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RESEARCH ARTICLE

Impact of psycho-socio and biographical variables on scientific attitude of secondary school students

Dayal Pyari[1] and Indira Shrama[2]

1. Lecturer (Aryan Institute of Management and Computer Studies Sikandra Agra).
2. Associate Professor(D.E.I.Deemed university,Dayalbagh Agra).

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Abstract

The aim of this study is to investigate the effects of scientific attitude of secondary school students to promote their science interest, study habits, cognitive style, academic achievement, scientific creativity, academic achievement motivation, delay of gratification, Task persistence, Science Methodology, science achievement, SES, School environment and home environment. The research includes a pre testpost test research with a control group. The subjects of the research consist of 1500 students reading at 10^{th} grade ofn secondary schoosl exiting in Agra, India. The data collection tools for the research includes the12 tools in which two tools were made by researcher. As a result of the research, it was determined that scientific attitude depends upon different factors viz. psychological, social and biographical. The results from this study also suggest that the psychological variables were more consistently related to scientific attitude then the socio-biographic variables.

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Introduction

Today we are living in a scientific world and science has permeated each and every aspect of our life. Science education; therefore is inevitable need of the hour. In the world of technology, each individual is influenced by science, every vocation is related to science and even teaching is most influenced by technology.Various commissions have recommended science education from time to time. Earlier **Wood [1888]** proposed the introduction of technical education; the Government published a proposal pointing out the need and importance of science education along with literary or liberal education. By 1964, the Ministry of Education with cooperation of the Ministry of Community Development had set up temples of science in various parts of our country.

Science is one of those human activities that man created to gratify certain human needs and desires. Science is valued mostly for its practical advantages though it is also valued for gratifying disinterested curiosity and as an object of great aesthetic charm. It is quite obvious that the bulk of mankind value science, chiefly for the practical advantages it brings with it. It will be futile to prepare separate case for the inclusion of science in the curriculum because the reasons for its inclusion are exactly the same as those for the inclusion of subjects other than science though it has been given a core place in the curriculum because of some special values provided by science only and not by any other subject. All the school subjects are taught because they provide liberal education, they are the part of the equipment and preparation for life which we expect the school to give to its pupils so that they may play their part in the community as intellectual citizens. Science takes its place side by side with other subjects as an essential element of one's education. It affords knowledge of certain facts and laws and an insight into methods and data peculiar to the domains of science.

Science has greatly revolutionized the world in the past two centuries. It has opened up ever-increasing vistas of knowledge, both embracing the physical as well as the psychological realities of life. Now it has emerged as a prime-mover of culture, philosophy and a total way of life. Every human act has certain behavioral inputs. Very often human behavior is conditioned by elders, their life-style, education and the larger social environment like home, school,

community etc. This behavior conditioning leads to attitude formation.

Allport [1935] has defined an attitude as a "Mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects with which it is related".

Attitudes as cognitive psychologists view are the driving force of human behavior. Attitudes are the particular ways in which a person thinks feels and acts. Anyone who likes to pursue a particular work objectively first needs to develop a scientific attitude or an attitude conditioned by the spirit and methods of science. This makes him capable of pursuing a problem in a scientific way. Scientific Attitude signifies, "The attitudes of mind which lie behind the method of acquiring reliable and practical knowledge". **Nayudamm [1999]** defines, "Scientific Attitude as the attitude of open rational mind, questioning, curious, critical mind – a tomorrow's mind instead of yesterday's mind – resistant to rigidity and resilient to change". It requires objectivity not jumping into hasty or ready-made opinions but patient observation and exploration and only then forming an opinion.

The spirit of science – that intellectual adventure informed by a critical method, the goal of which is knowledge which is the truth in an objective sense. Nehru's emphasis on promoting scientific attitude or climate of science was thus mainly to create a congenial environment for scientific, social, economic and industrial development and modernization. From Nehru point of view, scientific attitude or world view enables man to look upon himself, upon society, and upon the problems facing human race with an intellectual rigors that combines sympathy with objectivity in finely blended proportions. So for the development of scientific intellect the development of scientific attitude is necessary.

To learn science is one thing, to keep up with the latest development in science, and approaching the problems in life with a scientific approach is another thing. While, the former is to develop the field of science per se, the latter is a domain of science applications. The development of science and its applications in society are the two sides of the same coin. These are the two indispensable inputs for desirable social transformation or development. The major hurdle we face in solving problems is more of sociological nature, although it may seem to be scientific. Our beliefs, attitudes, aptitudes, traditions, life-style and the social milieu should be such that they not only respond to the development of science but also allow the changes in every aspect of life along scientific lines with a scientific spirit.

Therefore, the need of today is not only to develop civic sense but also a right type of scientific attitude among students because the students of today are the builders of tomorrow's India. Scientific attitude is absolutely necessary to dispel ignorance and backwardness; its spread will bring a rational perspective on social evils and conflicts and lead to a better world.

The growth of any nation depends upon its technological advancement as well as on degree of awareness about various issues, which affect its population, it may be education, health, energy and time management, harnessing of resources and so on. Though the teacher can teach science with help of modern educational technological devices and more advanced effective method of teaching, there is a poor performance of students in the science. Hence there must be some factors like psychological, social and biographical affecting the learner in learning of science at large.

The modern age eulogized by many as the age of reason, is said to reflect scientific attitude in all its splendor and glory. This is true only to a limited extent since science and its handmaid, technology is not to be equated with scientific attitude. To put it succinctly scientific attitude is not the monopoly or exclusive attribute of scientists, engineer or a technician. In fact each individual must possess scientific attitude to get success.

PURPOSE OF THE STUDY

This section includes critical analysis of scientific attitude of secondary school students. Which is sub divided into the following headings:

- Scientific Attitude with respect to Biographical Variables (Gender, Caste, Board of Examination, Father Education, Mother Education).
- Scientific Attitude with respect to Psychological Variables (Science Achievement, Academic Achievement, Science Interest, Study Habits, Academic Motivation, Cognitive Style, Scientific Creativity, Delay of Gratification, Task Persistence, Methodology of Science Teaching).
- Scientific Attitude with respect to Social Variables (Socio-Economic Status, Home Environment, School Environment).

METHOD

In the present study Ex-Post-Facto method of research is used.

In Present study psycho-socio-biographical variables have already occurred and only their dependent variables(scientific attitude) remain under research observation and analysis i.e. the independent variables (Psychological, social and biographical) have been studied in retrospect for their possible relation to and effects on the dependent variable(scientific attitude) since none of these independent variables under study are subject to direct manipulation and are manipulated through selection only , hence Ex-Post-Facto method of research has been followed.

INSTRUMENTS

The following tools have been used for collection of data:

1. S. C. Gakhar & Amandeep Kaur's Scientific Attitude Scale.
2. High School Board examination marks as a measure of Achievement.
3. Science subject marks as a measure of science achievement.
4. L. N. Debey&ArchanaDebey's Science Interest Test.
5. M. Mutihopodhya& D. N. Sansanwal's Study Habit Inventory.
6. T. R. Sharma's Sharma Academic Achievement Motivation Test.
7. ManjuLata& R. K. Tandon's Cognitive Style Scale.
8. Self-constructed Test for Scientific Creativity.
9. T. C. Gyanani's Delay of Gratification Test.
10. Thurstone's Scrambled World Task Persistence Test.
11. Self-made questionnaire for Science Methodology.
12. Rajeev Bharadwaj's Socio-Economic Status Scale.
13. K. S. Mishra's Home Environment Inventory
14. K. S. Misra's School Environment Inventory.

