CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

4.0.0. INTRODUCTION

In the previous chapter data gathering techniques, details of tools used and phases of study were illustrated. Present chapter deals with the analysis and interpretation of data where the collected data is converted into meaningful data by using the statistical tests.

Keeping in view the nature the data descriptive analysis and inferential analysis are used to analyse the data using mean, SD, Mann Whitney U test and Intensity Index to test the various hypotheses formed in chapter 1. The formulated hypotheses were:

H_o1: There is no significant difference between the mean pre-test and post-test scores of scientific temper among secondary school students those did not expose to the developed strategies.

H_o2: There is no significant difference between the mean pre-test and post-test scores of scientific temper among secondary school students those exposed to the developed strategies.

H_o3: There is no significant difference between the mean post-test score of scientific temper between secondary school students those exposed and whose did not expose to the developed strategies.

The statistical analysis of the collected data and to test the said hypotheses are given as follow:

4.1.0. ENHANCEMENT OF SCIENTIFIC TEMPER AMONG THE STUDENTS OF CONTROL GROUP DUE TO REGULAR TEACHING LEARNING PROCESS

To know the impact of regular teaching learning process in the enhancement of scientific temper among the students of control group and to test the hypothesis 1 "There is no significant difference between the mean pre-test and post-test scores of scientific temper among secondary school students those did not expose to the developed strategies" analysis of data is presented the following tables. Further the enhancement of scientific temper is studied in terms of its eight components and as a whole. Hence, the following nine sub hypothesis were formed and tested for all the eight components of scientific temper.

$H_o1.1$: There is no significant difference between the mean pre-test and post-test scores of healthy scepticism component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.2: There is no significant difference between the mean pre-test and post-test scores of objective intellectual honesty component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.3: There is no significant difference between the mean pre-test and post-test scores of rationality component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.4: There is no significant difference between the mean pre-test and post-test scores of perseverance component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.5: There is no significant difference between the mean pre-test and post-test scores of freedom from superstition component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.6: There is no significant difference between the mean pre-test and post-test scores of curiosity component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.7: There is no significant difference between the mean pre-test and post-test scores of open mindedness component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.8: There is no significant difference between the mean pre-test and post-test scores of observation component of scientific temper among secondary school students those did not expose to the developed strategies.

H_o1.9: There is no significant difference between the mean pre-test and post-test scores of scientific temper as a whole among secondary school students those did not expose to the developed strategies.

Table 4.1: Mean, Standard Deviation (SD) and Standard Error (SE) of Mean wise distribution of pre-test and post-test score of scientific temper of control group component wise and as a whole with the N of 32

Components of Scientific Temper	Tests	Mean	SD	SE of Mean
Healthy Scepticism	Pre-test	12.56	2.80	0.495
	Post-test	12.03	2.29	0.405

Objective Intellectual Honesty	Pre-test	12.18	2.85	0.504
	Post-test	12.25	2.87	0.508
Rationality	Pre-test	12.71	2.55	0.451
	Post-test	11.50	2.98	0.527
Perseverance	Pre-test	12.34	2.69	0.479
	Post-test	12.03	2.52	0.445
Freedom from Superstition	Pre-test	12.59	3.07	0.544
	Post-test	12.43	3.12	0.551
Curiosity	Pre-test	12.37	3.46	0.611
	Post-test	11.56	3.18	0.562
Open-Mindedness	Pre-test	13.41	3.16	0.558
	Post-test	11.97	3.21	0.567
Observation	Pre-test	11.78	2.31	0.408
	Post-test	12.46	3.35	0.593
Total	Pre-test	99.96	9.93	1.75
	Post-test	96.25	10.67	10.67

From table 4.1, it was found that the mean pre-test score of healthy scepticism of the control group taught through the regular teaching learning process was 12.56 out of the total score of 20. The standard deviation from the mean for healthy scepticism was found to be 2.80 with standard error of mean of 0.495. From this data it can be said that control group students were found homogenous and average in the healthy skepticism component of scientific temper. From the same table it was also found that the mean post-test score of healthy scepticism of the same group after a whole session was found to be 12.03 with standard deviation of 2.29 and standard error of mean of 0.405. The post-test mean score of healthy scepticism component of scientific temper of the same group was found to be less than their pre-test score. Hence the null hypothesis $H_o1.1$ "There is no significant difference between the mean pre-test and post-test scores of healthy scepticism component of scientific temper among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of healthy scepticism component of scientific temper of the control group due to the regular teaching learning process.

From the same table 4.1, it was found that the mean pre-test score of objective intellectual honesty component of scientific temper of the control group taught through the regular teaching learning process was 12.18 out of the total score of 20. The standard deviation from the mean for objective intellectual honesty was found to be 2.85 with standard error of mean of 0.504. From this data it can be said that control group students were found homogenous and average in the objective intellectual honesty component of scientific temper. From the same table it was also found that the mean post-test score of objective intellectual honesty of the same group

after a whole session was found to be 12.25 with standard deviation of 2.87 and standard error of mean of 0.508. Comparing the mean pre-test and post-test scores of objective intellectual honesty component of scientific temper of control group, it was found that the mean post-test score is slightly higher than the pre-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o1.2: There is no significant difference between the mean pre-test and post-test scores of objective intellectual honesty component of scientific temper among secondary school students those did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.2 with detailed analysis.

From the same table 4.1, it was found that the mean pre-test score of rationality of the control group taught through the regular teaching learning process was 12.71 out of the total score of 20. The standard deviation from the mean for rationality was found to be 2.55 with standard error of mean of 0.451. From this data it can be said that control group students were found homogenous and average in the rationality component of scientific temper. From the same table it was also found that the mean post-test score of rationality of the same group after a whole session was found to be 11.50 with standard deviation of 2.98 and standard error of mean of 0.527. The post-test mean score of rationality component of scientific temper of the same group was found to be less than their pre-test score. Hence the null hypothesis H_o1.3 "There is no significant difference between the mean pre-test and post-test scores of rationality component of scientific temper among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of rationality component of scientific temper of the control group due to the regular teaching learning process.

From the same table 4.1, it was found that the mean pre-test score of perseverance of the control group taught through the regular teaching learning process was 12.34 out of the total score of 20. The standard deviation from the mean for perseverance was found to be 2.69 with standard error of mean of 0.476. From this data it can be said that control group students were found homogenous and average in the perseverance component of scientific temper. From the same table it was also found that the mean post-test score of perseverance of the same group after a whole session was found to be 12.03 with standard deviation of 2.52 and standard error of mean of 0.445. The post-test mean score of perseverance component of scientific temper of the same group was found to be less than their pre-test score. Hence the null hypothesis H_o1.4 "There is no significant difference between the mean pre-test and post-test scores of

perseverance component of scientific temper among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of perseverance component of scientific temper of the control group due to the regular teaching learning process.

