Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.6, No.34, 2015

Scientific Temper among Academically High and Low Achieving Adolescent Girls

Sunmeet Kour
Ph.D Research Scholar, Department of Education, University of Kashmir, J&K (India)

Abstract
The present study was undertaken to compare the scientific temper of high and low achieving adolescent girl students. Random sampling technique was used to draw the sample from various high schools of District Srinagar. The sample for the present study consisted of 120 school going adolescent girls (60 high and 60 low achievers). Data was collected by using Nadeem and Rashid's scientific temper scale. Statistical techniques of Percentage, Mean, S.D. and t-test were used to analyse the data. The findings of the study revealed that two groups differ significantly on curiosity, objectivity and rationality dimension of scientific temper scale. The results of the study further revealed that there exists no significant difference between high and low achieving adolescent girl on Open mindedness and Aversion to superstition dimension of scientific temper.
Keywords: Scientific Temper, High Achievers, Low Achievers, Adolescent Girls.

INTRODUCTION

Scientific advances over the last fifty years have led to revolutionary changes in health, nutrition and communication, and generally enhancing socio-economic development and the quality of our lives. The role of science promises to be greater in the future because of the ever-more rapid scientific progress. Our society is becoming increasingly dependent on science and technology. It is essential for the well being of our society that all citizens develop 'science literacy', an appreciation of science and the benefits of technology. Scientific temper describes an attitude which involves the application of logic and the avoidance of bias. The mental attitude which is behind the method of acquiring reliable and practical knowledge may be called the "Scientific Temper". A scientific temper thus refers to an open, questioning seeking mind. Discussion, argument and analysis are vital parts of scientific temper. Krishnan and Bhuvaneshwari (1990) define scientific temper as one's reactions in his/her life situations as practice of seeing cause and effect relationship appreciation of utility of science in daily life functions, adventurousness, experimental bent, intellectual honesty, objectivity, open mindedness challenging blind faith and receptivity to change.A mind seeks truth and accepts it when proved. Thus scientific temper is approach of believing, only facts supported by relevant evidences. Where these evidences are derived from observation, Logical interpretation and conclusion made from experiment or experience which is repeatable under similar condition.

A mind that is curious to understand 'whys' and 'hows' of life while accepting that all questions may not be fully answerable. The defining characteristics of a scientific mindset are curiosity, logical ability, objectivity, criticality, emphasis on empirical evidence, open-mindedness, the ability to discern fact from hypothesis, ability to recognize self-limitation, and an interest in new developments. The concept of Scientific Temper was articulated first by Pandit Jawaharlal Nehru in 1946 in his book *Discovery of India,* referring to it as "a way of life, a process of thinking, a method of acting and associating with our fellowmen". The tradition of skepticism and humanism is not new to Indian intellectual tradition. Such notions go back to antiquity – Jain, Sankya, and Buddhist traditions have repeatedly emphasized the spirit of enquiry. During the Indian renaissance many leaders popularised the notion of scientific enquiry and gradually it became part of Indian ethos.

Nehru was instrumental in laying the foundations for building the infrastructure for science and technology in India – the Universities, the IITs, the CSIR labs, etc. These became the 'hardware' of science and technology in India, while Scientific Temper among the people of India was to be the 'software'. In 1976, India became the first country to include in its Constitution 'Scientific Temper with humanism' as a fundamental duty of all citizens of the country {Article 51-A (h)}.

"It shall be the duty of every citizen of India to develop the scientific temper, humanism and the spirit of inquiry and reform". -- Article 51A (h)

For creating scientific temper among the pupil, various endeavours are being made by the Government and Non Government Organizations. The Department of Science & Technology, Government of India declared February 28 as National Science Day in 1987. In an effort to popularise the benefits of scientific knowledge and practical appropriation, every year 28th February is celebrated as National Science Day. It helps to inculcate scientific temper among school children. Observation of National Science Day attempts at generating scientific minded citizens. Science has contributed a great deal to the human welfare. Through the gospel of reason and experimental observation, by which it works, it has enabled man to acquire intellectual and mental excellence. From the materialistic point of view, ranging from environmental issues, disease eradication, space exploration, energy production, information highway to name a few, science and technology has broken barriers to bring

peace and prosperity with a cleaner environment with sustainable use of resource for the benefit of mankind.

The National Curriculum 2005, framework which is now considered as the bible of the school education has also pointed out that sciences, like the systems of mathematics, have their own concepts, often interconnected through theories, and are attempts to describe and explain the natural world. Scientific inquiry involves observation and experimentation to validate predictions made by theory (hypotheses), which may be aided by instruments and controls. In view of the unique importance of science education the National Curriculum Frame Work for school education 2005 recommended that pedagogy of learning sciences should be designed to address the aims of learning science that is to learn the facts and principles of science and it's applications, consistent with the stage of cognitive development. It also recommended to imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment and to cultivate scientific temper, objectivity, critical thinking and freedom from fear and prejudice among students.

