CHAPTER 5

SUMMARY
AND
CONCLUSIONS
# Summary and conclusions

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5.0 **Prologue**

According to the prediction of our former president Dr. A. P. J. Kalam, India will be the superpower by 2020. Only science has the power to convert this prediction into truth. This is only possible when the productive population is of science achievers. If one agrees with this then it must be appreciated that it is responsibility of today’s teachers to teach them properly, by taking into account their learning preferences. Today there is a tough competition of marks for learning science related courses for getting nice opportunities. Teacher should help them to study and achieve good marks. But it is not so easy to help them according to their preferences. And it is also important to see whether learning according to their preferences help them for good achievement or does their attitude toward learning affect their achievement. With this thought, the researcher decided to undertake the research in the field of science. And studied achievement with reference to attitude towards its
learning and learning style. The research work carried out is presented in the earlier four chapters. Here is the summary of the whole work.

5.1 Summary

In universe only change is permanent. This change is the product of human innate tendency to explore. All most all inventions are the result of exploring tendency. For all inventions and discoveries science is a base. Every invention has its bright as well as dark side. To use its bright side is its advantage, but sometimes unfortunately its dark side is used and it harms to human life to large extent. But here also science is at the top to overcome that. So it is necessary to teach science from school level, help them to prefer right approach of the use of science through science learning. Good achievement in science may provide them good jobs and opportunities and also grant right approach of its use. This background embosses the need of achievement in science, and ultimately research in it.

Need for the subject Science

Present age is the age of science and technology; some may call it as the age of information technology; still some other predict that tomorrow’s age will be of bio-technology. Whatever may be the trend, one has to keep one’s knowledge about science updated if one wants to lead life
successfully and satisfactorily. The importance of this subject ‘science’ is recognized by many learned people throughout the world and tried to make science as a compulsory component in school curricula. In India also after independence many commissions emphasized the need of subject science to be compulsory and recommended for good science teaching and for providing laboratory material to make science learning effective. There is science in each and every activity in the world and it imparts certain values to human society, like, intellectual value, utilitarian value, vocational value, and cultural value too. The subject, its creation and knowledge help people right from cradle to grave in gratification of their needs. Person with the knowledge of science can lead his personal, social, national and global life successfully, and can save the world from destruction. So there is need for subject science in school as well as in life of every individual.

**Review of the related literature**

The literature regarding ‘learning style’ is not available in much detail, but there are many learning styles described by different researchers. Many inventories are available on internet for identifying learning styles, of which many styles are overlapping though nomenclature is different.

Not a single research was found which is exactly similar to the present research. In all 31 studies; 20 from
India and 11 studies from abroad were found. In all 31 studies 21 researches are done on learning styles whereas 10 researches were related to attitude.

For last 35 years more than 1000 researches are done by using LSI. Of which more than 430, were from Education, but their details are not available. Not a single research was found which was done in India using Kolb’s Learning Style Inventory. This situation underlines the importance of study in this field. For a developing country like India, it is not affordable to waste students’ time by teaching them without considering their learning styles. These thoughts encouraged the researcher to undertake the present study.

**The research problem**

When students are learning in secondary school stage they are in the crucial age. What they learn in this stage may affect their whole life. If they acquire right way of studying of any subject may help them to reach to their own potential in that field. It is our need of the nation that tomorrow’s citizen should be learned and especially with knowledge of science. Tomorrow’s citizen comprises both men and women who are now school going children. So both girls and boys should achieve in science, but many documents shows that girls are not equally admitting and achieving in science stream. Here the researcher felt need to think over
their learning preference or attitude that may hinder their admissions to science subject or success in it. If there is any relation of these two with achievement in science, it may help in deciding teaching strategies according to their learning preferences. Therefore, the researcher decided to undertake the present research problem entitled as-

**Title**: A study of achievement of secondary school students in science in relation to learning styles and attitude towards learning science.

**Objectives of the research**

The researcher had specific goal to achieve through present study, she wanted to find out if there is any gender difference in learning styles and attitude towards learning science of the students. Besides this she was also interested in finding out relation between learning style and achievement in science, and relation between attitude towards learning science and achievement in science of 9th standard students. The objectives of the present study were as follows.

