ability and intelligence scores and achievement of underachievers in science.

58. There is a positive and significant correlation or relationship between paper folding ability scores and achievement of underachievers in science.
59. There is a negative and non-significant correlation or relationship between personality scores, extrovert's scores and lie scores and achievement of underachievers in science.

60. There is a positive and non-significant correlation or relationship between psychotism and neuroticism scores and achievement of underachievers in science.

61. There is a positive and non-significant correlation or relationship between creativity scores, fluency scores and flexibility scores and achievement of underachievers in science.

62. There is a negative and non-significant correlation or relationship between originality scores and achievement of underachievers in science.

63. There is a positive and significant correlation or relationship between cognitive style scores, embedded figure test scores, intelligence scores and achievement of low achievers in science.

64. There is a positive and non-significant correlation or relationship between paper folding ability scores and achievement of low achievers in science.

65. There is a positive and non-significant correlation or relationship between personality scores, neuroticism scores and achievement of low achievers in science.

66. There is a negative and significant correlation or relationship between psychotism scores, lie scores and achievement of low achievers in science.

67. There is a positive and significant correlation or relationship between extrovert's scores and achievement of low achievers in science.
68. There is a positive and significant correlation or relationship between creativity, fluency scores, flexibility scores, originality scores and achievement of low achievers in science.

69. There is a positive and significant correlation or relationship between embedded figure test scores and paper folding test scores.

70. There is a positive and non-significant correlation or relationship between embedded figure test scores, paper folding scores with that of intelligence scores.

71. There is a negative and significant correlation or relationship between psychotism scores and neuroticism scores, psychotism scores and extrovert's scores.

72. There is a positive and significant correlation or relationship between psychotism scores and extrovert's scores, neuroticism scores and extrovert's scores, neuroticism scores and lie scores and extrovert's scores and lie scores.

73. There is a positive and significant correlation or relationship between fluency scores and flexibility scores, fluency scores and originality scores and flexibility scores and originality scores, the three dimensions of creativity.

74. There is a positive and significant impact of cognitive style, creativity and personality on achievement of secondary school students in science.

75. There is a negative and significant impact of scientific aptitude on achievement of secondary school students in science.
76. There is a positive and significant impact of cognitive style and personality on achievement of high achievers in science in secondary schools.

77. There is a positive and non-significant impact of creativity on achievement of high achievers in science in secondary schools.

78. There is a negative and non-significant impact of scientific aptitude on achievement of high achievers in science in secondary schools.

79. There is a positive and non-significant impact of cognitive style and personality on achievement of average achievers in science in secondary schools.

80. There is a negative and non-significant impact of creativity on achievement of average achievers in science in secondary schools.

81. There is a negative and significant impact of scientific aptitude on achievement of average achievers in science in secondary schools.

82. There is a positive and non-significant impact of cognitive style on achievement of underachievers in science in secondary schools.

83. There is a negative and non-significant impact of creativity and personality on achievement of underachievers in science in secondary schools.

84. There is a negative and significant impact of scientific aptitude on achievement of underachievers in science in secondary schools.

85. There is a positive and significant impact of creativity and scientific aptitude on achievement of low achievers in science in secondary schools.
86. There is a positive and non-significant impact of cognitive style on achievement of low achievers in science in secondary schools.

87. There is a negative and non-significant impact of personality on achievement of low achievers in science in secondary schools.

88. There is a positive and significant impact of cognitive style, creativity, personality and scientific aptitude on achievement of male students in science in secondary schools.

89. There is a positive and significant impact of creativity and scientific aptitude on achievement of female students in science in secondary schools.

90. There is a positive and non-significant impact of cognitive style and personality on achievement of female students in science in secondary schools.

91. There is a positive and non-significant impact of creativity and personality on achievement of rural secondary school students in science.

92. There is a negative and significant impact of cognitive style on achievement of rural secondary school students in science.

93. There is a positive and significant impact of scientific aptitude on achievement of rural secondary school students in science.

94. There is a positive and significant impact of cognitive style, creativity and scientific aptitude on achievement of urban secondary school students in science.

95. There is a negative and significant impact of personality on achievement of urban secondary school students in science.
96. There is a positive and non-significant impact of cognitive style, creativity and personality on achievement of government secondary school students in science.

97. There is a positive and significant impact of scientific aptitude on achievement of government secondary school students in science.

98. There is a positive and non-significant impact of cognitive style and creativity on achievement of aided secondary school students in science.

99. There is a negative and non-significant impact of personality on achievement of aided secondary school students in science.