NCF, 2005 is not the only document that has given directions for developing science temper among the students, but several commissions and committees on education have recommended for inculcating scientific temper, developing the spirit of inquiry and focusing on learning by doing through activity based science teaching in school curriculum which can play great role in developing scientific temper. However, despite these efforts, scientific temper did not permeate in society to make any perceptible impact on the national psyche. As Narlikar opined, 'Today we live in a free India that is feeling its way towards economic prosperity. Yet we are still a long way from achieving that scientific outlook which Nehru considered so essential for our future wellbeing' (Narlikar, 2003). If one were to pick out three or four most important reasons for the country's backwardness or failure in many areas, the lack of scientific temper would be one of them (Bhargava and Chakrabarti, 2010). Nehru's dream about the spread of scientific temper in the country has remained largely unrealised, in spite of significant growth in science and technology in India (Mahanti, 2013).

Though our country claim development in various spheres like atomic energy, space and telecommunication, technological excellence, it is a matter of regret that still there is lack of scientific temper in public in general and students in particular.

OBJECTIVES

The following objectives were formulated for the present investigation:

i. To identify the high and low achieving adolescent girls.
ii. To measure the scientific temper of high and low achieving adolescents girls.
iii. To compare high and low achieving adolescent girls on composite score of scientific temper.
iv. To compare high and low achieving adolescent girls on Curiosity dimension of scientific temper.
v. To compare high and low achieving adolescent girls on Open-mindedness dimension of scientific temper.
vi. To compare high and low achieving adolescent girls on Objectivity dimension of scientific temper.
vii. To compare high and low achieving adolescent girls on Rationality dimension of scientific temper.
viii. To compare high and low achieving adolescent girls on Aversion to Superstition dimension of scientific temper.

HYPOTHESES

The following hypotheses were formulated for the present investigation:

i. High and low achieving adolescent girls differ significantly on composite score of scientific temper.
ii. High and low achieving adolescent girls differ significantly on Curiosity dimension of scientific temper.
iii. High and low achieving adolescent girls differ significantly on composite score of scientific temper.
iv. High and low achieving adolescent girls differ significantly on Open-mindedness dimension of scientific temper.
v. High and low achieving adolescent girls differ significantly on Objectivity dimension of scientific temper.
vi. High and low achieving adolescent girls differ significantly on Rationality dimension of scientific temper.
vii. High and low achieving adolescent girls differ significantly on Aversion to Superstition dimension of scientific temper.

SAMPLE

The sample for the present study consisted of 120 high school adolescent girls. They were further split into high achievers and low achievers according to the marks obtained in their previous class. Students with 70% and above marks were considered as high achievers while those with less than 50% marks were taken as low achievers. The sample was taken randomly from various high school of district Srinagar.

TOOL USED

The data for the present study was collected with the help of scientific temper scale constructed by Prof. Nadeem and Showkat Rashid Wani which assesses five dimensions of scientific temper i.e. curiosity, open mindedness, objectivity, Rationality and Aversion to Superstitions.

STATISTICAL ANALYSIS

The data collected was subjected to the following statistical treatment:

1. Percentage statistics
2. Mean
3. S.D
4. t-test

ANALYSIS AND INTERPRETATION

In order to achieve the objectives formulated for the present study, the data collected has been tabulated as under.

Table 1.1:- Showing percentage of High Achieving Adolescent Girls falling on various levels of Scientific Temper (N=60).

Levels	Range of scores	No. of Respondents	Percentage
High Scientific Temper	40 and above	Nil	0%
Above Average Scientific Temper	30-39	25	41.7%
Average Scientific Temper	20-29	29	48.3%
Below Average Scientific Temper	10-19	6	10%
Poor Scientific Temper	0-9	Nil	0%
Total		60	100%

The perusal of above table shows that out of 60 high achieving adolescent girls 41.7% fall in above average category, 48.3% in average and 10% in below average while none of the high achieving girls falls in the range of high and poor scientific temper

Table 1.2:- Showing percentage of Low Achieving Adolescent falling on various levels of Scientific Temper among Girls (N=60).

Levels	Range of scores	No. of Respondents	Percentage
High Scientific Temper	40 and above	Nil	0%
Above Average Scientific Temper	30-39	5	8.3%
Average Scientific Temper	20-29	31	51.7%
Below Average Scientific Temper	10-19	20	33.4%
Poor Scientific Temper	0-9	4	6.6%
Total		60	100%

The perusal of above table shows that out of 60 low achieving adolescent girls 8.3% falls in the above average category, 51.7 in average, 33.4% in below average category and 6.6 % in poor scientific temper category. None of the low achieving adolescent girls fall in the category of high scientific temper.