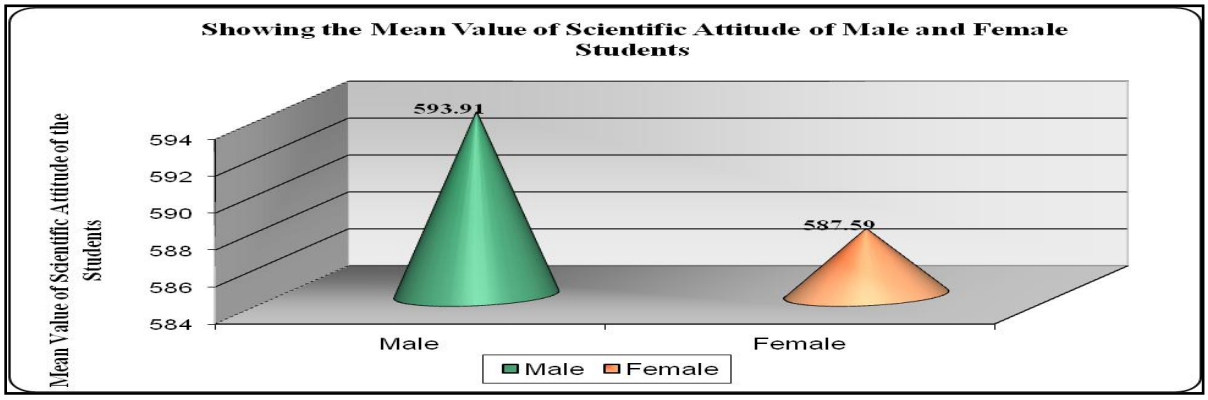
1. **SCIENTIFIC ATTITUDE WITH RESPECT TO BIOGRAPHICAL VARIABLES**

1.1 STUDY OF SCIENTIFIC ATTITUDE OF MALE AND FEMALE STUDENTS

In order to compare the scientific attitude of male and female students, mean S.D.and t is calculated, the values are presented in the table below:

Table 1.1: Showing t values of Scientific Attitude of Male and Female Students

Statistical Measures / Sex	N	Mean	SD	t	df
Male	**560**	593.91	72.754		
Female	**550**	587.59	70.828	1.467	1108



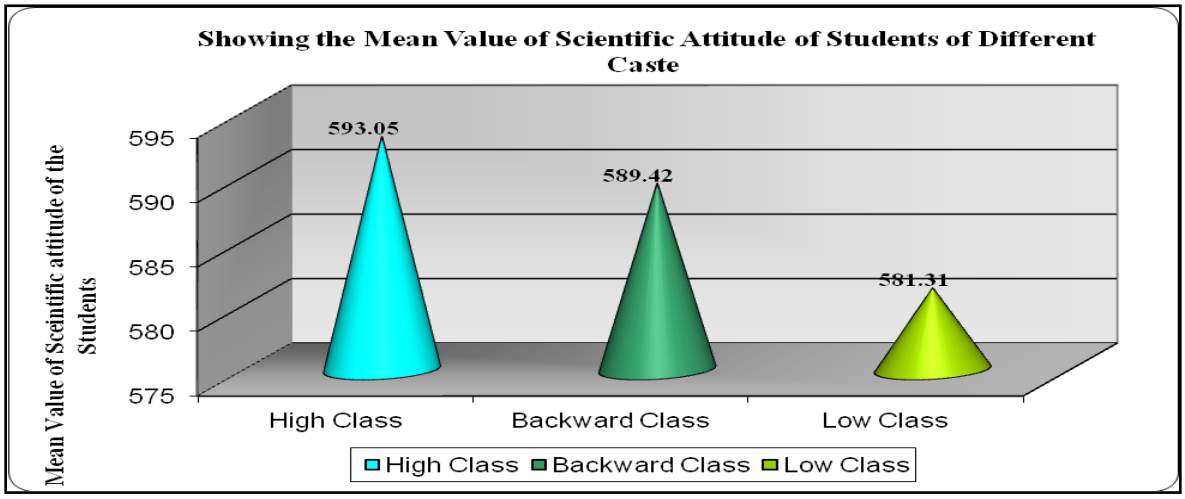
Above table shows that the mean values of scientific attitude scores obtained by two groups have been found 593.91 and 587.59 respectively, which shows that female group has a lower mean in comparison to male group but this difference is found statistically insignificant as inferred by t value shown in the table which is lower than the value of .05 level of significance. Thus this can be said that male and female students of higher secondary school do not differ in scientific attitude. This may be due to the availability of equal opportunities and environment of rearing and education.

1.2 STUDY OF SCIENTIFIC ATTITUDE OF STUDENTS OF DIFFERENT CASTE

To determine the significant difference between scientific attitude of students of different levels of caste, which are as follows:

Table 1.2: Showing t values of Scientific Attitude of the students of different Caste

Statistical Measures / Caste	N	Mean	SD	t	df
High Class	**667**	593.05	72.090		
Backward Class	**329**	589.42	70.321	0.754	994
High Class	**667**	593.05	72.090		
Low Class	**114**	581.31	74.471	1.600	779
Backward Class	**329**	589.42	70.321		
Low Class	**114**	581.31	74.471	1.046	441



It is evident from the above table that the computed t values are found to be insignificant at .05 level of significance. Therefore it can be said that there is no difference exist between scientific attitude of high, backward and low class.

1.3 STUDY OF SCIENTIFIC ATTITUDE OF STUDENTS AND THEIR PARENTS EDUCATION

To study the effect of father and mother education on the development of scientific attitude of secondary school students the one way ANOVA is computed, whose summary is shown in the table below:

Table 1.3.1: Showing summary of ANOVA, Effect of Father Education on Scientific Attitude

Groups		Sum of Squares	Mean Square	df	F
Male	**Between Groups**	10801.012	1800.169	6	0.338
	Within Groups	2948192.043		553	
	Total	2958993.055	5331.270	559	
Female	**Between Groups**	4845.693	807.615	6	0.159
	Within Groups	2749730.287		543	
	Total	2754575.980	5063.960	549	
Total	**Between Groups**	7846.578	1307.763	6	0.252
	Within Groups	5716862.013		1103	
	Total	5724708.591	5183.012	1109	

The perusal of table 1.3.1 reveals that father education exerts no effect on scientific attitude of secondary school students. This may be due to the low availability of father at home and children have less interaction with their father. At present scenario still father are more dominating and thus there is a communication gap between them and children.

Table1.3.2: Showing summary of ANOVA, Effect of Mother Education on Scientific Attitude

Groups		Sum of Squares	Mean Square	df	F
Male	**Between Groups**	58148.492	9691.415	6	1.848
	Within Groups	2900844.563		553	
	Total	2958993.055	5245.650	559	
Female	**Between Groups**	70632.789	11772.131	6	2.382*
	Within Groups	2683943.191		543	
	Total	2754575.980	4942.805	549	
Total	**Between Groups**	110233.986	18372.331	6	3.609*
	Within Groups	5614474.605		1103	
	Total	5724708.591	5090.185	1109	

***Significant at .01 level**

The F value shown in table for total group indicate that mother education effects the scientific attitude of secondary school students as F value is significant at .01 level of confidence. But when analyzed separately for male and female students than it can be inferred that female are only affected by mother education as the F value for female group is significant at .01 level of confidence.

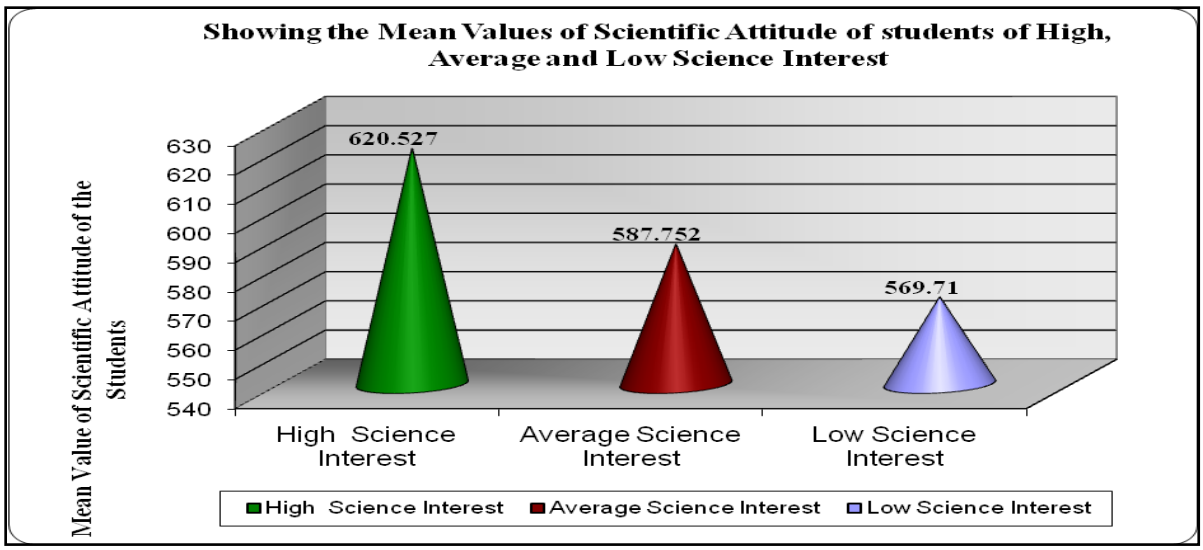
2. SCIENTIFIC ATTITUDE WITH RESPECT TO PYCHOLOGICAL VARIABLES

2.1 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO SCIENCE INTEREST

Table 2.1: Showing t values of Scientific Attitude with respect to Science Interest