1) To identify learning styles of 9th std. students.
2) To measure the attitude of 9th std. students towards learning science.
3) To find out if there is any gender difference in terms of learning style of the 9th std. students.

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4) To compare achievement in science of 9th std. students of two opposite learning styles.

5) To compare the achievement in science of 9th std. boys and girls having same learning style.

6) To find out if there is any gender difference regarding attitude towards learning science of 9th std. students.

7) To find out relation between achievement in science and attitude towards learning science of 9th std. students.

**Research hypotheses**

While starting on the above mentioned objectives, researcher had some guesses in her mind. Some of those guesses were stated explicitly by the researcher as follows in the form of hypotheses, and sub-hypotheses.

**H1:** There is no significant difference between the number of boys and girls of 9th std. having same learning style.

As there were four types of learning style; four different sub-hypotheses were stated. Those hypotheses are as follows.

**1A:** There is no significant difference between the number of boys and girls of 9th std. having converging learning style.
1B: There is no significant difference between the number of boys and girls of 9th std. having diverging learning style.

1C: There is no significant difference between the number of boys and girls of 9th std. having accommodating learning style.

1D: There is no significant difference between the number of boys and girls of 9th std. having assimilating learning style.

H₂: 9th std. students having two opposite learning styles show equal achievement in science.

As there were two pairs of opposite learning styles; two different sub-hypotheses were formulated. Those were as follows.

2A: 9th std. students having converging learning style and students having diverging learning style show equal achievement in science.

2B: 9th std. students having accommodating learning style and students having assimilating learning style show equal achievement in science.

H₃: There is no significant difference between achievement in science of boys and girls having same learning style.
Here also four different sub-hypotheses were necessary to set as there were four types of learning styles. Those hypotheses were as follows.

3A: There is no significant difference between achievement in science of boys and girls having converging learning style.

3B: There is no significant difference between achievement in science of boys and girls having diverging learning style.

3C: There is no significant difference between achievement in science of boys and girls having accommodating learning style.

3D: There is no significant difference between achievement in science of boys and girls having assimilating learning style.

3E: There is no significant difference between achievement in science of boys and girls.

H4: There is no significant difference in attitude towards learning science of 9th std. boys and girls.

Though the above mentioned hypothesis could be tested separately; four different sub-hypotheses were stated so as to test style-wise difference in attitude towards learning science of boys and girls. And two more hypotheses were formulated to test difference in attitude towards learning science of students with opposite learning style.
4A: There is no significant difference in attitude towards learning science of 9th std. boys and girls, having converging learning style.

4B: There is no significant difference in attitude towards learning science of 9th std. boys and girls having diverging learning style.

4C: There is no significant difference in attitude towards learning science of 9th std. boys and girls having accommodating learning style.

4D: There is no significant difference in attitude towards learning science of 9th std. boys and girls having assimilating learning style.

4E: There is no significant difference in attitude towards learning science of 9th std. students of opposite learning style.

As there were two pairs of opposite learning styles; two different sub-hypotheses were formulated.

4E₁: There is no significant difference in attitude towards learning science of 9th std. students having converging learning style and students having diverging learning style.

4E₂: There is no significant difference in attitude towards learning science of 9th std. students having accommodating learning style and students having assimilating learning style.
**H5:** There exists significant positive relation between the achievement in science of 9th std. students and attitude towards learning science.

**Significance of the problem**

Necessity of education is unquestionable. Parents send their children to school and expect some achievement from them. Achievement is a level of success attended by individual on the completion of a task. Experience of success is very important in life, as that motivates the individual intrinsically towards socially accepted ways.

Now a day too much importance is given on the marks, this pulls the students in a race of marks achievement. Those students who achieve high, no problem, they could enter into their interesting field. Those who don’t succeed in that race may get frustrated. One of the reasons of their underachievement may be their learning style, attitude and way through which they get inputs in schools about the content on which they are expected to achieve.