100. There is a negative and significant impact of scientific aptitude on achievement of aided secondary school students in science.

101. There is a negative and non-significant impact of cognitive style on achievement of unaided secondary school students in science.

102. There is a positive and significant impact of creativity on achievement of unaided secondary school students in science.

103. There is a positive and non-significant impact of personality on achievement of unaided secondary school students in science.

104. There is a negative and significant impact of scientific aptitude on achievement of unaided secondary school students in science.

105. There is a significant and direct effect of cognitive styles, creativity, personality and scientific aptitude on achievement of secondary school students in science, as a whole.

106. There is a significant and indirect effect of cognitive styles, creativity and scientific aptitude on achievement of secondary school students in science, as a whole.
107. There is a significant and indirect effect of creativity through cognitive styles, personality and scientific aptitude on achievement of secondary school students in science, as a whole.

108. There is a significant and indirect effect of personality through creativity and scientific aptitude on achievement of secondary school students in science, as a whole.

109. There is a significant and indirect effect of scientific aptitude through cognitive styles and personality on achievement of secondary school students in science, as a whole.

110. There is a significant and direct effect of cognitive styles on achievement of secondary school high achievers in science.

111. There is a significant and indirect effect of cognitive styles through personality and scientific aptitude on achievement of secondary school high achievers in science.

112. There is a significant and indirect effect of creativity through cognitive styles and scientific aptitude on achievement of secondary school high achievers in science.

113. There is a significant and indirect effect of personality through scientific aptitude on achievement of secondary school high achievers in science.

114. There is a significant and indirect effect of scientific aptitude through creativity and personality on achievement of secondary school high achievers in science.

115. There is a significant and direct effect of scientific aptitude on achievement of secondary school average achievers in science.
116. There is a significant and indirect effect of cognitive styles through scientific aptitude on achievement of secondary school average achievers in science.

117. There is a significant and direct effect of cognitive styles, creativity, personality and scientific aptitude on achievement of secondary school average achievers in science.

118. There is a significant and indirect effect of personality through cognitive styles, creativity and scientific aptitude on achievement of secondary school average achievers in science.

119. There is a significant and direct effect of personality and scientific aptitude on achievement of secondary school underachievers in science.

120. There is a significant and indirect effect of cognitive styles through creativity and scientific aptitude on achievement of secondary school underachievers in science.

121. There is a significant and indirect effect of creativity through cognitive styles, personality and scientific aptitude on achievement of secondary school underachievers in science.

122. There is a significant and indirect effect of personality through creativity and scientific aptitude on achievement of secondary school underachievers in science.

123. There is a significant and indirect effect of scientific aptitude through cognitive styles, creativity and personality on achievement of secondary school underachievers in science.

124. There is a significant and direct effect of creativity and personality on achievement of secondary school low achievers in science.
125. There is a significant and indirect effect of cognitive styles through creativity and scientific aptitude on achievement of secondary school low achievers in science.

126. There is a significant and indirect effect of creativity through cognitive styles and scientific aptitude on achievement of secondary school low achievers in science.

127. There is a significant and indirect effect of personality through creativity on achievement of secondary school low achievers in science.

128. There is a significant and indirect effect of scientific aptitude through cognitive styles, creativity and personality on achievement of secondary school low achievers in science.

129. There is a significant and direct effect of cognitive styles, creativity, personality and scientific aptitude on achievement of secondary school male students in science.

130. There is a significant and indirect effect of cognitive styles through creativity, personality and scientific aptitude on achievement of secondary school male students in science.

131. There is a significant and indirect effect of personality through cognitive styles on achievement of secondary school male students in science.

132. There is a significant and indirect effect of scientific aptitude through cognitive styles on achievement of secondary school male students in science.

133. There is a significant and direct effect of creativity and scientific aptitude on achievement of secondary school female students in science.
134. There is a significant and indirect effect of cognitive styles through creativity on achievement of secondary school female students in science.

135. There is a significant and indirect effect of creativity through cognitive styles and personality on achievement of secondary school female students in science.

136. There is a significant and indirect effect of personality through creativity on achievement of secondary school female students in science.

137. There is a significant and indirect effect of scientific aptitude through cognitive styles on achievement of secondary school female students in science.

138. There is a significant and direct effect of cognitive styles and scientific aptitude on achievement of rural secondary school students in science.

139. There is a significant and indirect effect of cognitive styles through creativity and scientific aptitude on achievement of rural secondary school students in science.