Table 1.3:- Significance of mean difference between high and low achieving adolescent girls on Composite score of Scientific Temper

Group	N	Mean	S. D	t -Value	Level of Significance
High Achievers	60	25	5.40	4.79	Significant at 0.01 level
Low Achievers	60	20.59	4.83		

Table 1.3 shows the mean comparison of high and low achieving adolescent girls on composite score of scientific temper. The calculated t-value 4.79 exceeds the tabulated t-value at 0.01 level of significance, which depicts that there exists a significant difference between high and low achieving adolescent girls on composite score of scientific temper. Thus from the confirmation of the results from the above table, the hypothesis which reads as, *"high and low achieving adolescent girls differ significantly on composite score of scientific temper"*, stands accepted.

Table 1.4:- Significance of mean difference between high and low achieving adolescent girls on Curiosity dimension of scientific temper

Group	N	Mean	S. D	t -Value	Level of Significance
High Achievers	60	5.69	1.58	3.96	Significant at 0.01 level
Low Achievers	60	4.50	1.82		

Table 1.4 shows the mean comparison of high and low achieving adolescent girls on curiosity dimension of scientific temper. The calculated t-value 3.96 exceeds the tabulated t-value at 0.01 level of significance, which depicts that there is significant difference between high and low achieving adolescent girls

on curiosity dimension of scientific temper. Thus from the confirmation of the results from the above table, the hypothesis which reads as, *"high and low achieving adolescent girls High and low achieving adolescents girls differ significantly on curiosity",* stands accepted.

Table 1.5:- Significance of mean difference between high and low achieving adolescent girls on Open Mindedness dimension of scientific temper

Group	N	Mean	S. D	t -Value	Level of Significance
High Achievers	60	4.20	1.86	0.53	Not Significant
Low Achievers	60	4.05	1.43		

Table 1.5 depicts the mean comparison of high and low achieving adolescent girls on open mindedness dimension of scientific temper. The calculated t-value 0.53 is less than tabulated t-value at 0.05 level of significance, which shows that there is no significant difference between high and low achieving adolescent girls on open mindedness dimension of scientific temper. Thus from the confirmation of the results from the above table, the hypothesis which reads as, *"high and low achieving adolescents girls differ significantly on open mindedness",* stands rejected.

Table 1.6:- Significance of mean difference between high and low achieving adolescent girls on Objectivity dimension of scientific temper

Group	N	Mean	S. D	t -Value	Level of Significance
High Achievers	60	5.59	1.42	5.03	Significant at 0.01 level
Low Achievers	60	4.28	1.63		

Table 1.6 shows the mean comparison of high and low achieving adolescent girls on objectivity dimension of scientific temper. The calculated t-value 5.03 exceeds the tabulated t-value at 0.01 level of significance, which depicts that there is significant difference between high and low achieving adolescent girls on objectivity dimension of scientific temper. Thus from the confirmation of the results from the above table, the hypothesis which reads as, *"high and low achieving adolescent girls High and low achieving adolescents girls differ significantly on objectivity",* stands accepted.

Table 1.7:- Significance of mean difference between high and low achieving adolescent girls on Rationality dimension of scientific temper

Group	N	Mean	S. D	t -Value	Level of Significance
High Achievers	60	5.42	1.48	7	Significant at 0.01 level
Low Achievers	60	3.74	1.51		

Table 1.7 shows the mean comparison of high and low achieving adolescent girls on rationality dimension of scientific temper. The calculated t-value 7 exceeds the tabulated t-value at 0.01 level of significance, which depicts that there is significant difference between high and low achieving adolescent girls on rationality dimension of scientific temper. Thus from the confirmation of the results from the above table, the hypothesis which reads as, *"high and low achieving adolescent girls High and low achieving adolescents girls differ significantly on rationality",* stands accepted.

Table 1.8:- Significance of mean difference between high and low achieving adolescent girls on Aversion to Superstition dimension of Scientific Temper

Group	N	Mean	S. D	t -Value	Level of Significance
High Achievers	60	4.11	1.36	0.5	Not Significant
Low Achievers	60	4	1.29		

Table 1.8 depicts the mean comparison of high and low achieving adolescent girls on open mindedness dimension of scientific temper. The calculated t-value 0.5 is less than tabulated t-value at 0.05 level of significance, which depicts that there is no significant difference between high and low achieving adolescent girls on superstition dimension of scientific temper. Thus from the confirmation of the results from the above table, the hypothesis which reads as, *"high and low achieving adolescents girls differ significantly on superstition",* stands rejected.