From the same table 4.1, it was found that the mean pre-test score of freedom from superstition of the control group taught through the regular teaching learning process was 12.59 out of the total score of 20. The standard deviation from the mean for freedom from superstition was found to be 3.07 with standard error of mean of 0.544. From this data it can be said that control group students were found homogenous and average in the freedom from superstition component of scientific temper. From the same table it was also found that the mean post-test score of freedom from superstition of the same group after a whole session was found to be 12.43 with standard deviation of 3.12 and standard error of mean of 0.551. The post-test mean score of freedom from superstition component of scientific temper of the same group was found to be less than their pre-test score. Hence the null hypothesis $H_o1.5$ "There is no significant difference between the mean pre-test and post-test scores of freedom from superstition component of scientific temper among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of freedom from superstition component of scientific temper of the control group due to the regular teaching learning process.

From the same table 4.1, it was found that the mean pre-test score of curiosity of the control group taught through the regular teaching learning process was 12.37 out of the total score of 20. The standard deviation from the mean for curiosity was found to be 3.46 with standard error of mean of 0.611. From this data it can be said that control group students were found homogenous and average in the curiosity component of scientific temper. From the same table it was also found that the mean post-test score of curiosity of the same group after a whole session was found to be 11.56 with standard deviation of 3.18 and standard error of mean of 0.562. The post-test mean score of curiosity component of scientific temper of the same group was found to be less than their pre-test score. Hence the null hypothesis $H_o1.6$ "There is no significant difference between the mean pre-test and post-test scores of curiosity component of scientific temper among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of curiosity component of scientific temper of the control group due to the regular teaching learning process.

From the same table 4.1, it was found that the mean pre-test score of open mindedness of the control group taught through the regular teaching learning process was 13.41 out of the total score of 20. The standard deviation from the mean for open mindedness was found to be 3.16 with standard error of mean of 0.558. From this data it can be said that control group students were found homogenous and average in the open mindedness component of scientific temper. From the same table it was also found that the mean post-test score of open mindedness of the same group after a whole session was found to be 11.97 with standard deviation of 3.21 and standard error of mean of 0.567. The post-test mean score of open mindedness component of scientific temper of the same group was found to be less than their pre-test score. Hence the null hypothesis $H_o1.7$ "There is no significant difference between the mean pre-test and post-test scores of open mindedness component of scientific temper among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of open mindedness component of scientific temper of the control group due to the regular teaching learning process.

From the same the same table 4.1, it was found that the mean pre-test score of observation component of scientific temper of the control group taught through the regular teaching learning process was 11.78 out of the total score of 20. The standard deviation from the mean for observation was found to be 2.31 with standard error of mean of 0.408. From this data it can be said that control group students were found homogenous and average in the observation component of scientific temper. From the same table it was also found that the mean post-test score of observation of the same group after a whole session was found to be 12.46 with Standard deviation of 3.35 and standard error of mean of 0.593. Comparing the mean pre-test and post-test scores of observation component of scientific temper of control group, it was found that the mean post-test score is slightly higher than the pre-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "$H_o1.8$: There is no significant difference between the mean pre-test and post-test scores of observation component of scientific temper among secondary school students those did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.2 with detailed analysis.

From the same table 4.1, it was found that the mean pre-test score of scientific temper as a whole of the control group taught through the regular teaching learning process was 99.96 out of the total score of 160. The standard deviation from the mean for scientific temper as a whole was found to be 9.93 with standard error of mean of 1.75. From this data it can be said that

control group students were found homogenous and average in the scientific temper as a whole. From the same table it was also found that the mean post-test score of scientific temper as a whole of the same group after a whole session was found to be 96.25 with standard deviation of 10.67 and standard error of mean of 1.88. The post-test mean score of scientific temper as a whole of the same group was found to be less than their pre-test score. Hence the null hypothesis $H_o1.9$ "There is no significant difference between the mean pre-test and post-test scores of scientific temper as a whole among secondary school students those did not expose to the developed strategies" is retained and it can be said that there is no enhancement of scientific temper as a whole of the control group due to the regular teaching learning process.

To test the null hypothesis of 8 components and as a whole it was perceived that for 6 components and for the whole test the mean pre-test was found to be more than the mean post-test score in the respective components of scientific temper for which these components are not treated for U test and it can be said that in all these 6 components and as a whole the regular teaching learning process was not found to enhance scientific temper. For the two component objective intellectual honesty and observation, the mean post-test score was found to be more than mean pre-test hence these two components are exposed for U test which is given in table 4.2.

Table 4.2: Mean, Sum of the Ranks (SR), U-Value (U), Z-Value (Z) and Level of Significance wise distribution of pre-test and post-test score of scientific temper of control group component wise with the N of 32

Groups	Tests	Mean	Sum of Ranks	U	Z	Level of Significance
Objective Intellectual Honesty	Pre-test	12.18	1044	508	-0.054	0.957
	Post-Test	12.25	1036			
Observation	Pre-test	11.78	984	456	-0.757	0.449
	Post-Test	12.46	1096			

From table 4.2, it was found that the sum of the ranks of the pre and post-test of control group taught through the traditional method were 1044 and 1036 respectively for the objective intellectual honesty component of scientific temper. The U-value and Z-value were found to be 508 and -0.054. The Z-value of -0.054 was found to be significant at 0.957 level of significance which was found to be less than the decided significant level (α) i.e. 0.01.

Therefore, the null hypothesis, Ho1.2: “There is no significant difference between the mean pre-test and post-test scores of objective intellectual honesty component of scientific temper among secondary school students those did not expose to the developed strategies” was retained and it could be said that the group does not differed stochastically in terms of the pre-test and post-test mean scores of objective intellectual honesty and the difference found was by chance. Hence, it can be said that there is no significant enhancement of objective intellectual honesty component of scientific temper of the control group due to their regular teaching learning process.

From the same table 4.2, it was found that the sum of the ranks of the pre and post-test of control group taught through the traditional method were 984 and 1096 respectively for the observation component of scientific temper. The U-value and Z-value were found to be 456 and -0.757. The Z-value of -0.757 was found to be significant at 0.449 level of significance which was found to be less than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho1.8: “There is no significant difference between the mean pre-test and post-test scores of observation component of scientific temper among secondary school students those did not expose to the developed strategies” was retained and it could be said that the group does not differed stochastically in terms of the pre-test and post-test mean scores of observation and the difference found was by chance. Hence, it can be said that there is no significant enhancement of observation component of scientific temper of the control group due to their regular teaching learning process.