140. There is a significant and indirect effect of creativity through cognitive styles on achievement of rural secondary school students in science.

141. There is a significant and indirect effect of scientific aptitude through cognitive styles on achievement of rural secondary school students in science.

142. There is a significant and direct effect of cognitive styles, creativity, personality and scientific aptitude on achievement of urban secondary school students in science.
143. There is a significant and indirect effect of cognitive styles through creativity and personality on achievement of urban secondary school students in science.

144. There is a significant and indirect effect of creativity through cognitive styles, personality and scientific aptitude on achievement of urban secondary school students in science.

145. There is a significant and indirect effect of personality through cognitive styles and creativity on achievement of urban secondary school students in science.

146. There is a significant and indirect effect of scientific aptitude through creativity on achievement of urban secondary school students in science.

147. There is a significant and direct effect of cognitive styles on achievement of government secondary school students in science.

148. There is a significant and indirect effect of cognitive styles through creativity, personality and scientific aptitude on achievement of government secondary school students in science.

149. There is a significant and indirect effect of creativity through cognitive styles on achievement of government secondary school students in science.

150. There is a significant and indirect effect of personality through cognitive styles and scientific aptitude on achievement of government secondary school students in science.

151. There is a significant and indirect effect of scientific aptitude through creativity and personality on achievement of government secondary school students in science.
152. There is a significant and direct effect of scientific aptitude on achievement of aided secondary school students in science.

153. There is a significant and indirect effect of personality through scientific aptitude on achievement of aided secondary school students in science.

154. There is a significant and indirect effect of scientific aptitude through personality on achievement of aided secondary school students in science.

155. There is a significant and direct effect of creativity, personality and scientific aptitude on achievement of unaided secondary school students in science.

156. There is a significant and indirect effect of cognitive styles through scientific aptitude on achievement of unaided secondary school students in science.

157. There is a significant and indirect effect of creativity through personality on achievement of unaided secondary school students in science.

158. There is a significant and indirect effect of personality through creativity and scientific aptitude on achievement of unaided secondary school students in science.

159. There is a significant and indirect effect of scientific aptitude through cognitive styles and personality on achievement of unaided secondary school students in science.

5.11 Conclusion

Children in a given classroom may not vary only in things they know and in their capabilities of learning, but also in which they approach and deal with the given task. The cognitive style be referred specifically to a persons
characteristic pattern of behaviour in a particular learning field. The cognitive style represents patterns of individual variation in the mode of perceiving, remembering and thinking which is to be reflected with consistency in a wide range of learning. Cognitive styles do play a significant role in the science achievement of tenth standard students.

Creative thinking as has been shown gets stultified when not properly cared for and stimulated. The creative potential and talented be identified and cultivated. It is a fact that creativity like other personality traits is distributed normally among the population and there is every possibility to be creative in ones own field – The urge to inquire, to invent, to perform, is stifled in means of school children to be tapped and nourished.

Science now being a compulsory subject in every system of school education right from the elementary level. Scientific aptitude is a complex of interacting heredity and environmental determinants, producing pre-dispositions are abilities in science. Scientific aptitude is necessary for pupil to pursue science education.

- The cognitive style, creativity and personality factors supports in increasing the achievement of secondary school students in science.
- The cognitive style, creativity and personality factors supports in increasing the achievement of high achievers in secondary schools in science.
- The cognitive style, personality and scientific aptitude dimensions supports in increasing the achievement of average achievers of secondary schools in science.
• The creativity, personality and scientific aptitude dimensions are not supporting in increasing the achievement of underachievers of secondary schools in science.

• The cognitive style, creativity and scientific aptitude dimensions supports in increasing the achievement of low achievers in secondary schools in science.

• The cognitive style, creativity, personality and scientific aptitude dimensions supports in increasing the achievement of male students of secondary schools in science.

• The cognitive style, creativity, personality and scientific aptitude dimensions supports in increasing the achievement of female students of secondary schools in science.

• The cognitive style, creativity, personality and scientific aptitude dimensions supports in increasing the achievement of rural school students of secondary schools in science.

• The cognitive style, creativity and scientific aptitude dimensions supports in increasing the achievement of urban school students of secondary schools in science.

• The cognitive style, creativity, personality and scientific aptitude dimensions supports in increasing the achievement of students of government secondary schools in science.

• The cognitive style and creativity dimensions supports in increasing the achievement of aided school students of secondary schools in science.