The present study succeeded in finding attitude of students towards learning science and the prominent learning style of boys and girls. So it will be easy for teacher to concentrate on these two styles while teaching, and could plan some additional activities for the students having another two styles. Teacher could also think on, the inputs could be provided to students having positive attitude
towards science. Such effort will enable to take cognizance of attitudes of students and distinct learning styles comprising a heterogeneous group in the class in order to make teaching more effective, and help students to achieve high.

**Research Method**

The present research is a descriptive research, in which, learning styles, achievement in science and attitude towards learning science of students are found out. Comparison of achievement in science, attitude towards learning science and learning styles of boys and girls is done and relationship between learning styles and achievement in science and relationship between attitude towards learning science is discovered. It was a survey testing, including assessment and evaluation.

**Sampling**

Out of 100 English medium Schools in Pune 10 % schools were selected by simple random sampling for survey purpose, and that was sample first.

Other than these ten schools, one more school was selected from the remaining 90 schools by simple random sampling for determination of reliability of the tools prepared. This was sample second, comprising of 55 students.
The 10% schools included 10 schools and the above mentioned one school; all the eleven schools selected randomly belong to co-education.

Each school from sample was considered as a cluster, and all students of 9th std. from that school were included in the sample. The sample first used for study and it consisted of 709 students; out of which 310 were girls and 399 were boys.

**Limitations**

The researcher had selected geographical area of Pune for her study. There are hundred English medium schools in Pune. It was not possible to study on all students from hundred English medium schools, so it was necessary to delimit in terms of population covered, sample selected and scope of variables studied and so on. The following were the delimitations of the study.

1) The study was carried out on 9th class students.
2) The sample was selected from English medium schools from Pune city.
3) The study covered over the learning style, achievement in science and attitude towards learning science.
**Tools for data collection**

For data collection the researcher used three tools, those were as follows.

(1) For measuring achievement in science two achievement tests were prepared by the researcher related to 9th std. science-I syllabus and science-II syllabus. Content validity was established with the help of subject teachers in schools. Reliability coefficient of these two tests by test-retest method was estimated. The reliability coefficient of achievement test 1 was 0.86 and index of reliability was 0.93. The reliability coefficient of achievement test 2 was 0.84 and index of reliability was 0.91.

(2) The researcher prepared attitude scale, to find out attitude towards learning science.

Content validity of attitude towards learning science scale was established with the help of five subject experts.

Reliability of attitude scale was established by two methods to check internal consistency. Reliability coefficient by test-retest method was 0.67 and by split half method it was 0.80. The Index of reliability was 0.82 and 0.89 respectively.

(3) In order to find out the learning style of the 9th Std. students a learning style inventory version 3.1 was administered. It is revised in 2005, and is the latest revision of original Kolb's
Learning Style Inventory developed in 1984, according to the standards of educational and psychological testing developed by the American Research Association, The American Psychological Association and the National Council on Measurement in education (1999).

This inventory is designed to understand the way one learns best in any life situations. In this inventory there are 12 sentences with a choice of endings. One has to rank the ending for each sentence, according to one's learning. “4” rank should be given to the ending which describes how one learns best, and down to a “1” for the ending the least like the way one learn. Subject has to rank all endings for each sentence and no one rank should be repeated for that single statement.

The researcher had contacted the concerned authority and secured permission to administer the test in the present research for data collection to all the students covered in the sample.

The researcher herself administered all these tests to students in the sample, assessed answer sheets and analyzed the scores.
Statistics Used in Research

In order to find the dependency of achievement in science with attitude towards learning science correlation (product-moment method) was found.

In order to test the significance of the difference between means of achievement in science pertaining to different groups CR was calculated, and significance was tested at 0.01 level.

In order to test the significance of the difference between percentage of number of boys and girls pertaining to different groups CR was calculated, and significance was tested at 0.01 level.