4.2.0. ENHANCEMENT OF SCIENTIFIC TEMPER AMONG THE STUDENTS OF EXPERIMENTAL GROUP DUE TO IMPLICATION OF DEVELOPED STARATEGIES

To know the impact of developed starategies in the enhancement of scientific temper among the students of experimental group and to test the hypothesis 2 “There is no significant difference between the mean pre-test and post-test scores of scientific temper between secondary school students those exposed to the developed strategies” analysis of data is presented the following tables. Further the enhancement of scientific temper is studied in terms of its eight components and as a whole. Hence, the following nine sub hypothesis were formed and tested for all the eight components of scientific temper.

H_o2.1: There is no significant difference between the mean pre-test and post-test scores of healthy scepticism component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.2: There is no significant difference between the mean pre-test and post-test scores of objective intellectual honesty component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.3: There is no significant difference between the mean pre-test and post-test scores of rationality component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.4: There is no significant difference between the mean pre-test and post-test scores of perseverance component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.5: There is no significant difference between the mean pre-test and post-test scores of freedom from superstition component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.6: There is no significant difference between the mean pre-test and post-test scores of curiosity component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.7: There is no significant difference between the mean pre-test and post-test scores of open mindedness component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.8: There is no significant difference between the mean pre-test and post-test scores of observation component of scientific temper among secondary school students those exposed to the developed strategies.

H_o2.9: There is no significant difference between the mean pre-test and post-test scores of scientific temper as a whole among secondary school students those exposed to the developed strategies.

Table 4.3: Mean, Standard Deviation (SD) and Standard Error (SE) of Mean wise distribution of pre-test and post-test score of scientific temper of experimental group component wise and as a whole with the N of 32

Components of Scientific Temper	Tests	Mean	SD	SE of Mean
Healthy Scepticism	Pre-test	12.03	1.53	0.271
	Post-test	16.15	1.93	0.342
Objective Intellectual Honesty	Pre-test	13.25	2.94	0.519
	Post-test	16.68	1.74	0.309
Rationality	Pre-test	12.84	3.10	0.548
	Post-test	15.78	1.75	0.310
Perseverance	Pre-test	12.91	2.94	0.520
	Post-test	16.34	1.31	0.231
Freedom from Superstition	Pre-test	13.21	3.56	0.629
	Post-test	15.96	2.27	0.402
Curiosity	Pre-test	12.87	2.61	0.461
	Post-test	16.91	1.72	0.305
Open-Mindedness	Pre-test	12.28	3.45	0.611
	Post-test	16.37	2.16	0.382
Observation	Pre-test	10.56	2.57	0.455
	Post-test	15.84	1.88	0.333
Total	Pre-test	99.96	9.93	1.75
	Post-test	130.06	6.34	1.12

From the table 4.3, it was found that the mean pre-test score of healthy scepticism component of scientific temper of the experimental group taught through the developed strategies was 12.03 out of the total score of 20. The standard deviation from the mean for healthy scepticism was found to be 1.53 with standard error of mean of 0.271. From this data it can be said that experimental group students were found homogenous and average in the of healthy scepticism component of scientific temper. From the same table it was also found that the mean post-test score of healthy scepticism of the same group after a whole session was found to be 16.15 with standard deviation of 1.93 and standard error of mean of 0.342. Comparing the mean pre-test and post-test scores of healthy scepticism component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.1: There is no significant difference between the mean pre-test and post-test scores of healthy scepticism component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of objectivity intellectual honesty component of scientific temper of the experimental group taught through the developed strategies was 13.25 out of the total score of 20. The standard deviation from the mean for objectivity intellectual honesty was found to be 2.94 with standard error of mean of 0.519. From this data it can be said that experimental group students were found homogenous and average in the of objectivity intellectual honesty component of scientific temper. From the same table it was also found that the mean post-test score of objectivity intellectual honesty of the same group after a whole session was found to be 16.68 with standard deviation of 1.74 and standard error of mean of 0.309. Comparing the mean pre-test and post-test scores of objectivity intellectual honesty component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.2: There is no significant difference between the mean pre-test and post-test scores of objectivity intellectual honesty component of scientific temper among secondary school students those exposed to the developed strategies to enhance scientific temper" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of rationality component of scientific temper of the experimental group taught through the developed strategies was 12.84 out of the total score of 20. The standard deviation from the mean for rationality was found to be 3.10 with standard error of mean of 0.548. From this data it can be said that experimental group students were found homogenous and average in the of rationality component of scientific temper. From the same table it was also found that the mean post-test score of rationality of the same group after a whole session was found to be 15.78 with standard deviation of 1.75 and standard error of mean of 0.310. Comparing the mean pre-test and post-test scores of rationality component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.3: There is no significant difference between the mean pre-test and post-test scores of rationality component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of perseverance component of scientific temper of the experimental group taught through the developed strategies was

12.91 out of the total score of 20. The standard deviation from the mean for perseverance was found to be 2.94 with standard error of mean of 0.520. From this data it can be said that experimental group students were found homogenous and average in the of perseverance component of scientific temper. From the same table it was also found that the mean post-test score of perseverance of the same group after a whole session was found to be 16.34 with standard deviation of 1.31 and standard error of mean of 0.231. Comparing the mean pre-test and post-test scores of perseverance component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.4: There is no significant difference between the mean pre-test and post-test scores of perseverance component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of freedom from superstition component of scientific temper of the experimental group taught through the developed strategies was 13.21 out of the total score of 20. The standard deviation from the mean for freedom from superstition was found to be 3.56 with standard error of mean of 0.629. From this data it can be said that experimental group students were found homogenous and average in the of freedom from superstition component of scientific temper. From the same table it was also found that the mean post-test score of freedom from superstition of the same group after a whole session was found to be 15.96 with standard deviation of 2.27 and standard error of mean of 0.402. Comparing the mean pre-test and post-test scores of freedom from superstition component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.5: There is no significant difference between the mean pre-test and post-test scores of freedom from superstition component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of curiosity component of scientific temper of the experimental group taught through the developed strategies was 12.87 out of the total score of 20. The standard deviation from the mean for curiosity was found to be 2.61 with standard error of mean of 0.461. From this data it can be said that experimental