Statistical Measures / Science Interest	N	Mean	SD	t	df
High Science Interest	196	620.527	76.086	6.087*	938
Average Science Interest	744	587.752	64.484		
High Science Interest	196	620.527	76.086	5.998*	364
Low Science Interest	170	569.710	86.000		
Average Science Interest	744	587.752	64.484	3.077*	912
Low Science Interest	170	569.710	86.000		

***Significant at .01 level**



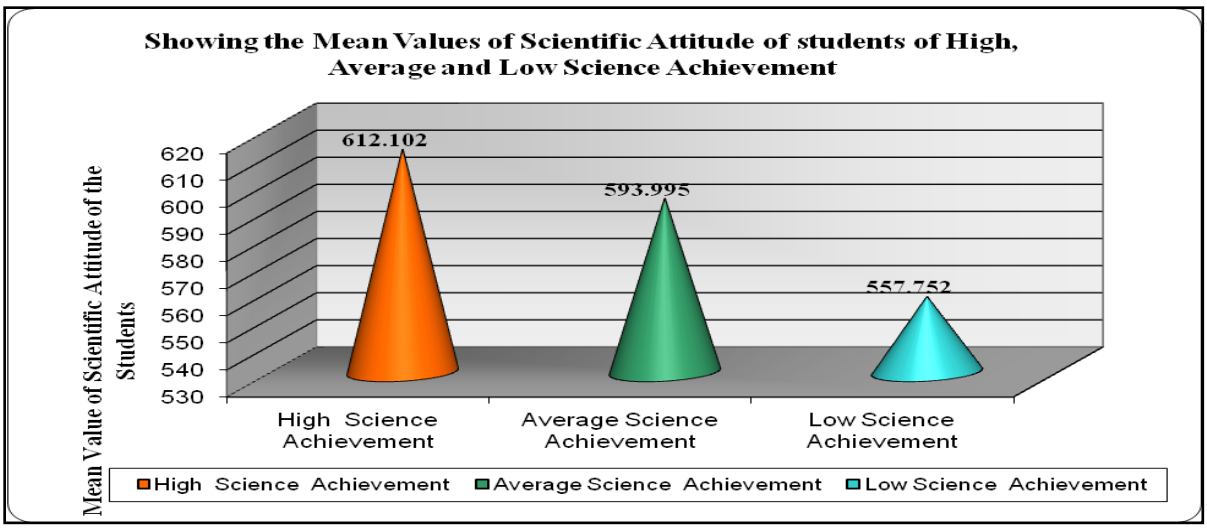
Above table clearly indicates that the all computed t values are significant at .01 level. Which confirms that significant difference exists in mean scores of scientific attitude of the students having high, average and low science interest. The students having high interest in the science subject have more scientific attitude than others, as these students thus able to understand the scientific facts more clearly and solve scientific problems easily which develop in them the scientific temper and scientific attitude.

2.2 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO SCIENCE ACHIEVEMENT

Table 2.2: Showing t values of Scientific Attitude with respect to Science Achievement

Statistical Measures / Science Achievement	N	Mean	SD	t	df
High Science Achievement	201	612.102	67.944		
Average Science Achievement	710	593.995	71.518	3.203*	909
High Science Achievement	201	612.102	67.944		
Low Science Achievement	199	557.752	65.850	8.123*	398
Average Science Achievement	710	593.995	71.518		
Low Science Achievement	199	557.752	65.850	6.426*	907

Significant at .01 level



The findings of the above table suggest that the t values between high vs. average, high vs. low and average vs. low science achievement are respectively 3.203, 8.123, and 6.426 which are significant at .01 level, which confirms the difference in scientific attitude among students having high, average and low Science achievement. The students having high science achievement are having high scientific attitude than average and low science achievement. The result shows that the science achievement is affecting significantly the scientific attitude of students.

Through the results it is found that the science achievement of the students effect the scientific attitude, because only that student will be a high achiever in science who understands the scientific facts very clearly and deeply and give answer systematically and to the point. Similarly one who performs scientific experiment correctly and precisely and thus these acts certainly exert positive effect in development of scientific attitude of students.

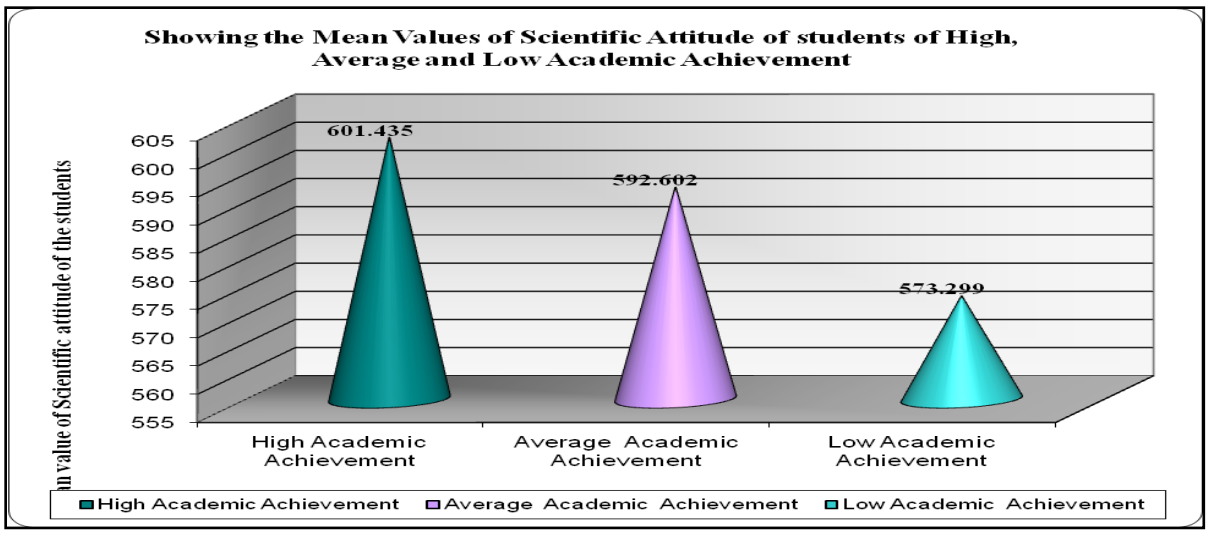
2.3 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO ACADEMIC ACHIEVEMENT

To know the effect of academic achievement on scientific attitude of students, the t values were calculated, which are as follows:

Table 2.3: Showing t values of Scientific Attitude with respect to Academic Achievement

Statistical Measures / Academic Achievement	**N**	**Mean**	**SD**	**t**	**df**
High Academic Achievement	212	601.435	66.630		
Average Academic Achievement	696	592.602	73.594	1.563	906
High Academic Achievement	212	601.435	66.630		
Low Academic Achievement	202	573.299	68.205	4.246*	412
Average Academic Achievement	696	592.602	73.594		
Low Academic Achievement	202	573.299	68.205	3.335*	896