FINDINGS

- It has been found that 41.7% of the high achieving adolescent girls possess above average scientific temper whereas only 8.3% of the low achieving adolescent girls have above average level of scientific temper.
- It has been found that only 10% of the high achieving adolescent girls possess below average scientific temper whereas 33.4% of the low achieving adolescent girls have below average level of scientific temper.
- It has been found that 48.3% of the high achieving adolescent girls possess average scientific temper whereas 51.7% of the low achieving adolescent girls have average level of scientific temper.
- It has also been found that none of the high achieving adolescent girls possess poor scientific temper whereas 6.6% of the low achieving girls possess poor scientific temper.
- It has also been found that none of the high and low achieving adolescent girl students possess high scientific temper.
- It has been found that high achieving adolescent girls displayed better scientific temper as compared to low achieving adolescent girls.
- It has been found that high and low achieving adolescent girls differ significantly on curiosity dimension of scientific temper. The mean difference favours high achieving adolescent girls, which clearly indicates that high achieving adolescent girls are more curious to ask questions, watch science based programmes, are eager to conduct experiments as compared to low achieving adolescent girls.
- No significant difference has been found between high and low achieving adolescent girls on open mindedness dimension of scientific temper as both groups believe that teachers should make use of new methods and techniques of teaching, internet is useful for students etc.
- It has been found that high and low achieving adolescent girls differ significantly on objectivity dimension of scientific temper. The mean difference favours high achieving adolescent girls, which clearly indicates that high achieving adolescent girls showed more objectivity. High achieving girls agree that classroom discussion is beneficial as it enhance students' understanding; science related articles should be published in newspapers. Whereas, low achieving adolescent girls opted undecided option for these items under objectivity dimension of scientific temper scale.
- It has been found that high and low achieving adolescent girls differ significantly on rationality dimension of scientific temper. The mean difference favours high achieving adolescent girls, which clearly indicates that high achieving adolescent girls showed more rationality as they agree that an idea should be accepted only after its verification, questioning in classroom is important to remove doubts while low achieving adolescent girls responded negatively to these items.
- No significant difference has been found between high and low achieving adolescent girls on superstition dimension of scientific temper as both groups agree that luck plays an important role in life; both groups believe that people should not discriminate on the basis of caste, colour and creed.

INFERENTIAL SUGGESTIONS

The findings of the present study reveal that there exists a significant difference between high and low achieving adolescent girls on curiosity, objectivity and rationality dimension of scientific temper whereas as no significant difference has been found on open mindedness and aversion to superstition dimension. It further reveals that none of the adolescent girls possess high level of scientific temper as per the norms of the scale. It is a matter of regret that there is lack of scientific temper among adolescent girls and has not reached the desirable level. Therefore it is important to develop the scientific temper of students' upto maximum level because this kind of attitude enables the students to take their decisions rationally as it involves the application of logic and the avoidance of bias and preconceived notions, which in turn furthers the overall growth and development of the country and nation. Steps should be taken for the use of various technologies in instructional strategies which may pave way for innovations, science consciousness and problem solving ability in a wider way. An effective method of fostering scientific temper is imparting knowledge of science through experimentation and demonstration, by involving students directly in activities. To inculcate scientific temper among the students they need to be placed in such situations where critical and rational thinking is needed i.e. by organising science clubs, quizzes, model making, arranging visits to Science centres, laboratories, organizing talks by eminent scientists and technologists, encouraging them to participate in science exhibitions and celebration of national science day etc. Hence, if teaching–learning activities include, apart from its regular curricular activities, various co-curricular activities such as organization of science fairs, science exhibitions, scientific debates, scientific quizzes and science clubs, use of problem solving and project methods and brain storming, inquiry training model and concept attainment model, emphasis on numerical based problems, activity based self learning, use of ICT etc. then it will be possible to foster scientific temper and scientific creativity among our students.

REFERENCES

Bhargava, P. M. and Chakrabarti C (2010). Angels, Devil and Science: A Collection of Articles on Scientific Temper, National Book Trust, New Delhi, India.

Krishnan, K. And Bhuvaneswari, G. (1990). What does Scientific Temper Mean.? The Educational Review Vol. / XCVL, September 1990, PP.149-150.

Narlikar, J. V. (2003). The Scientific Age: The Indian Scientist from Vedic to Modern Times, Penguin Books, New Delhi, India.

Subodh Mahanti (2013). Research Article: A Perspective on Scientific Temper in India. *Journal of Scientific Temper* Vol. 1, January 2013, pp. 46-62