group students were found homogenous and average in the of curiosity component of scientific temper. From the same table it was also found that the mean post-test score of curiosity of the same group after a whole session was found to be 16.91 with standard deviation of 1.72 and standard error of mean of 0.305. Comparing the mean pre-test and post-test scores of curiosity component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.6: There is no significant difference between the mean pre-test and post-test scores of curiosity component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of open mindedness component of scientific temper of the experimental group taught through the developed strategies was 12.28 out of the total score of 20. The standard deviation from the mean for open mindedness was found to be 3.45 with standard error of mean of 0.611. From this data it can be said that experimental group students were found homogenous and average in the of open mindedness component of scientific temper. From the same table it was also found that the mean post-test score of open mindedness of the same group after a whole session was found to be 16.37 with standard deviation of 2.16 and standard error of mean of 0.382. Comparing the mean pre-test and post-test scores of open mindedness component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.7: There is no significant difference between the mean pre-test and post-test scores of open mindedness component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of observation component of scientific temper of the experimental group taught through the developed strategies was 10.56 out of the total score of 20. The standard deviation from the mean for observation was found to be 2.57 with standard error of mean of 0.455. From this data it can be said that experimental group students were found homogenous and average in the of observation component of scientific temper. From the same table it was also found that the mean post-test score of observation of the same group after a whole session was found to be 15.84 with

standard deviation of 1.88 and standard error of mean of 0.333. Comparing the mean pre-test and post-test scores of observation component of scientific temper of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.8: There is no significant difference between the mean pre-test and post-test scores of observation component of scientific temper among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

From the same table 4.3, it was found that the mean pre-test score of scientific temper as a whole of the experimental group taught through the developed strategies was 99.96 out of the total score of 160. The standard deviation from the mean for scientific temper as a whole was found to be 9.93 with standard error of mean of 1.75. From this data it can be said that experimental group students were found homogenous and average in the of scientific temper as a whole. From the same table it was also found that the mean post-test score of scientific temper as a whole of the same group after a whole session was found to be 130.06 with Standard deviation of 6.34 and standard error of mean of 1.12. Comparing the mean pre-test and post-test scores of scientific temper as a whole of experimental, it was found that the mean post-test score is higher than the pre-test mean score of the experimental group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o2.9: There is no significant difference between the mean pre-test and post-test scores of scientific temper as a whole among secondary school students those exposed to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.4 with detailed analysis.

Table 4.4: Mean, Sum of the Ranks (SR), U-Value (U), Z-Value (Z) and Level of Significance wise distribution of pre-test and post-test score of scientific temper of experimental group component wise and as a whole with the N of 32

Groups	Tests	Mean	Sum of Ranks	U	Z	Level of Significance
Healthy Scepticism	Pre-test	12.03	588	60	-6.113	0.000
	Post-Test	16.15	1492			
Objective Intellectual Honesty	Pre-test	13.25	701.5	173.5	-4.577	0.000
	Post-Test	16.68	1378.5			
Rationality	Pre-test	12.84	747	219	-3.979	0.000
	Post-Test	15.78	1333			

Perseverance	Pre-test	12.91	663.5	135.5	-5.115	0.000
	Post-Test	16.34	1416.5			
Freedom from Superstition	Pre-test	13.21	831.5	303.5	-2.826	0.005
	Post-Test	15.96	1248.5			
Curiosity	Pre-test	12.87	639	111	-5.422	0.000
	Post-Test	16.91	1441			
Open-Mindedness	Pre-test	12.28	684.5	156.5	-4.807	0.000
	Post-Test	16.37	1395.5			
Observation	Pre-test	10.56	589.5	61.5	-6.122	0.000
	Post-Test	15.84	1490.5			
Total	Pre-test	99.96	528	000	-6.879	0.000
	Post-Test	130.06	1522			

From table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 588 and 1432 respectively for the healthy scepticism component of scientific temper. The U-value and Z-value were found to be 60 and -6.113. The Z-value of -6.113 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.1: "There is no significant difference between the mean pre-test and post-test scores of healthy scepticism component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of healthy scepticism and the difference found was by not chance. Hence, it can be said that there is significant enhancement of healthy scepticism component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 701.5 and 1378.5 respectively for the objectivity intellectual honesty component of scientific temper. The U-value and Z-value were found to be 173.5 and -4.577. The Z-value of -4.577 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.2: "There is no significant difference between the mean pre-test and post-test scores of objectivity intellectual honesty component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of objectivity intellectual honesty and the difference found was by not chance. Hence, it can be said that there is significant enhancement of objectivity intellectual

honesty component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 747 and 1333 respectively for the rationality component of scientific temper. The U-value and Z-value were found to be 219 and -3.976. The Z-value of -3.976 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.3: "There is no significant difference between the mean pre-test and post-test scores of rationality component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of rationality and the difference found was by not chance. Hence, it can be said that there is significant enhancement of rationality component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 663.5 and 1416.5 respectively for the perseverance component of scientific temper. The U-value and Z-value were found to be 135.5 and -5.115. The Z-value of -5.115 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.4: "There is no significant difference between the mean pre-test and post-test scores of perseverance component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of perseverance and the difference found was by not chance. Hence, it can be said that there is significant enhancement of perseverance component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 831.5 and 1248.5 respectively for the freedom from superstition component of scientific temper. The U-value and Z-value were found to be 303.5 and -2.826. The Z-value of -2.826 was found to be significant at 0.005 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.5: "There is no significant difference between the mean pre-test and post-test scores of freedom from superstition component of scientific temper among secondary school students those exposed" was not retained and it could be said that the

group differed stochastically in terms of the pre-test and post-test mean scores of freedom from superstition and the difference found was by not chance. Hence, it can be said that there is significant enhancement of freedom from superstition component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 639 and 1441 respectively for the curiosity component of scientific temper. The U-value and Z-value were found to be 111 and -5.442. The Z-value of -5.442 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.6: "There is no significant difference between the mean pre-test and post-test scores of curiosity component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of curiosity and the difference found was by not chance. Hence, it can be said that there is significant enhancement of curiosity component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 684.5 and 1395.5 respectively for the open mindedness component of scientific temper. The U-value and Z-value were found to be 156.5 and -4.807. The Z-value of -4.807 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.7: "There is no significant difference between the mean pre-test and post-test scores of open mindedness component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of open mindedness and the difference found was by not chance. Hence, it can be said that there is significant enhancement of open mindedness component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 589.5 and 1490.5 respectively for the observation component of scientific temper. The U-value and Z-value were found to be 61.5 and -6.122. The Z-value of -6.122 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.8: "There is no significant difference between the mean pre-test and post-test

scores of observation component of scientific temper among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of observation and the difference found was by not chance. Hence, it can be said that there is significant enhancement of observation component of scientific temper of the experimental group due to implementation of developed strategies.