Findings

In present research the researcher explored learning styles, attitude towards learning science and achievement in science of 9th std. students. The results obtained after applying the statistical techniques to the data are presented in the next pages.
Learning styles of 9th std. students-

Table No. 5.1: Distribution of students on learning styles

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>Girls %</th>
<th>Boys %</th>
<th>Total students %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converging</td>
<td>(49)</td>
<td>(48)</td>
<td>(97) 13.68 %</td>
</tr>
<tr>
<td></td>
<td>15.81 %</td>
<td>12.03 %</td>
<td></td>
</tr>
<tr>
<td>Diverging</td>
<td>(101)</td>
<td>(176)</td>
<td>(277) 39.06 %</td>
</tr>
<tr>
<td></td>
<td>32.58 %</td>
<td>44.11 %</td>
<td></td>
</tr>
<tr>
<td>Accommodating</td>
<td>(50)</td>
<td>(66)</td>
<td>(116) 16.36 %</td>
</tr>
<tr>
<td></td>
<td>16.13 %</td>
<td>16.54 %</td>
<td></td>
</tr>
<tr>
<td>Assimilating</td>
<td>(110)</td>
<td>(109)</td>
<td>(219) 30.89 %</td>
</tr>
<tr>
<td></td>
<td>35.48 %</td>
<td>27.32 %</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>(310)</td>
<td>(399)</td>
<td>(709) 100 %</td>
</tr>
<tr>
<td></td>
<td>100 %</td>
<td>100 %</td>
<td></td>
</tr>
</tbody>
</table>

- The sample exhibited all the four learning styles.
- 15.81% girls, 12.03 % boys and 13.68 % total students possessed converging learning style.
- 32.58 % girls, 44.11 % boys and 39.06 % total students possessed diverging learning style.
- Girls, boys and total students were more in number on the diverging learning style than the converging learning style.
- 16.13% girls 16.54% boys and 16.36 % total students possessed accommodating learning style.
- 35.48 % girls, 27.32 % boys and 30.89 % total student possessed assimilating learning style.
- Girls, boys and total students were more in number on the assimilating learning style than the accommodating learning style.
Attitude towards learning science of 9th std. students

Table No.5.2: Distribution of students on attitude towards learning science scale.

<table>
<thead>
<tr>
<th>Range of Attitude</th>
<th>Girls’% (N=310)</th>
<th>Boys’% (N=399)</th>
<th>Total students % (N=709)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly negative attitude</td>
<td>-</td>
<td>0.50</td>
<td>0.28</td>
</tr>
<tr>
<td>Negative attitude</td>
<td>0.64</td>
<td>1.25</td>
<td>0.98</td>
</tr>
<tr>
<td>Positive attitude</td>
<td>13.78</td>
<td>17.29</td>
<td>15.79</td>
</tr>
<tr>
<td>Strongly positive attitude</td>
<td>85.48</td>
<td>80.95</td>
<td>82.93</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

- Most of the sample possessed strongly positive attitude towards learning science.
- All most all the students possessed positive attitude towards learning science.
- Very few, i.e. less than 0.3% of total students showed strongly negative attitude, and less than 1% showed negative attitude.
- No one from girls showed strongly negative attitude towards learning science.
Testing the Hypotheses

Hypotheses and sub-hypotheses were tested and significance was decided on the basis of CR values. The findings are shown below.

\( H_1 \): There is no significant difference between the number of boys and girls of 9\textsuperscript{th} std. having same learning style.

**Table No. 5.3  Hypothesis 1- findings**

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypotheses stated</th>
<th>CR</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>There is no significant difference between the number of boys and girls of 9\textsuperscript{th} std. having converging learning style.</td>
<td>1.35</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td>1B</td>
<td>There is no significant difference between the number of boys and girls of 9\textsuperscript{th} std. having diverging learning style.</td>
<td>2.94</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (boys are more in numbers than girls)</td>
</tr>
<tr>
<td>1C</td>
<td>There is no significant difference between the number of boys and girls of 9\textsuperscript{th} std. having accommodating learning style.</td>
<td>0.15</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td>1D</td>
<td>There is no significant difference between the number of boys and girls of 9\textsuperscript{th} std. having assimilating learning style.</td>
<td>2.33</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
</tbody>
</table>
**H₂:** 9ᵗʰ std. students having two opposite learning styles show equal achievement in science.