***Significant at .01 level**



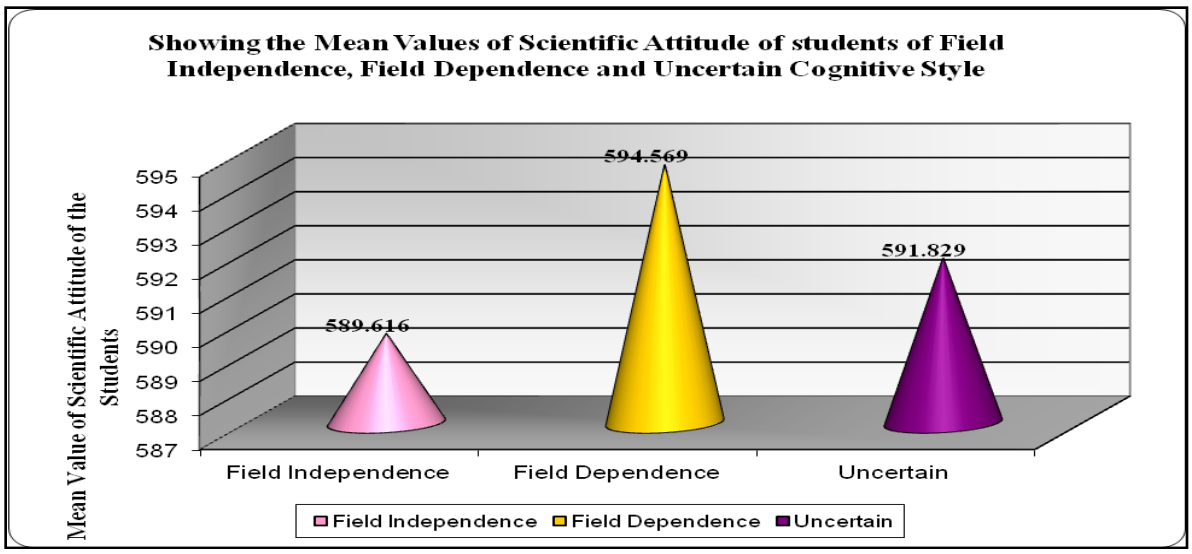
The above table reveals that the t values of high vs. low academic achievement and average vs. low academic achievement are significant at .01 level and the t value between high vs. average academic achievement is 1.563, which is not significant at any level. It indicates that high and average academic achievement affects the scientific attitude of the students. Students having high and average academic achievement have high scientific attitude as these students will be good enough in science and have the temperament of writing subject matter systematically, correctly, to the point and in logical manner.

2.4 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO COGNITIVE STYLE

To compare the students of different cognitive style with respect to their scientific attitude, the t value was calculated which are presented below:

Table 2.4: Showing t values of Scientific Attitude with respect to Cognitive Style

Statistical Measures / **Cognitive Style**	**N**	**Mean**	**SD**	**t**	**df**
Field Independence	761	589.616	70.098		
Field Dependence	188	594.569	77.367	0.849	947
Field Independence	761	589.616	70.098		
Uncertain	161	591.829	73.590	0.337	347
Field Dependence	188	594.569	77.367		
Uncertain	161	591.829	73.590	0.361	920



The statistical results in the above table show that the t values are found to be insignificant at .05 level, showing that there is no difference in scientific attitude of secondary school students, in relation to independence, dependence and uncertain cognitive style.

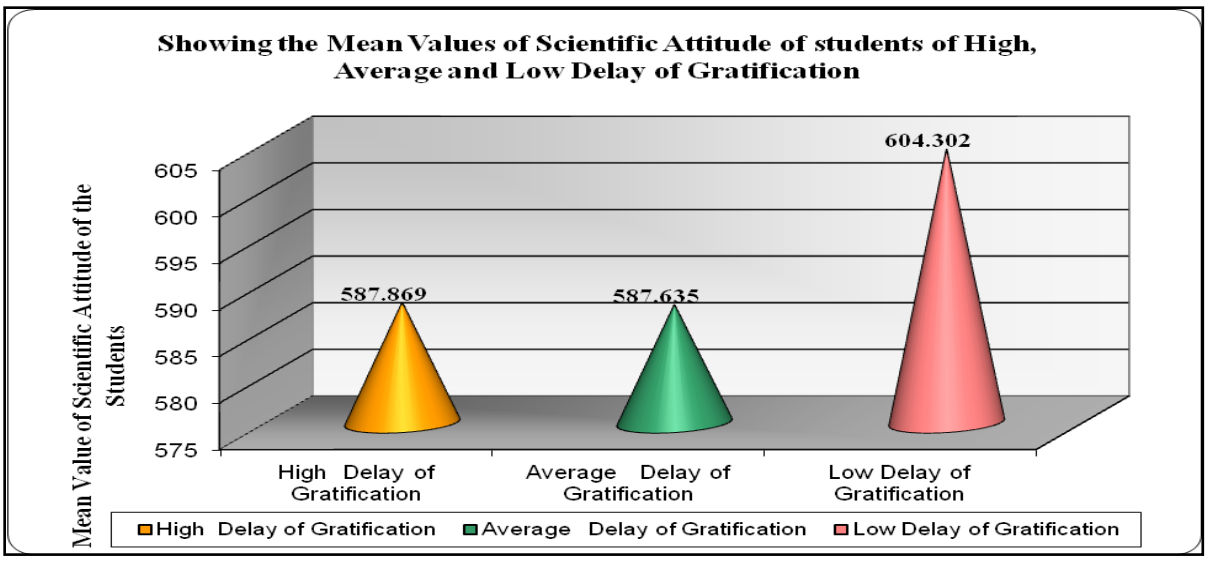
2.5 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO DELAY OF GRATIFICATION

To test whether the differences between scientific attitude of students having three levels of delay of gratification were significant or not,mean,S,D,,and t have been calculated values presented in the table given below:

Table 2.5 : Showing t values of Scientific Attitude with respect to Delay of Gratification

Statistical Measures / Delay of Gratification	N	Mean	SD	t	df
High Delay of Gratification	158	587.869	67.213		
Average Delay of Gratification	745	587.635	72.338	0.037	901
High Delay of Gratification	158	587.869	67.213		
Low Delay of Gratification	207	604.302	72.242	2.219**	363
Average Delay of Gratification	745	587.635	72.338		
Low Delay of Gratification	207	604.302	72.242	2.933*	950

***Significant at .01 level** ****Significant at .05 level**

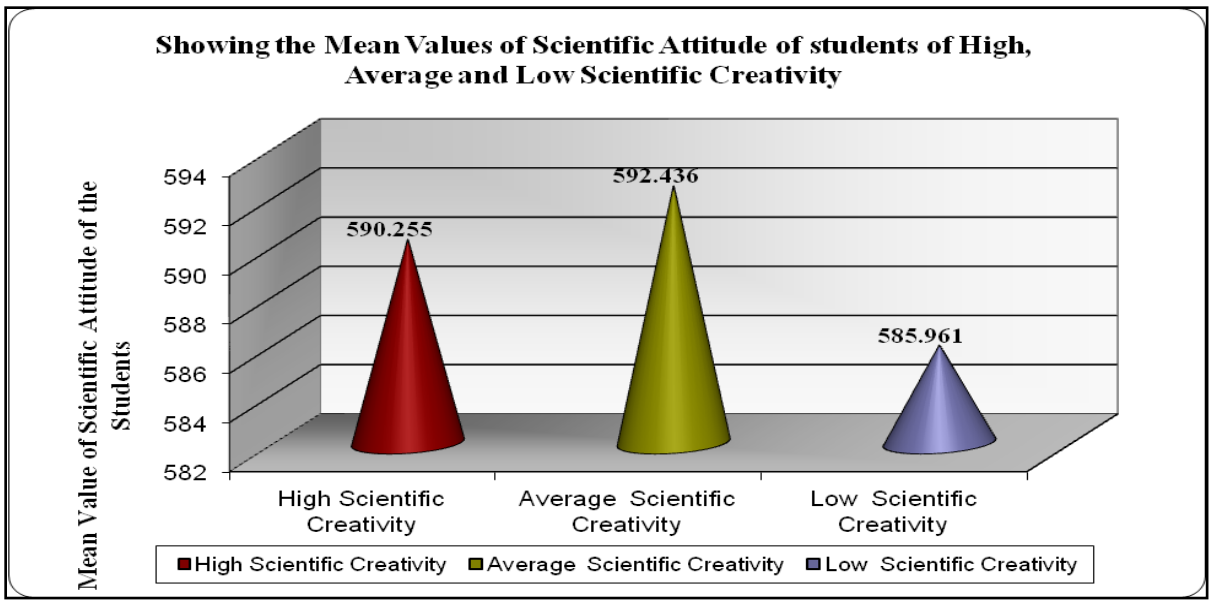


The table reveals that computed t values for high vs. low and average vs. low delay of gratification are significant at .01 level and .05 level of significance. It indicates that two groups i.e. high vs. low, average vs. low delay of gratification are significantly different from each other in relation to scientific attitude and it can be interpreted on the basis of mean values of both groups that low delay of gratification group is having more scientific attitude in comparison to high and average delay of gratification group and it may be due to the reason that the group having low delay of gratification have power of taking decision thus they perform their work quickly without doing any delay.