From the same table 4.4, it was found that the sum of the ranks of the pre and post-test of experimental group taught through the developed strategies were 528 and 1552 respectively for the scientific temper as a whole. The U-value and Z-value were found to be 000 and -6.879. The Z-value of -6.879 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho2.9: "There is no significant difference between the mean pre-test and post-test scores of scientific temper as a whole among secondary school students those exposed to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the pre-test and post-test mean scores of scientific temper as a whole and the difference found was by not chance. Hence, it can be said that there is significant enhancement of scientific temper as a whole of the experimental group due to implementation of developed strategies.

4.2.0. EFFECTIVENESS OF THE STRATEGIES IN TERMS OF POST TEST OF STUDENTS IN CONTROL AND EXPERIMENTAL GROUP

To know the impact of developed starategies in the enhancement of scientific temper among the students of experimental and control group and to test the hypothesis 3 "There is no significant difference between the mean post-test scores of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" analysis of data is presented in the following tables. Further the comparison of enhancement of scientific temper is studied in terms of its eight components and as a whole. Hence, the following nine sub-hypothesis were formed and tested for all the eight components of scientific temper.

H_o3.1: There is no significant difference between the mean post-test scores of healthy scepticism component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.2: There is no significant difference between the mean post-test scores of objective intellectual honesty component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.3: There is no significant difference between the mean post-test scores of rationality component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.4: There is no significant difference between the mean post-test scores of perseverance component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.5: There is no significant difference between the mean post-test scores of freedom from superstition component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.6: There is no significant difference between the mean post-test scores of curiosity component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.7: There is no significant difference between the mean post-test scores of open mindedness component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.8: There is no significant difference between the mean post-test scores of observation component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies.

H_o3.9: There is no significant difference between the mean post-test scores scientific temper as a whole between secondary school students those exposed and who did not expose to the developed strategies.

Table 4.5: Mean, Standard Deviation (SD) and Standard Error (SE) of Mean wise distribution of post-test score of scientific temper of experimental and control group component wise and as a whole with the N of 32

Components of Scientific Temper	Tests	Mean	SD	SE of Mean
Healthy Scepticism	Experimental Group	16.15	1.93	0.342
	Control Group	12.03	2.29	0.405
Objective Intellectual Honesty	Experimental Group	13.25	2.94	0.519
	Control Group	12.25	2.87	0.508

Rationality	Experimental Group	15.78	1.75	0.310
	Control Group	11.5	2.98	0.527
Perseverance	Experimental Group	16.34	1.31	0.231
	Control Group	12.03	2.52	0.445
Freedom from Superstition	Experimental Group	15.96	2.27	0.402
	Control Group	12.43	3.12	0.551
Curiosity	Experimental Group	16.91	1.72	0.305
	Control Group	11.56	3.18	0.562
Open-Mindedness	Experimental Group	16.37	2.16	0.382
	Control Group	11.96	3.20	0.567
Observation	Experimental Group	15.84	1.88	0.333
	Control Group	12.46	3.35	0.593
Total	Experimental Group	130.06	6.34	1.12
	Control Group	96.25	10.66	1.88

From the table 4.5, it was found that the mean post-test score of healthy scepticism component of scientific temper of the experimental group taught through the developed strategies after a whole session was 16.15 out of the total score of 20. The standard deviation from the mean for healthy scepticism was found to be 1.93 with standard error of mean of 0.342. From this data it can be said that experimental group students were found homogenous and above average in the of healthy scepticism component of scientific temper. From the same table it was also found that the mean post-test score of healthy scepticism of the control group after a whole session was found to be 12.03 with standard deviation of 2.29 and standard error of mean of 0.405. Comparing the mean post-test scores of healthy scepticism component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.1: There is no significant difference between the mean post-test scores of healthy scepticism component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of objective intellectual honesty component of scientific temper of the experimental group taught through the developed strategies after a whole session was 13.25 out of the total score of 20. The standard deviation from the mean for objective intellectual honesty was found to be 2.94 with standard error of mean of 0.519. From this data it can be said that experimental group students were found homogenous and above average in the of objective intellectual honesty component of

scientific temper. From the same table it was also found that the mean post-test score of objective intellectual honesty of the control group after a whole session was found to be 12.25 with standard deviation of 2.87 and standard error of mean of 0.508. Comparing the mean post-test scores of objective intellectual honesty component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.2: There is no significant difference between the mean post-test scores of objective intellectual honesty component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of rationality component of scientific temper of the experimental group taught through the developed strategies after a whole session was 15.78 out of the total score of 20. The standard deviation from the mean for rationality was found to be 1.75 with standard error of mean of 0.310. From this data it can be said that experimental group students were found homogenous and above average in the of rationality component of scientific temper. From the same table it was also found that the mean post-test score of rationality of the control group after a whole session was found to be 11.5 with standard deviation of 2.98 and standard error of mean of 0.527. Comparing the mean post-test scores of rationality component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.3: There is no significant difference between the mean post-test scores of rationality component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of perseverance component of scientific temper of the experimental group taught through the developed strategies after a whole session was 16.34 out of the total score of 20. The standard deviation from the mean for perseverance was found to be 1.31 with standard error of mean of 0.231. From this data it can be said that experimental group students were found homogenous and above average in the of perseverance component of scientific temper. From the same table it was also found that the mean post-test score of perseverance of the control group after a whole session was found to

be 12.03 with standard deviation of 2.52 and standard error of mean of 0.445. Comparing the mean post-test scores of perseverance component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.4: There is no significant difference between the mean post-test scores of perseverance component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of freedom from superstition component of scientific temper of the experimental group taught through the developed strategies after a whole session was 15.96 out of the total score of 20. The standard deviation from the mean for freedom from superstition was found to be 2.27 with standard error of mean of 0.402. From this data it can be said that experimental group students were found homogenous and above average in the of freedom from superstition component of scientific temper. From the same table it was also found that the mean post-test score of freedom from superstition of the control group after a whole session was found to be 12.43 with standard deviation of 3.12 and standard error of mean of 0.551. Comparing the mean post-test scores of freedom from superstition component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.5: There is no significant difference between the mean post-test scores of freedom from superstition component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of curiosity component of scientific temper of the experimental group taught through the developed strategies after a whole session was 16.91 out of the total score of 20. The standard deviation from the mean for curiosity was found to be 1.72 with standard error of mean of 0.305. From this data it can be said that experimental group students were found homogenous and above average in the of curiosity component of scientific temper. From the same table it was also found that the mean post-test score of curiosity of the control group after a whole session was found to be 11.56