**Table No. 5.4  Hypothesis 2- findings**

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypotheses stated</th>
<th>CR</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>9ᵗʰ std. students having converging learning style and students having diverging learning style show equal achievement in science.</td>
<td>2.91</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (Achievement of students having Con. L.S. is higher than the students having Div. L.S.)</td>
</tr>
<tr>
<td>2B</td>
<td>9ᵗʰ std. students having accommodating learning style and students having assimilating learning style show equal achievement in science.</td>
<td>7.35</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (achievement of students having Assi. L.S. is higher than the students having Acco. L.S.)</td>
</tr>
</tbody>
</table>
\( H_3: \) There is no significant difference between achievement in science of boys and girls having same learning style.

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypotheses stated</th>
<th>CR</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>There is no significant difference between achievement in science of boys and girls having converging learning style.</td>
<td>2.58</td>
<td>Not significant at 0.01 level, hence, null hypothesis accepted</td>
</tr>
<tr>
<td>3B</td>
<td>There is no significant difference between achievement in science of boys and girls having diverging learning style.</td>
<td>3.42</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (achievement of girls is higher than the boys)</td>
</tr>
<tr>
<td>3C</td>
<td>There is no significant difference between achievement in science of boys and girls having accommodating learning style.</td>
<td>1.77</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td>3D</td>
<td>There is no significant difference between achievement in science of boys and girls having assimilating learning style.</td>
<td>1.74</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td>3E</td>
<td>There is no significant difference between achievement in science of boys and girls.</td>
<td>5.59</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (girls achievement is more than boys)</td>
</tr>
<tr>
<td>No.</td>
<td>Hypotheses stated</td>
<td>CR</td>
<td>Findings</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>H4</td>
<td>There is no significant difference in attitude towards learning science</td>
<td>2.77</td>
<td>Significant at 0.01 level, hence null hypothesis rejected</td>
</tr>
<tr>
<td></td>
<td>of 9&lt;sup&gt;th&lt;/sup&gt; std. boys and girls.</td>
<td></td>
<td>(girls attitude is more positive than boys)</td>
</tr>
<tr>
<td>4A</td>
<td>There is no significant difference in attitude towards learning science</td>
<td>0.07</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>of 9&lt;sup&gt;th&lt;/sup&gt; std. boys and girls, having converging learning style.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>There is no significant difference in attitude towards learning science</td>
<td>2.38</td>
<td>Not Significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>of 9&lt;sup&gt;th&lt;/sup&gt; std. boys and girls, having converging learning style.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4C</td>
<td>There is no significant difference in attitude towards learning science</td>
<td>0.74</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>of 9&lt;sup&gt;th&lt;/sup&gt; std. boys and girls, having accommodating learning style.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4D</td>
<td>There is no significant difference in attitude towards learning science</td>
<td>1.30</td>
<td>Not significant at 0.01 level, hence null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>of 9&lt;sup&gt;th&lt;/sup&gt; std. boys and girls, having assimilating learning style.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Hypotheses stated</td>
<td>CR</td>
<td>Findings</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4E₁</td>
<td>There is no significant difference in attitude towards learning science of 9ᵗʰ std. students having converging learning style and students having diverging learning style.</td>
<td>2.91</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (more positive attitude of students having converging learning style than the students having diverging learning style)</td>
</tr>
<tr>
<td>4E₂</td>
<td>There is no significant difference in attitude towards learning science of 9ᵗʰ std. students having accommodating learning style and students having assimilating learning style.</td>
<td>7.35</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (more positive attitude of students having assimilating learning style than the students having accommodating learning style)</td>
</tr>
</tbody>
</table>
**H₅:** There exists significant positive relation between the achievement in science of 9ᵗʰ std. students and attitude towards learning science.