2.6 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO SCIENTIFIC CREATI

Table 2.6: Showing t values of Scientific Attitude with respect to Scientific Creativity

Statistical Measures / **Scientific Creativity**	**N**	**Mean**	**SD**	**t**	**df**
High Scientific Creativity	263	590.255	71.614		
Average Scientific Creativity	651	592.436	72.372	0.414	912
High Scientific Creativity	263	590.255	71.614		
Low Scientific Creativity	196	585.961	70.512	0.640	457
Average Scientific Creativity	651	592.436	72.372		
Low Scientific Creativity	196	585.961	70.512	1.105	845



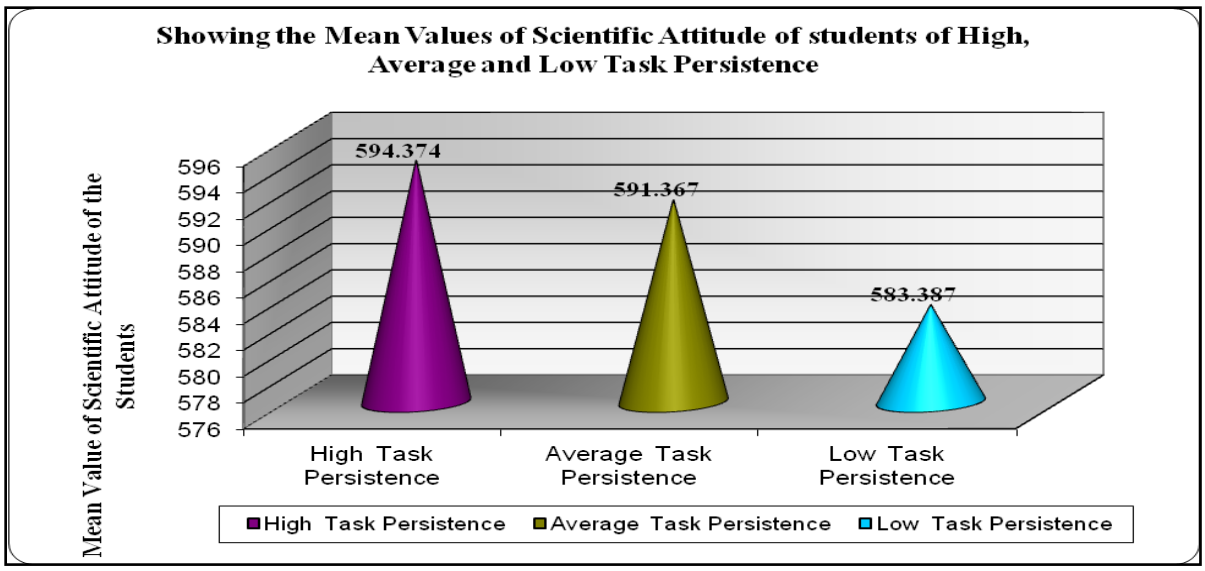
It is evident from the above table that the computed t values are found to be insignificant at .05 level of significance, thus it can be inferred that creativity do not effect scientific attitude.

2.7 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO TASK PERSISTENCE

To compare the students of different task persistence with respect to their scientific attitude, the t values were calculated which are presented below:

Table 2.7 : Showing t values of Scientific Attitude with respect to Task Persistence

Statistical Measures / Task Persistence	N	Mean	SD	t	df
High Task Persistence	188	594.374	75.452		
Average Task Persistence	769	591.367	70.756	0.515	955
High Task Persistence	188	594.374	75.452		
Low Task Persistence	153	583.387	72.707	1.359	339
Average Task Persistence	769	591.367	70.756		
Low Task Persistence	153	583.387	72.707	1.268	920



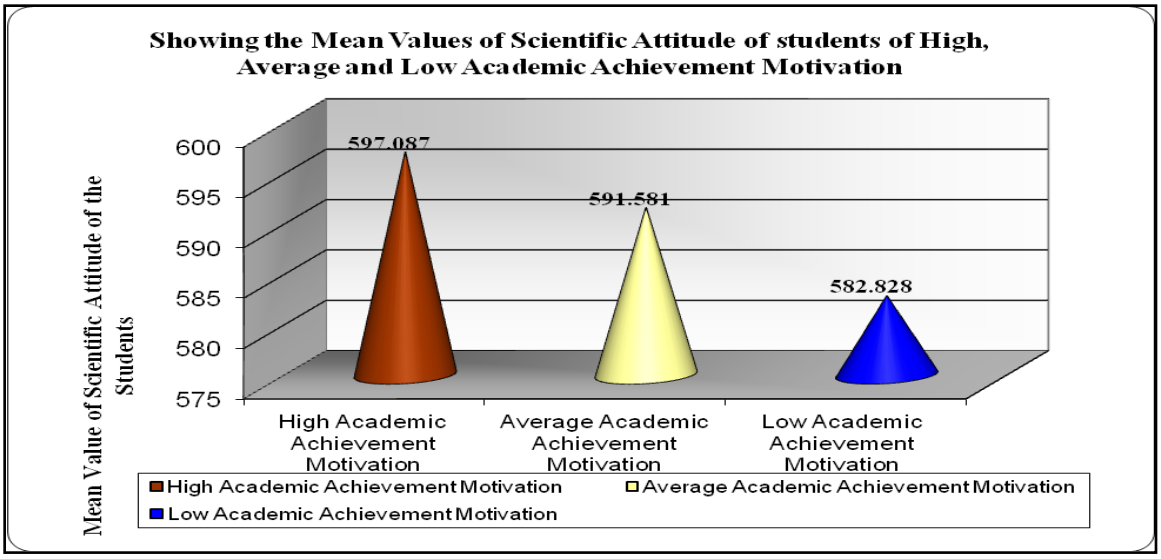
The statistical results in the above table show that the t values are found to be insignificant at .05 level, which are showing that there is no difference of scientific attitude in relation to high, average and low task persistence of the students.

2.8 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO ACADEMIC ACHIEVEMENT MOTIVATION

To determine the significant difference between scientific attitude of students of different levels of academic achievement motivation, the t values were calculated, which are as follows:

Table 2.8 : Showing t values of Scientific Attitude with respect to Academic Achievement Motivation

Statistical Measures / Academic Achievement Motivation	N	Mean	SD	t	df
High Academic Achievement Motivation	162	597.087	72.298		
Average Academic Achievement Motivation	744	591.581	70.862	0.893	904
High Academic Achievement Motivation	162	597.087	72.298		
Low Academic Achievement Motivation	204	582.828	74.667	1.840	364
Average Academic Achievement Motivation	744	591.581	70.862		
Low Academic Achievement Motivation	204	582.828	74.667	1.545	946



It is evident from the above table that the computed t values are found to be insignificant at .05 level of significance, so with 99% of confidence it can be said that academic achievement affects scientific attitude.

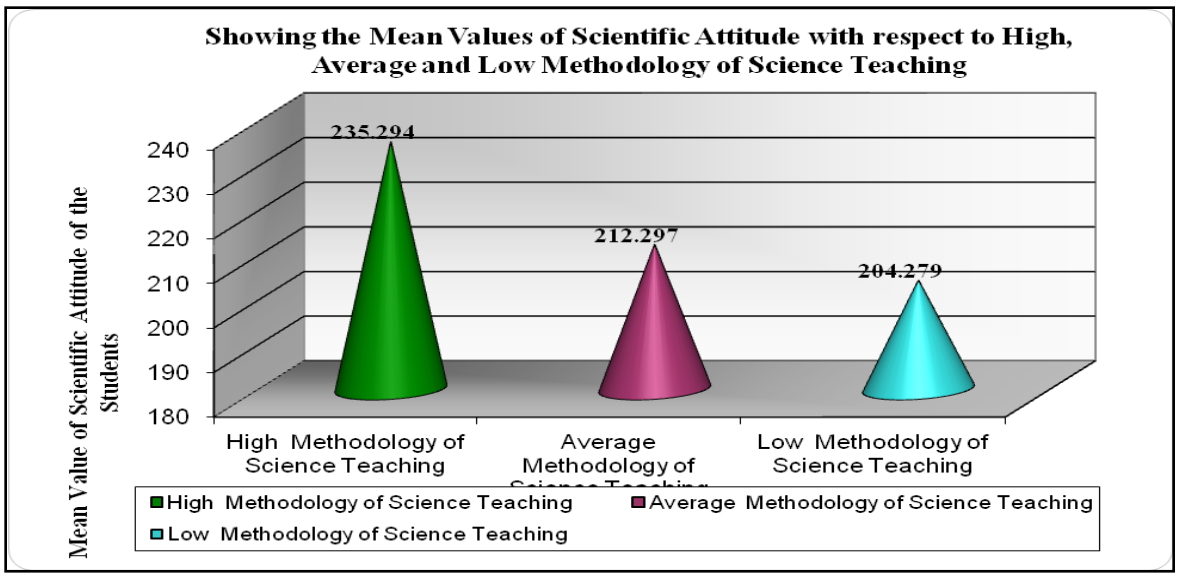
2.9 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO METHODOLOGY OF SCIENCE TEACHING