with Standard deviation of 3.18 and standard error of mean of 0.562. Comparing the mean post-test scores of curiosity component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.6: There is no significant difference between the mean post-test scores of curiosity component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of open mindedness component of scientific temper of the experimental group taught through the developed strategies after a whole session was 16.37 out of the total score of 20. The standard deviation from the mean for open mindedness was found to be 2.16 with standard error of mean of 0.382. From this data it can be said that experimental group students were found homogenous and above average in the of open mindedness component of scientific temper. From the same table it was also found that the mean post-test score of open mindedness of the control group after a whole session was found to be 11.96 with standard deviation of 3.20 and standard error of mean of 0.567. Comparing the mean post-test scores of open mindedness component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.7: There is no significant difference between the mean post-test scores of open mindedness component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of observation component of scientific temper of the experimental group taught through the developed strategies after a whole session was 15.84 out of the total score of 20. The standard deviation from the mean for observation was found to be 1.88 with standard error of mean of 0.333. From this data it can be said that experimental group students were found homogenous and above average in the of observation component of scientific temper. From the same table it was also found that the mean post-test score of observation of the control group after a whole session was found to be 12.46 with standard deviation of 3.35 and standard error of mean of 0.593. Comparing the

mean post-test scores of observation component of scientific temper of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.8: There is no significant difference between the mean post-test scores of observation component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

From the same table 4.5, it was found that the mean post-test score of scientific temper as a whole of the experimental group taught through the developed strategies after a whole session was 130.06 out of the total score of 160. The standard deviation from the mean for scientific temper as a whole was found to be 6.34 with standard error of mean of 1.12. From this data it can be said that experimental group students were found homogenous and above average in the of scientific temper as a whole. From the same table it was also found that the mean post-test score of scientific temper as a whole of the control group after a whole session was found to be 96.25 with standard deviation of 10.66 and standard error of mean of 1.88. Comparing the mean post-test scores of scientific temper as a whole of experimental and control group, it was found that the mean post-test score of experimental group is higher than the post-test mean score of the control group. To find whether the difference in the mean score was significant or by chance and to test the null hypothesis "H_o3.9: There is no significant difference between the mean post-test scores of scientific temper as a whole between secondary school students those exposed and who did not expose to the developed strategies" Mann-Whitney U-test was used, the summary of which is given in table 4.6 with detailed analysis.

Table 4.6: Mean, Sum of the Ranks (SR), U-Value (U), Z-Value (Z) and Level of Significance wise distribution of post-test score of scientific temper of experimental and control group component wise and as a whole with the N of 32

Groups	Tests	Mean	Sum of Ranks	U	Z	Level of Significance
Healthy Scepticism	Experimental Group	12.03	1469	83	-5815	0.000
	Control Group	16.15	611			
	Experimental Group	13.25	1455.5	96.5	-5.617	0.000

Objective Intellectual Honesty	Control Group	16.68	624.5			
Rationality	Experimental Group	12.84	1454.5	97.5	-5.622	0.000
	Control Group	15.78	625.5			
Perseverance	Experimental Group	12.91	1469	83	-5.820	0.000
	Control Group	16.34	611			
Freedom from Superstition	Experimental Group	13.21	1361.5	190.5	-4.343	0.000
	Control Group	15.96	718.5			
Curiosity	Experimental Group	12.87	1485	67	-6.007	0.000
	Control Group	16.91	595			
Open-Mindedness	Experimental Group	12.28	1424.5	127.5	-5.198	0.000
	Control Group	16.37	655.5			
Observation	Experimental Group	10.56	1330	222	-3.928	0.000
	Control Group	15.84	750			
Total	Experimental Group	99.96	1549	2.5	-6.845	0.000
	Control Group	130.06	530.5			

From table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1469 and 611 respectively for the healthy scepticism component of scientific temper. The U-value and Z-value were found to be 83 and -5.815. The Z-value of -5.815 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.1: "There is no significant difference between the mean post-test scores of healthy scepticism component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of healthy scepticism and the difference found was by not chance. Hence, it can be said that there is significant enhancement of healthy

scepticism component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1455 and 624.5 respectively for the objectivity intellectual honesty component of scientific temper. The U-value and Z-value were found to be 96.5 and -5.617. The Z-value of -5.617 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.2: "There is no significant difference between the mean post-test scores of objectivity intellectual honesty component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of objectivity intellectual honesty and the difference found was by not chance. Hence, it can be said that there is significant enhancement of objectivity intellectual honesty component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1454.5 and 625.5 respectively for the rationality component of scientific temper. The U-value and Z-value were found to be 97.5 and -5.622. The Z-value of -5.622 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.3: "There is no significant difference between the mean post-test scores of rationality component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of rationality and the difference found was by not chance. Hence, it can be said that there is significant enhancement of rationality component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1469 and 611 respectively for the perseverance component of scientific temper. The U-value and Z-value were found to be 83 and -5.820. The Z-value of -5.820 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.4: "There is no significant difference between the mean post-test scores of perseverance component of scientific temper between secondary school students those exposed and who did not expose to

the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of perseverance and the difference found was by not chance. Hence, it can be said that there is significant enhancement of perseverance component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1361.5 and 718.5 respectively for the freedom from superstition component of scientific temper. The U-value and Z-value were found to be 190.5 and -4.343. The Z-value of -4.343 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.5: "There is no significant difference between the mean post-test scores of freedom from superstition component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of freedom from superstition and the difference found was by not chance. Hence, it can be said that there is significant enhancement of freedom from superstition component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1485 and 595 respectively for the curiosity component of scientific temper. The U-value and Z-value were found to be 67 and -6.007. The Z-value of -6.007 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.6: "There is no significant difference between the mean post-test scores of curiosity component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of curiosity and the difference found was by not chance. Hence, it can be said that there is significant enhancement of curiosity component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1424.5 and 655.5 respectively for the open mindedness component of scientific temper. The U-value and Z-value were found to be 127.5 and -5.198. The Z-value of -5.198 was found to be significant at 0.000 level of significance which was found to be more

than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.7: "There is no significant difference between the mean post-test scores of open mindedness component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of open mindedness and the difference found was by not chance. Hence, it can be said that there is significant enhancement of open mindedness component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1330 and 750 respectively for the observation component of scientific temper. The U-value and Z-value were found to be 222 and -3.928. The Z-value of -3.928 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.8: "There is no significant difference between the mean post-test scores of observation component of scientific temper between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of observation and the difference found was by not chance. Hence, it can be said that there is significant enhancement of observation component of scientific temper of the experimental group as compared to control group due to implementation of developed strategies.