**Table No. 5.7  Hypothesis 5- findings**

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis stated</th>
<th>‘r’</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null hypothesis</td>
<td>No significant positive relation exists between the achievement in science of 9ᵗʰ Std. students and attitude towards learning science.</td>
<td>0.26</td>
<td>Significant at 0.01 level, hence null hypothesis rejected (There exists significant positive relation between the achievement in science and attitude towards learning science.)</td>
</tr>
</tbody>
</table>

**5.3 Conclusions**

1) Distribution of 9ᵗʰ std. students was found uneven on all four learning styles, however, the prominent learning style of the boys was diverging learning style, and the prominent learning style of the girls was assimilating learning style.

2) Almost all the students showed positive attitude towards learning science.
3) Gender difference was susceptible only in diverging learning style. Diverging learning style suited to more number of boys, while, the remaining three learning styles were neutral in terms of gender difference.

4) In case of opposite learning styles, converging and assimilating learning styles were contributory for achievement in science.
   - Converging learning style was a contributory factor for achievement in science of 9\textsuperscript{th} std. students in comparison to diverging learning style.
   - Assimilating learning style was a contributory factor for achievement in science of 9\textsuperscript{th} std. students in comparison to accommodating learning style.

5) In case of girls, diverging learning style promoted achievement in science, but it was not so in case of boys.
   - Except the diverging learning style all remaining three learning styles promoted equally to achievement in science in case of boys & girls.

6) Gender difference was susceptible to attitude towards learning science. The girls showed more positive attitude towards learning science than the boys of 9\textsuperscript{th} standard.

7) Achievement of the girls was higher than that of the boys.
8) Achievement in science depends on attitude towards learning science hence; attitude towards learning science was a contributory factor for achievement in science.

5.4 Discussion about the conclusions

- As individual differences occur on many traits; the researcher also found individual differences in case of learning styles of students. 9th std. students were found unevenly distributed on four learning styles. More students were found on diverging learning style. As in many fields; boys and girls showed inclination towards different styles resulting into obvious gender difference. Boys showed inclination towards diverging learning style whereas of girls showed inclination towards assimilating learning style.

- Though number of boys was more on diverging learning style, girls of the same learning style showed higher achievement in science than that of the boys. While more boys were attracted towards diverging learning style but the style promoted girls for achievement. This observation was rather thought-provoking. As mentioned earlier, divergers are collaborative learners; they enjoy partner and group work, but in examination they have to answer individually. Today also many Indian parents permit boys to stay with their friends for study after
school hours, so they might not get opportunity to study individually. This might have affected on the achievement of the boys, whereas, girls generally are not allowed to stay with friends for a longer duration compelling them to study individually. This practice might have helped the girls in writing answers individually and ultimately in achieving higher than the boys.

As earlier seen in previous chapter; boys prefer highly structured lessons, teacher led work, clear objectives, detail instructions, firm preferential requirements, and practical literacy. Whereas girls prefer, opportunities to develop idea, self developed learning, open ended activities, guidance but with freedom, Individuality in presentation, and emotional literacy. This is what is required for achievement. One who prefers such things definitely scores higher in comparison to those who don’t prefer it.

The preferences of boys if met properly could help them in achieving higher or equal to the girls. If the requirements of boys are not fulfilled through teaching, that may get affected directly on their achievement. This may be the cause of their achievement lower than that of girls having same learning style, that is, diverging learning style.
Here girls showed higher achievement than boys when they showed almost equal positive attitude towards learning science as that of the boys having diverging learning style. So, one can say that; it may be the effect of study habit.

- Students having converging learning style showed more positive attitude towards learning science and higher achievement in science than the students having diverging learning style. When the researcher tried to find out why it was so it was found that; convergers performed well when there was a single correct answer, they preferred to deal with things rather than people, they could focus clearly on specific problem, were not easily distracted, could organize time well, prepare systematic notes, and read instructions carefully. These all attributes were helpful in achieving higher. In contrast to them; divergers see things from different perspectives, enjoys brainstorming and generation of ideas. These qualities do not get opportunity in our traditional examination system. Again and the another thought immerged was; the attributes of a converger were helpful in study of ‘normal’ science but the characteristics of a diverger needed ‘revolutionary advances’ and this also did not get chance in examination
In present research the pattern of achievement tests given by S.S.C. board was followed that was suitable for students of converging learning style, and not that much suitable for divergent students. So it is obvious that it is a little bit difficult for the students having diverging learning style to achieve high in such examination system contrary to their learning style. This might have affected the achievement. So before stating something about this, one has to prepare achievement tests which will suit to divergent students, implement that, assess, analyze and then conclude.