To know the impact of methodology of science teaching on scientific attitude of students, the t values shown below:

Table 2.9: Showing Mean, SD and t values of Scientific Attitude with respect to Methodology of Science Teaching

Statistical Measures / Methodology of Science Teaching	N	Mean	SD	t	df
High Methodology of Science Teaching	230	212.297	78.784		
Average Methodology of Science Teaching	636	204.279	47.897	1.696	864
High Methodology of Science Teaching	230	212.297	78.784		
Low Methodology of Science Teaching	244	235.294	58.269	10.030*	472
Average Methodology of Science Teaching	636	204.279	47.897		
Low Methodology of Science Teaching	244	235.294	58.269	15.817*	878

***Significant at .01 level**



The above table reveals that the t values of high vs. low methodology of science teaching and average vs. low methodology of science teaching are significant at .01 level and the t value between high vs. average methodology of science teaching is 0.563, which is not significant at any level of significance and indicates that high and average methodology of science teaching effects the scientific attitude of the students.

Good methodology of science teaching means methodology in which methods like, learning by doing, self discovery, problem solving and experimentation included and these methods develop power of logical thinking, judgment, acceptability of facts after proper verification which directly help in developing the scientific attitude among students. The result clearly indicates that if we want to develop scientific attitude among students, the suitable methodology of science teaching should be adopted by our teachers in class room.

2.10 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO STUDY HABITS

To compare the scientific attitude of students having different study habits, the data were analysed and t value were calculated which are presented below:

Table 2.10: Showing t values of Scientific Attitude with respect to Study Habits

Statistical Measures / Dimensions of Study Habit Inventory	**N**	**N**	**Mean**	**Mean**	**SD**	**SD**	**t**	**df**
Comprehension/ Concentration	**1**	**2**	**1**	**2**	**1**	**2**		
	236	240	755.280	756.713	99.847	104.531	0.153	474
Comprehension/Task Orientation	**1**	**3**	**1**	**3**	**1**	**3**		
	236	251	755.280	761.841	99.847	92.536	0.753	485
Comprehension/Study Sets	**1**	**4**	**1**	**4**	**1**	**4**		
	236	164	755.280	743.762	99.847	88.738	1.187	398
Comprehension/Interaction	**1**	**5**	**1**	**5**	**1**	**5**		
	236	245	755.280	748.208	99.847	87.963	0.825	479
Comprehension/Drilling	**1**	**6**	**1**	**6**	**1**	**6**		
	236	171	755.280	748.170	99.847	89.455	0.740	405
Comprehension/Supports	**1**	**7**	**1**	**7**	**1**	**7**		

	236	143	755.280	749.713	99.847	88.062	0.550	377
Comprehension/Recording	**1**	**8**	**1**	**8**	**1**	**8**		
	236	326	755.280	759.632	99.847	95.790	0.522	560
Comprehension/Language	**1**	**9**	**1**	**9**	**1**	**9**		
	236	265	755.280	748.740	99.847	90.218	0.770	499
Concentration/ Task Orientation	**2**	**3**	**2**	**3**	**2**	**3**		
	240	251	756.713	761.841	104.531	92.536	0.576	489
Concentration/ Study Sets	**2**	**4**	**2**	**4**	**2**	**4**		
	240	164	756.713	743.762	104.531	88.738	1.299	402
Concentration/ Interaction	**2**	**5**	**2**	**5**	**2**	**5**		
	240	245	756.713	748.208	104.531	87.963	0.970	483
Concentration/ Drilling	**2**	**6**	**2**	**6**	**2**	**6**		
	240	171	756.713	748.170	104.531	89.455	0.866	409
Concentration/ Supports	**2**	**7**	**2**	**7**	**2**	**7**		
	240	143	756.713	749.713	104.531	88.062	0.671	381
Concentration/ Recording	**2**	**8**	**2**	**8**	**2**	**8**		
	240	326	756.713	759.632	104.531	95.790	0.345	564
Concentration/Language	**2**	**9**	**2**	**9**	**2**	**9**		
	240	265	756.713	748.740	104.531	90.218	0.920	503
Task Orientation/ Study Sets	**3**	**4**	**3**	**4**	**3**	**4**		
	251	164	761.841	743.762	92.536	88.738	1.977**	413
Task Orientation/ Interaction	**3**	**5**	**3**	**5**	**3**	**5**		
	251	245	761.841	748.208	92.536	87.963	1.681	494
Task Orientation/ Drilling	**3**	**6**	**3**	**6**	**3**	**6**		
	251	171	761.841	748.170	92.536	89.455	1.510	420
Task Orientation/ Supports	**3**	**7**	**3**	**7**	**3**	**7**		
	251	143	761.841	749.713	92.536	88.062	1.273	392
Task Orientation/ Recording	**3**	**8**	**3**	**8**	**3**	**8**		
	251	326	761.841	759.632	92.536	95.790	0.279	575
Task Orientation/Language	**3**	**9**	**3**	**9**	**3**	**9**		
	251	265	761.841	748.740	92.536	90.218	1.628	514
Study Sets/ Interaction	**4**	**5**	**4**	**5**	**4**	**5**		
	164	245	743.762	748.208	88.738	87.963	0.499	407
Study Sets/ Drilling	**4**	**6**	**4**	**6**	**4**	**6**		
	164	171	743.762	748.170	88.738	89.455	0.453	333
Study Sets/ Supports	**4**	**7**	**4**	**7**	**4**	**7**		
	164	143	743.762	749.713	88.738	88.062	0.588	305
Study Sets/ Recording	**4**	**8**	**4**	**8**	**4**	**8**		
	164	326	743.762	759.632	88.738	95.790	1.773	488
Study Sets/Language	**4**	**9**	**4**	**9**	**4**	**9**		
	164	265	743.762	748.740	88.738	90.218	0.559	427
Interaction/ Drilling	**5**	**6**	**5**	**6**	**5**	**6**		
	245	171	748.208	748.170	87.963	89.455	0.004	414
Interaction/ Supports	**5**	**7**	**5**	**7**	**5**	**7**		
	245	143	748.208	749.713	87.963	88.062	0.163	386

Interaction/ Recording	**5**	**8**	**5**	**8**	**5**	**8**		
	245	326	748.208	759.632	87.963	95.790	1.460	569
Interaction/Language	**5**	**9**	**5**	**9**	**5**	**9**		
	245	265	748.208	748.740	87.963	90.218	0.067	508
Drilling/ Supports	**6**	**7**	**6**	**7**	**6**	**7**		
	171	143	748.170	749.713	89.455	88.062	0.153	312
Drilling/ Recording	**6**	**8**	**6**	**8**	**6**	**8**		
	171	326	748.170	759.632	89.455	95.790	1.296	495
Drilling/Language	**6**	**9**	**6**	**9**	**6**	**9**		
	171	265	748.170	748.740	89.455	90.218	0.065	434
Supports/ Recording	**7**	**8**	**7**	**8**	**7**	**8**		
	143	326	749.713	759.632	88.062	95.790	1.058	467
Supports/Language	**7**	**9**	**7**	**9**	**7**	**9**		
	143	265	749.713	748.740	88.062	90.218	0.105	406
Recording/Language	**8**	**9**	**8**	**9**	**8**	**9**		
	326	265	759.632	748.740	95.790	90.218	1.411	589

****Significant at .05 level**

The mean values shown in table above indicates that the students having task orientation study habit have maximum value of scientific attitude followed by the recording study habit but all the calculated t values were found insignificant even at .05 level of confidence except t value between mean value of task orientation and study sets, conforming the fact that study habit of student do not account in development of scientific attitude of students.