From the same table 4.6, it was found that the sum of the ranks of the post-test of experimental and control group were 1549.5 and 530.5 respectively for the scientific temper as a whole. The U-value and Z-value were found to be 2.5 and -6.845. The Z-value of -6.845 was found to be significant at 0.000 level of significance which was found to be more than the decided significant level (α) i.e. 0.01. Therefore, the null hypothesis, Ho3.9: "There is no significant difference between the mean post-test scores of scientific temper as a whole between secondary school students those exposed and who did not expose to the developed strategies" was not retained and it could be said that the group differed stochastically in terms of the post-test mean scores of scientific temper as a whole and the difference found was by not chance. Hence, it can be said that there is significant enhancement of scientific temper as a whole of the experimental group as compared to control group due to implementation of developed strategies.

4.5.0. EFFECTIVENESS OF THE STRATEGIES IN TERMS OF THE REACTIONS OF THE STUDENTS

To achieve objective 5 of the present study i.e. "To evaluate the effectiveness of the developed strategies in terms of the reaction of secondary school students towards the strategies" data were collected from the sample of experimental group students who were taught through developed strategies of scientific temper. Data were collected through a Likert type five point reaction scale. Collected data were analysed using percentage and intensity index (II) which is given and analysed in table 4.7.

Table 4.7: Summary of the Reactions of the Students towards the Statements related to the Developed strategies to Enhance Scientific Temper in terms of Percentage Response and Intensity Index (II)

S. No.	Statement	SA	A	UD	D	SD	II
1	Teaching was interesting in this approach	37.50	62.50	0	0	0	4.38
2	I understood the concepts taught in Science, Mathematics and Social Science	40.63	56.25	03.13	0	0	4.38
3	All the activities were exciting	28.13	46.88	25.00	0	0	4.03
4	I liked to participate in all the activities	31.25	53.13	15.63	0	0	4.16
5	I found the content appropriate in all the subjects	25.00	53.13	21.88	0	0	4.03
6	The teaching aid used were interesting	43.75	46.88	09.38	0	0	4.34
7	Instructions given during the classes were clear	40.63	50.00	09.38	0	0	4.31
8	Teacher was cooperative throughout the teaching	43.75	46.88	09.38	0	0	4.34
9	Teaching was connected to the real life situation	53.13	21.88	25.00	0	0	4.28
10	Questions asked during the presentations were interesting	31.25	68.75	0	0	0	4.31
11	Questions asked during the presentations were thought provoking	28.13	46.88	25.00	0	0	4.03
12	It helped me to think critically	21.88	65.63	12.50	0	0	4.09

13	It helped me to ask question without fear	37.50	37.50	25.00	0	0	4.13
14	It helped me to be logical in my thinking	46.88	34.38	18.75	0	0	4.28
15	It aware me about various superstitious beliefs and its reasons	28.13	56.25	15.63	0	0	4.13
16	It helped me to take decision without any biases	25.00	53.13	21.88	0	0	4.03
17	It has provided me the scope to express in alternative modes like drawing, flowchart, timeline etc.	37.50	46.88	15.63	0	0	4.22
18	It doesn't affect negatively in completing the syllabus	37.50	53.13	09.38	0	0	4.28
19	I would love to learn through this approach in future classes	31.25	53.13	15.63	0	0	4.16
20	It developed my interest towards learning different subjects	40.63	50.00	09.38	0	0	4.31
21	Learning through Power Point Presentation and videos of different subject was interesting to us	43.75	40.63	15.63	0	0	4.28
22	It helped me to expand my learning out of the classroom and textbook	43.75	53.13	03.13	0	0	4.41
23	I came to know about some interesting facts about nature and society	62.50	28.13	09.38	0	0	4.53
24	We were encouraged to participate in each and every activity in the class.	37.50	40.63	21.88	0	0	4.16
25	I liked the present classroom environment	56.25	34.38	09.38	0	0	4.47
26	Enough time for discussion was provided	50.00	40.63	09.38	0	0	4.41
27	Concept mapping, time line and flowchart making helped us to remember difficult things easily	28.13	50.00	21.88	0	0	4.06
28	It has helped me to become more aware towards various events happening around me	46.88	46.88	06.25	0	0	4.41

29	It helped me to increase my confidence level	46.88	37.50	15.63	0	0	4.31
30	I realised the importance of scientific temper in our daily life	31.25	53.13	15.63	0	0	4.16
Overall Reactions							**4.25**

SA - Strongly Agree, **A** - Agree, **UD** - Undecided, **D** - Disagree, **SD** - Strongly Disagree, **II** - Intensity Index

For the statement 1 i.e. **"Teaching was interesting in this approach"**, 37.50% and 62.50% of them reacted as strongly agree and agree respectively. The intensity index of 4.38 shows favourable reaction of the students towards the developed strategies stating that they like the way teaching was done during the treatment phase and it was interesting to them.

For the statement 2 i.e. **"I understood the concepts taught in Science, Mathematics and Social Science"**, 40.63% and 56.25% of them reacted as strongly agree and agree respectively. The intensity index of 4.38 shows favourable reaction of the students towards the developed strategies in terms of their understanding of taught concepts in the class.

In terms of the reaction of the students towards statement 3 i.e. **"All the activities were exciting"**, 28.13% and 46.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.03 shows favourable reaction of the students towards the developed strategies indicating the likelihood of students towards all the activities.

In terms of the reaction of the students towards statement 4 i.e. **"I liked to participate in all the activities"**, 31.25% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.16 showed favourable reaction of the students towards the developed strategies stating that they were very comfortable during the teaching and liked to take part in all the activities conducted during the implementation of strategies.

In terms of the reaction of the students towards statement 5 i.e. **"I found the content appropriate in all the subjects"**, 25.00% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.03 shows favourable reaction of the students towards the developed strategies stating that they are in agreement of appropriateness of content and its relevant connection with all the three selected subjects.

For statement 6 i.e. **"The teaching aid used were interesting"**, 43.75% and 46.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.34 shows favourable

reaction of the students towards the developed strategies in terms of likelihood of teaching aids used during the teaching.

In terms of the reaction of the students towards statement 7 i.e. "**Instructions given during the classes were clear"**, 40.63% and 50.00% of them reacted as strongly agree and agree respectively. The intensity index of 4.31 shows favourable reaction of the students towards the developed strategies stating that they clearly understood the instructions given to them before the implementation of the activities and tasks.

In terms of the reaction of the students towards statement 8 i.e. "**Teacher was cooperative throughout the teaching"**, 43.75% and 46.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.34 shows favourable reaction of the students towards the developed strategies stating that the teacher during the teaching clearly understood their needs and was cooperative throughout the implementation phase.