• The scientific aptitude dimension is not supporting in increasing the achievement of secondary school students in science.
- The scientific aptitude dimension is not supporting in increasing the achievement of secondary school high achievers in science.
- The creativity dimension is not supporting in increasing the achievement of secondary school average achievers in science.
- The cognitive style is supporting in increasing the achievement of secondary school underachievers in science.
- The personality factor is not supporting in increasing the achievement of secondary school low achievers in science.
- The personality factor is not supporting in increasing the achievement of urban secondary school students in science.
- The personality factor is not supporting in increasing the achievement of aided secondary school students in science.
- The scientific aptitude dimension in the secondary school pupils as a whole was average.
- The scientific aptitude dimension in the pupils of urban and rural schools was average, but urbanites possessed a little bit high than ruralites.
- The pupils of private schools possessed a bit high scientific aptitude dimension than those of government schools.

5.12 Educational Implications

The findings of the present study has clear and meaningful implications for teachers, teacher educators, parents, school guidance & counselors and educational administrators.

The classroom teachers and teacher educators should manage the differently abled children such as high achievers, average achievers,
underachievers and low achievers in improving their academic achievement, especially science achievement.

The teachers should make use of different methodologies of teaching – heuristic method, problem solving and project method to improve the students' achievement in science.

The guidance and school counselors should provide guidance services for different types of achievers along with follow up services to pop up with their potential, psychological imbalances and other social factors. Specially the creative children are very much in need of counseling services to nurture their creative ability.

The parents must be well informed and to be aware of the abilities, capabilities, talents, weaknesses and strengths of their children to provide a suitable environment for their educational nourishment at home.

The educational administrators and policy makers should manage the total school system and children effectively by providing self-study materials, promote reading habits, scope for problem solving abilities, competitive spirit, sense of educational and occasional aspiration among students of different levels of achievement based on the innate and hidden talents suitably. They should be encouraged and provide a platform to come up in the field of their interest.

The personality development training programmes for students should be organized to overcome the negative personality characteristics which were found by the investigator in his study.

As creativity and intelligence can be seen as a very high level of meaningful learning, education in relation to the creative talents and
intellectual abilities specially in science subject should be nurtured well by providing rich and varied experiences like science project works, science olympiads, competitive examinations at national and international levels so that we can overcome the negavities of the children which is very much found in underachievers and low achievers in the study.

Though the aptitude is not totally inherited quality where one can modify it, not completely but to a considerable extent, but it is quite certain that one who has scientific aptitude, not only perceive the knowledge correctly but also apply it in understanding new situations and able to solve the problems confidently as scientific aptitude is of very significant concern in the process of science education.

The present study also helps in designing certain learning activities like maze learning techniques, reasoning ability exercises, word association tests, brain storming sessions, puzzle problems based on convergent and divergent thinking, to develop the cognitive styles of students who are at different levels of achievement.

Independent variables such as general mental ability, scientific aptitude and creativity have significant relationships on achievement of science of high, average, low and underachievers. Hence these three variables may be used on all science students.

Greater and active participation of students of different levels of achievement must be ensured by teachers for quick grasping of the concepts and to improve the science achievement of students.

The use of teaching aid both projected and non-projected materials and experiments may be ensured while teaching science subjects for correct
understanding of the concepts and help them to develop a favourable attitude towards science especially meant for high, average and low achievers where they can improve their science achievement.

The human memory is not a single vessel to be filled, but rather a complex set of inter-related cognitive factors. The investigator concluded by this study that cognitive styles, creativity, personality, scientific aptitude highly influences the achievement of students in science. Therefore these variables are to be considered as important factors in school guidance and counseling.

5.13 Tips to Improve Students Science Achievement

Based on the findings of the present study and investigators observation the following practical tips are also made for improving the science achievement of high, average, under and low achievers.

- Helping students to understand both mechanics and methods of effective study.

- Development of clear understanding of objectives of science education.

- Achievement motivation training.

- Counseling treatment.

5.14 Suggestions for Further Research

Based on the findings of the present study and taking into consideration of its limitations the following suggestions are made for further research in this area.

1) The similar studies can be conducted to 8th, 9th standards and at P.U. level in different subjects.

2) The studies can be carried out at the Kendriya Vidyalayas, Sainik Schools and Navodaya Vidyalayas where classroom climate may be different.
3) The similar studies can be carried out by taking regional level samples on different subjects at different levels of education.

4) The similar studies can be conducted on a large sample.

5) Based on the findings of the present study the investigation can be extended for development and construction of guidance and resource materials for fostering the abilities of differently abled children.