3. SCIENTIFIC ATTITUDE WITH RESPECT TO SOCIAL VARIABLES

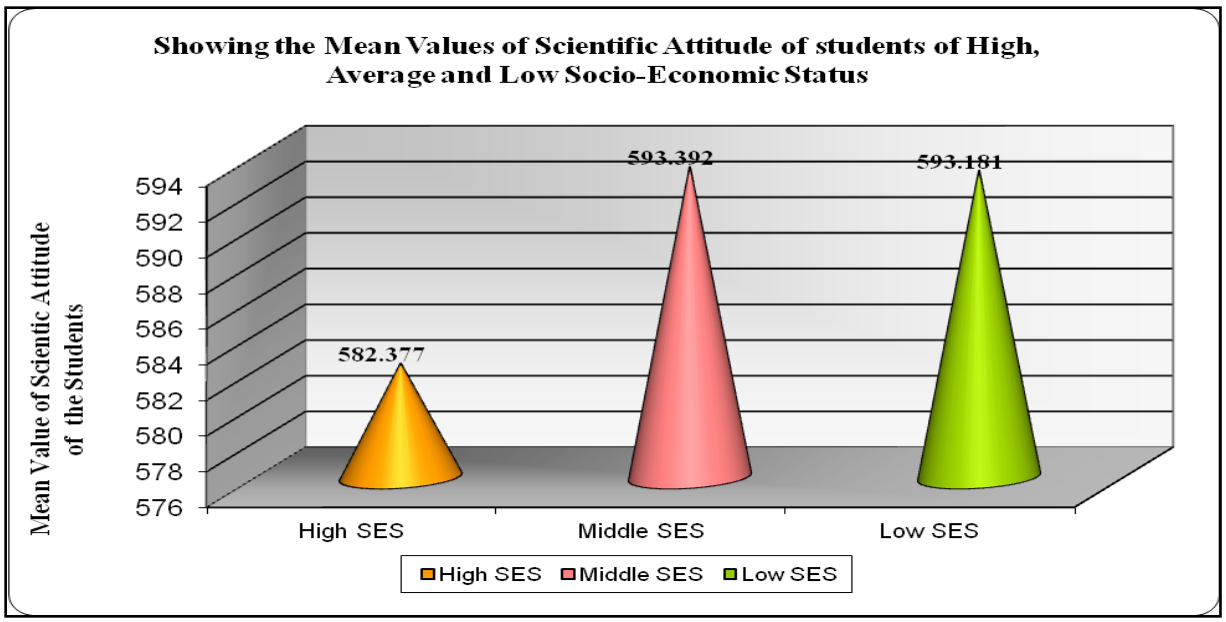
3.1 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO SOCIO-ECONOMIC STATUS

The effect of socio-economic status on scientific attitude, the t values were computed and are shown below:

Table 3.1: Showing t values of Scientific Attitude with respect to Socio-Economic Status

Statistical Measures / Socio-Economic Status	**N**	**Mean**	**SD**	**t**	**df**
High SES	259	582.377	75.273		
Average SES	612	593.392	70.201	2.071**	869
High SES	259	582.377	75.273		
Low SES	239	593.181	71.811	1.636	496
Average SES	612	593.392	70.201		
Low SES	239	593.181	71.811	0.039	849

****Significant at .05 level**



The above table reveals the facts that t value between high vs. average SES are significant at .05 level of confidence. It means that among high and average SES, the students belonging to average SES have more scientific attitude than by the high SES. The t values between high vs. low and average vs. low SES is not significant at any level of significance. The results clearly show that the Students of average and low SES have more scientific attitude than students belonging to high level of SES.

SES comprise of the facilities, opportunities, privileges, prestige and recognition and high SES means achievement of these while low SES is deprivation from these and middle SES is the condition between two extremes.

The students belonging to high SES families get facilities more easily and they may be not so serious to utilize them whereas students of average and low SES use the available facilities and resources more seriously as they get them by great efforts. High SES do not affect scientific attitude of secondary school students.

3.2 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO DIFFERENT SCHOOL ENVIRONMENT

To determine the significant difference between scientific attitude of students of different levels of school environment, the t values were calculated, which are as follows:

Table 3.2: Showing Mean, SD and t values of Scientific Attitude with respect to Different School Environment

Statistical Measures / Dimensions of School Environment Inventory	**N**	**N**	**Mean**	**Mean**	**SD**	**SD**	**t**	**df**
Creative Stimulation/ Cognitive Encouragement	**1**	**2**	**1**	**2**	**1**	**2**		
	179	187	761.698	760.096	91.392	91.564	0.167	364
Creative Stimulation/Permissiveness	**1**	**3**	**1**	**3**	**1**	**3**		
	179	162	761.698	760.278	91.392	86.951	0.147	339
Creative Stimulation/Acceptance	**1**	**4**	**1**	**4**	**1**	**4**		
	179	198	761.698	749.727	91.392	99.350	1.213	375
Creative Stimulation/Rejection	**1**	**5**	**1**	**5**	**1**	**5**		
	179	214	761.698	743.079	91.392	97.870	1.935	391
Creative Stimulation/Control	**1**	**6**	**1**	**6**	**1**	**6**		
	179	185	761.698	760.816	91.392	95.036	0.090	362
Cognitive Encouragement/	**2**	**3**	**2**	**3**	**2**	**3**		

Permissiveness								
	187	162	760.096	760.278	91.564	86.951	0.019	347
Cognitive Encouragement/ Acceptance	**2**	**4**	**2**	**4**	**2**	**4**		
	187	198	760.096	749.727	91.564	99.350	1.063	383
Cognitive Encouragement/ Rejection	**2**	**5**	**2**	**5**	**2**	**5**		
	187	214	760.096	743.079	91.564	97.870	1.790	399
Cognitive Encouragement/ Control	**2**	**6**	**2**	**6**	**2**	**6**		
	187	185	760.096	760.816	91.564	95.036	0.074	370
Permissiveness/ Acceptance	**3**	**4**	**3**	**4**	**3**	**4**		
	162	198	760.278	749.727	86.951	99.350	1.060	358
Permissiveness/ Rejection	**3**	**5**	**3**	**5**	**3**	**5**		
	162	214	760.278	743.079	86.951	97.870	1.770	374
Permissiveness/ Control	**3**	**6**	**3**	**6**	**3**	**6**		
	162	185	760.278	760.816	86.951	95.036	0.055	345
Acceptance/ Rejection	**4**	**5**	**4**	**5**	**4**	**5**		
	198	214	749.727	743.079	99.350	97.870	0.684	410
Acceptance/ Control	**4**	**6**	**4**	**6**	**4**	**6**		
	198	185	749.727	760.816	99.350	95.036	1.115	381
Rejection/ Control	**5**	**6**	**5**	**6**	**5**	**6**		
	214	185	743.079	760.816	97.870	95.036	1.830	397

The perusal of mean values of attitude scores belonging to different school environment shown in the table indicates that the students having creative stimulation, cognitive encouragement, permissiveness and control, school environment have more scientific attitude in comparison to acceptance and rejection school environment. This clearly indicates that for the development of scientific attitude acceptance and rejection school environment should be check but the calculated t values among the mean values of attitude scores belong to these six environments are found statistically insignificant rejecting the above finding and confirms the view that school environment to do exert any effect on the development of scientific attitude of secondary school students.