- Still the question, why students with converging learning style possessed more positive attitude towards science than that of the students having diverging learning style remained unanswered. To get the answer the attributes of these styles were again studied.

  While learning convergers always think of application of that knowledge and if they find the way about applying the knowledge it changes their view about that knowledge. Same must have happened with learning science; for the knowledge studied in science, before attempting attitude scale, they might have asked the question like "How can I apply this in practice?" This might have showed them way to apply and that might have developed more positive attitude towards science.
Another and important attribute of convergers is that they show narrow technical interests and quite often choose to specialize in the physical sciences. This original tendency of convergers might have reflected in showing more attitude towards learning science. Likewise the natural tendency of diverger is they show broad cultural interests and tend to specialize in the arts. If there is original inclination towards arts how can one expect that they will show more positive attitude towards learning science, this may be the cause of divergers less positive attitude towards learning science than the convergers.

- Students having assimilating learning style showed more positive attitude towards learning science and higher achievement in science than that of the students having accommodating learning style. Here also when the researcher tried to find out why it was so, and studied the attributes of assimilators it revealed that; assimilators got attracted towards basic sciences. So it is obvious that there attraction towards science could be responsible for their more positive attitude towards learning science. And as findings of present and previous researches showed that there was significant positive relation between attitude towards science and achievement in science, their more attitude towards learning science might be responsible for assimilators higher achievement than the
accommodators. While accommodators solve problems intuitively, not much interested in logical thinking; it is obvious that without logical thinking it is impossible to have positive attitude or higher achievement in science, this may be the reason of less positive attitude and ultimately lower achievement in science of accommodators than the assimilators.

- Almost all students showed positive attitude towards learning science is a good thing. This might be because in the age of science and technology what they learn in schools, what they experience in the world or from the environment they get. Here girls’ attitude towards learning science was more positive and also they achieved more in science than the boys. This might be because preferences of boys and girls are different. girls prefer- opportunities to develop ideas, self developed learning, open ended activities, guidance but with freedom, individuality in presentation and especially emotional literacy, these preferences must have helped them in developing more positive attitude towards learning sciences, through their learning and own experiences. Boys prefer- highly structured lessons, teacher laid work, clear objectives, detailed instructions, firm preferential requirement and practical literacy. Due to these preferences boys might not get chance to think
over what they learn or what they observe as that of the girls, this might have lead them behind in attitude towards learning science and achievement in science in comparison to girls.

- Attitude towards learning science is a contributory factor for achievement in science. This conclusion is very natural; if one has attitude towards doing something; can do it best.

- In related researches it was found that the total sample showed favorable attitude towards science. The finding of present research is supporting the previous research, here also total students showed positive attitude towards learning science.

- The finding of related researches showed the distribution of the attitude score was negatively skewed, the present findings are supporting the previous studies, here also attitude towards learning science was found negatively skewed both in case of boys and girls.

- One of the previous studies showed that, the sex difference was not significantly related to attitude towards science. The present research finding did not support to previous one, as the girls showed more positive attitude towards learning science than the boys.
• In other previous study boys were found to be more favorably disposed towards science than girls. Contradictory findings were observed in present research, as girls showed more positive attitude towards learning science than the boys.

• In case of relation between scores on science attitude and achievement in science the previous study indicated significant and positive relationships between scores on science attitude and achievement in science. Present research finding supported that. Significant positive relation between the achievement in science of 9th std. students and attitude towards learning science was found.

• In previous studies significant sex difference in achievement in science was observed; girls scored higher than the boys in science. Same results were observed in present research also.

5.5 Educational implications

Any classroom is not a homogeneous group of students, most of the times it is heterogeneous group consisting of students with different capabilities.