In terms of the reaction of the students towards statement 9 i.e. 53.13% **"Teaching was connected to the real life situation"**, and 21.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.28 shows favourable reaction of the students towards the developed strategies stating that they could able to connect the teaching with the outside world successfully.

In terms of the reaction of the students towards statement 10 i.e. **"Questions asked during the presentations were interesting"**, 31.25% and 68.75% of them reacted as strongly agree and agree respectively. The intensity index of 4.31 shows favourable reaction of the students towards the developed strategies indicating that the questions were able to capture their attention and interesting.

In terms of the reaction of the students towards statement 11 i.e. **"Questions asked during the presentations were thought provoking"**, 28.13% and 46.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.03 shows favourable reaction of the students towards the developed strategies stating that the questions had given them chance to think in multiple directions and made them think upon them.

In terms of the reaction of the students towards statement 12 i.e. **"It helped me to think critically"**, 21.88% and 65.63% of them reacted as strongly agree and agree respectively. The intensity index of 4.09 showed favourable reaction of the students towards the developed strategies indicating that the strategies had given them enough chance to stimulate their critical thinking ability.

For statement 13 i.e. **"It helped me to ask question without fear"**, 37.50% and 37.50% of them reacted as strongly agree and agree respectively. The intensity index of 4.13 shows favourable reaction of the students towards the developed strategies in terms of their comfort in responding the questions asked during the class.

In terms of the reaction of the students towards statement 14 i.e. **"It helped me to be logical in my thinking"**, 46.88% and 34.38% of them reacted as strongly agree and agree respectively. The intensity index of 4.28 shows favourable reaction of the students towards the developed strategies stating that the strategies helped the students to think in logical way.

In terms of the reaction of the students towards statement 15 i.e. **"It aware me about various superstitious beliefs and its reasons"**, 28.13% and 56.25% of them reacted as strongly agree and agree respectively. The intensity index of 4.13 shows favourable reaction of the students towards the developed strategies stating that the activities helped them to know about all kinds of belief systems persisting in the society with the explanation of how it started.

In terms of the reaction of the students towards statement 16 i.e. **"It helped me to take decision without any biases"**, 25.00% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.03 shows favourable reaction of the students towards the developed strategies stating that the strategies helped them to take decision without the influence of personal beliefs.

In terms of the reaction of the students towards statement 17 i.e. **"It has provided me the scope to express in alternative modes like drawing, flowchart, timeline etc. "**, 37.50% and 46.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.22 shows favourable reaction of the students towards the developed strategies indicating that enough opportunity were provided to them for expressing their responses in multiple ways.

For statement 18 i.e. **"It doesn't affect negatively in completing the syllabus"**, 37.50% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.28 shows favourable reaction of the students towards the developed strategies stating that the activities didn't hinder their regular classes.

For statement 19 i.e. **"I would love to learn through this approach in future classes"**, 31.25% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.16 shows favourable reaction of the students towards the developed strategies in terms of its continue implacability in future classes as well.

In terms of the reaction of the students towards statement 20 i.e. "**It developed my interest towards learning different subjects"**, 40.63% and 50.00% of them reacted as strongly agree and agree respectively. The intensity index of 4.31 shows favourable reaction of the students towards the developed strategies stating that the strategies helped to stimulate the interest towards different subjects in them.

For statement 21 i.e. **"Learning through Power Point Presentation and videos of different subject was interesting to us"**, 43.75% and 40.63% of them reacted as strongly agree and agree respectively. The intensity index of 4.28 shows favourable reaction of the students towards the developed strategies in terms of likelihood the way content was presented to them.

In terms of the reaction of the students towards statement 22 i.e. **"It helped me to expand my learning out of the classroom and textbook"**, 43.75% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.41 shows favourable reaction of the students towards the developed strategies stating that it helped them to expand their mental horizon by relating the learning with the outside world.

For statement 23 i.e. "**I came to know about some interesting facts about nature and society"**, 62.50% and 28.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.53 shows strongly favourable reaction of the students towards the developed strategies in terms of acquiring new and interesting information of nature and society.

In terms of the reaction of the students towards statement 24 i.e. **"We were encouraged to participate in each and every activity in the class"**, 37.50% and 40.63% of them reacted as strongly agree and agree respectively. The intensity index of 4.16 shows favourable reaction of the students towards the developed strategies indicating that they had got enough boasting to take part in all the conducted activities.

For statement 25 i.e. **"I liked the present classroom environment"**, 56.25% and 34.38% of them reacted as strongly agree and agree respectively. The intensity index of 4.47 shows favourable reaction of the students towards the developed strategies in terms of likelihood of the classroom environment formed during the implementation of strategies.

For statement 26 i.e. **"Enough time for discussion was provided"**, 50.00% and 40.63% of them reacted as strongly agree and agree respectively. The intensity index of 4.41 shows favourable reaction of the students towards the developed strategies in terms of allotment of time for discussion and doubt removing sessions.

In terms of the reaction of the students towards statement 27 i.e. **"Concept mapping, time line and flowchart making helped us to remember difficult things easily"**, 28.13% and 50.00% of them reacted as strongly agree and agree respectively. The intensity index of 4.06 shows favourable reaction of the students towards the developed strategies stating that the implemented methods like concept map, time line and flow chart helped them to remember the tough things in better way.

In terms of the reaction of the students towards statement 28 i.e. **"It has helped me to become more aware towards various events happening around me"**, 46.88% and 46.88% of them reacted as strongly agree and agree respectively. The intensity index of 4.41 shows favourable reaction of the students towards the developed strategies stating that it helped them to increase their attention ability that made them more conscious of the things happening in their surroundings.

In terms of the reaction of the students towards statement 29 i.e. **"It helped me to increase my confidence level"**, 46.88% and 37.50% of them reacted as strongly agree and agree respectively. The intensity index of 4.31 shows favourable reaction of the students towards the developed strategies stating that it helped them to become more confident person.

For statement 30 i.e. **"I realised the importance of scientific temper in our daily life"**, 31.25% and 53.13% of them reacted as strongly agree and agree respectively. The intensity index of 4.16 shows favourable reaction of the students towards the developed strategies in terms of recognising the value of scientific temper in their daily life.

Considering the reaction towards all the 30 statements in the reaction scale, it was found that in all the 30 statements, the students reaction was favourable towards different aspects of strategies developed for enhancing scientific temper. The intensity index of overall reaction was found to be 4.25 which shows favourable reaction towards the developed strategies to enhance scientific temper.

The major findings and discussion have been described in chapter 5.