3. 3 STUDY OF SCIENTIFIC ATTITUDE WITH RESPECT TO DIFFERENT HOME ENVIRONMENT

To test whether the differences between scientific attitude of students according to ten dimensions of home environment were significant or not, t values were calculated:

Table 3.3 : Showing t values of Scientific Attitude with respect to different Home Environment

Statistical Measures / **Dimensions of Home Environment Inventory**	**N**	**N**	**Mean**	**Mean**	**SD**	**SD**	**t**	**df**
Control/Protectiveness	**1**	**2**	**1**	**2**	**1**	**2**		
	246	183	756.780	774.628	90.189	87.604	2.052**	427
Control/Punishment	**1**	**3**	**1**	**3**	**1**	**3**		
	246	196	756.780	750.505	90.189	89.317	0.730	440
Control/Conformity	**1**	**4**	**1**	**4**	**1**	**4**		
	246	184	756.780	772.087	90.189	92.126	1.725	428
Control/Social Isolation	**1**	**5**	**1**	**5**	**1**	**5**		
	246	184	756.780	759.228	90.189	79.466	0.293	428

Control/Reward	**1**	**6**	**1**	**6**	**1**	**6**		
	246	184	756.780	784.136	90.189	85.010	3.189*	428
Control/Deprivation of Privileges	**1**	**7**	**1**	**7**	**1**	**7**		
	246	194	756.780	749.567	90.189	81.120	0.870	438
Control/Nurturance	**1**	**8**	**1**	**8**	**1**	**8**		
	246	214	756.780	766.836	90.189	96.696	1.153	458
Control/Rejection	**1**	**9**	**1**	**9**	**1**	**9**		
	246	173	756.780	748.208	90.189	81.366	0.997	417
Control/Permissiveness	**1**	**10**	**1**	**10**	**1**	**10**		
	246	219	756.780	748.799	90.189	88.640	0.960	463
Protectiveness /Punishment	**2**	**3**	**2**	**3**	**2**	**3**		
	183	196	774.628	750.505	87.604	89.317	2.652*	377
Protectiveness /Conformity	**2**	**4**	**2**	**4**	**2**	**4**		
	183	184	774.628	772.087	87.604	92.126	0.271	365
Protectiveness /Social Isolation	**2**	**5**	**2**	**5**	**2**	**5**		
	183	184	774.628	759.228	87.604	79.466	1.764	365
Protectiveness /Reward	**2**	**6**	**2**	**6**	**2**	**6**		
	183	184	774.628	784.136	87.604	85.010	1.055	365
Protectiveness /Deprivation of Privileges	**2**	**7**	**2**	**7**	**2**	**7**		
	183	194	774.628	749.567	87.604	81.120	2.884*	375
Protectiveness /Nurturance	**2**	**8**	**2**	**8**	**2**	**8**		
	183	214	774.628	766.836	87.604	96.696	0.836	395
Protectiveness/ Rejection	**2**	**9**	**2**	**9**	**2**	**9**		
	183	173	774.628	748.208	87.604	81.366	2.944*	354
Protectiveness /Permissiveness	**2**	**10**	**2**	**10**	**2**	**10**		
	183	219	774.628	748.799	87.604	88.640	2.925*	400
Punishment/ Conformity	**3**	**4**	**3**	**4**	**3**	**4**		
	196	184	750.505	772.087	89.317	92.126	2.318**	378
Punishment/ Social Isolation	**3**	**5**	**3**	**5**	**3**	**5**		
	196	184	750.505	759.228	89.317	79.466	1.003	378
Punishment/ Reward	**3**	**6**	**3**	**6**	**3**	**6**		
	196	184	750.505	784.136	89.317	85.010	3.755*	378
Punishment/ Deprivation of Privileges	**3**	**7**	**3**	**7**	**3**	**7**		
	196	194	750.505	749.567	89.317	81.120	0.109	388
Punishment/ Nurturance	**3**	**8**	**3**	**8**	**3**	**8**		
	196	214	750.505	766.836	89.317	96.696	1.772	408
Punishment/ Rejection	**3**	**9**	**3**	**9**	**3**	**9**		
	196	173	750.505	748.208	89.317	81.366	0.257	367
Punishment/ Permissiveness	**3**	**10**	**3**	**10**	**3**	**10**		
	196	219	750.505	748.799	89.317	88.640	0.195	413
Conformity/ Social Isolation	**4**	**5**	**4**	**5**	**4**	**5**		
	184	184	772.087	759.228	92.126	79.466	1.434	366
Conformity/ Reward	**4**	**6**	**4**	**6**	**4**	**6**		
	184	184	772.087	784.136	92.126	85.010	1.304	366
Conformity/ Deprivation of Privileges	**4**	**7**	**4**	**7**	**4**	**7**		

	184	194	772.087	749.567	92.126	81.120	2.526**	376
Conformity/ Nurturance	**4**	**8**	**4**	**8**	**4**	**8**		
	184	214	772.087	766.836	92.126	96.696	0.552	396
Conformity/ Rejection	**4**	**9**	**4**	**9**	**4**	**9**		
	184	173	772.087	748.208	92.126	81.366	2.589*	355
Conformity/ Permissiveness	**4**	**10**	**4**	**10**	**4**	**10**		
	184	219	772.087	748.799	92.126	88.640	2.580**	401
Social Isolation/ Reward	**5**	**6**	**5**	**6**	**5**	**6**		
	184	184	759.228	784.136	79.466	85.010	2.903*	366
Social Isolation/ Deprivation of Privileges	**5**	**7**	**5**	**7**	**5**	**7**		
	184	194	759.228	749.567	79.466	81.120	1.169	376
Social Isolation/ Nurturance	**5**	**8**	**5**	**8**	**5**	**8**		
	184	214	759.228	766.836	79.466	96.696	0.849	396
Social Isolation/ Rejection	**5**	**9**	**5**	**9**	**5**	**9**		
	184	173	759.228	748.208	79.466	81.366	1.294	355
Social Isolation/ Permissiveness	**5**	**10**	**5**	**10**	**5**	**10**		
	184	219	759.228	748.799	79.466	88.640	1.233	401
Reward/ Deprivation of Privileges	**6**	**7**	**6**	**7**	**6**	**7**		
	184	194	784.136	749.567	85.010	81.120	4.046*	376
Reward/ Nurturance	**6**	**8**	**6**	**8**	**6**	**8**		
	184	214	784.136	766.836	85.010	96.696	1.881	396
Reward/ Rejection	**6**	**9**	**6**	**9**	**6**	**9**		
	184	173	784.136	748.208	85.010	81.366	4.074*	355
Reward/ Permissiveness	**6**	**10**	**6**	**10**	**6**	**10**		
	184	219	784.136	748.799	85.010	88.640	4.061*	401
Deprivation of Privileges/ Nurturance	**7**	**8**	**7**	**8**	**7**	**8**		
	194	214	749.567	766.836	81.120	96.696	1.944	406
Deprivation of Privileges/ Rejection	**7**	**9**	**7**	**9**	**7**	**9**		
	194	173	749.567	748.208	81.120	81.366	0.160	365
Deprivation of Privileges/ Permissiveness	**7**	**10**	**7**	**10**	**7**	**10**		
	194	219	749.567	748.799	81.120	88.640	0.091	411
Nurturance/ Rejection	**8**	**9**	**8**	**9**	**8**	**9**		
	214	173	766.836	748.208	96.696	81.366	2.021**	385
Nurturance/ Permissiveness	**8**	**10**	**8**	**10**	**8**	**10**		
	214	219	766.836	748.799	96.696	88.640	2.024**	431
Rejection/ Permissiveness	**9**	**10**	**9**	**10**	**9**	**10**		
	173	219	748.208	748.799	81.366	88.640	0.068	390

***Significant at .01 level **Significant at .05 level**

The mean values of attitude scores of students belonging to different home environment clearly indicate that the students whose home environment correspond to protective, reward, conformity and nurturance have high scientific attitude in relation to other home environment and those view is also confirmed by the calculated t values among mean scores of these school environment with other school environment and which are significant at .05 and .01 level of significance. Thus it can be said that protective, reward, conformity and nurturance home environment help in the development of scientific attitude of students while control, punishment, school isolation, deprivation of

privileges, rejection and permissiveness environment do not create favorable conditions for the development of scientific attitude among students.

CONCLUSION

The present study involved a tentative attempt to ferret out and focus upon the contribution of some psychological, social and biographical characteristics of secondary school students to the total predicted variance in scientific attitude. The psychological variables under study were science interest, science achievement, academic achievement, study habit, academic achievement motivation, cognitive style scientific creativity, delay of gratification, task persistence, methodology of science teaching; and socio-biographic variables were SES, Home environment, school environment, sex, caste, father education, mother education and board. The results of the present study suggest that scientific attitude depends upon different factors viz. psychological, social and biographical. The results from this study also suggest that the psychological variables were more consistently related to scientific attitude then the socio-biographic variables.

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