The present research also has depicted that there is a variety in learning style of the students. The teacher has to satisfy to the four types of students possessing four different learning styles. Hardly it is possible, to satisfy all the
students every time and simultaneously, but keeping in mind the teacher can adopt different teaching styles appropriately suitable to the learning styles. Teacher has to adopt different strategies for all four learning styles.

**Strategy for convergers:**

Convergers are comfortable with ordered and structured routine with clear guidelines and expectations, so teacher should provide such type information to them to learn. But all situations to which learners likely to face are not always predictable and organized. So it is very necessary to give them break out of the routine and let them learn to deal with ambiguity, spontaneity and anomalies.

**Strategy for divergers:**

As divergers are collaborative learners; they enjoy partner and group work so teacher should provide them chance for group work. But it is necessary to train them to work independently in new areas; this will help them in testing their own judgments.

**Strategy for assimilators:**

Assimilators like to analyze and investigate the truth they seek. They need sufficient time to study deeply for their learning, so teacher should allow them to take their own time within certain limits, and considering their weaknesses it is necessary to provide them help in working with others,
developing collaborative skills and understanding other people’s point of view.

**Strategy for accommodators:**

Accommodators are happy when there is choice and options for experimentation and creativity, so teacher should provide those options. But considering their weaknesses they need guidelines, deadlines and boundaries or something else to make them work on proper time. Balancing their creativity and spontaneity with time management is very necessary. They should learn to stick up to particular thing which is important at that particular time. They should learn to recognize the difference between urgency and importance, and take the decisions accordingly.

Besides this, teachers should use instructional practices that appeal to all learning styles. Teachers may prepare their own tool or check list, to reflect on their instructional practices. This might be helpful in increasing range of diversity of instructions and the success of their learners.

Teachers can use the strategies mentioned below to involve all types of learners in learning.

- Try to make all the students aware of their own learning style.
- Try to connect the learning with the world of learners and give them a reason of learning.
• Try to provide opportunities for collecting information from variety of accurate sources.
• Try to give sufficient time for application and rehearsal for long term memory retention.
• Try to increase interactions with material and skills, to help in retention of learned things and also increase creativity.
• Try to give them flexible classroom as only desks in rows do not satisfy all learning styles.
• Try to provide classroom with resources, materials, and technology that will provide freedom of access to all type of learners.
• Try to engage and satisfy the diversity in the classroom through implementation of various instructional strategies.
• While trying something new, work with other teachers as the teachers’ learning styles vary and that brings different ideas in planning.
• Help the students in recognizing their strengths and preferences.
• Collect the reflection of students of there own learning; this will serve as feedback.
• Try to build their curriculum with a variety of learning strategies and assessment tools that accommodate all learners.
• Let the students know that learning style is not an excuse for a learner to avoid the responsibility for areas where he/she is not strong but, rather an opportunity to raise conscious about the lacking and continue to grow.

• Try to develop and retain more and more positive attitude towards learning science as it enhances achievement in science.

5.6 Recommendations for further research

The present study on *A study of achievement of secondary school students in science in relation to learning styles and attitude towards learning science* brought to light a good number of new areas to be studied by the future researchers. The areas and variables which are not covered by this study may be put to test to enlighten the factors related with achievement in science and learning styles, and attitude towards learning science. So, the researchers in future may think on the following areas to study in detail.

1. Studies may be carried out to find the reasons of prominent learning styles of boys and girls.

2. Preparation of achievement test for divergent students and then study relation between achievement and learning style.

3. Science text book at secondary level could be analyzed with a view to find suitability to different learning styles of students.
4. A survey could be taken for methods used for science teaching to 9th std. in schools.

5. A study could be taken up to find relation between attitude, learning style and achievement in the subject other than science.

6. Studies may be carried out to find out relation between attitude towards learning science of students and attitude towards learning science of teachers and its impact on achievement in science of students.

7. A study may be taken up to find whether there is any relation between the learning styles and subject to be learned.

8. Studies can be taken up on the relation between learning styles of students and learning style of teacher and its effect on achievement of students.

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