



# SCIENTIFIC TEMPER AMONG UNDERGRADUATE STUDENTS: A COMPARATIVE STUDY BASED ON CERTAIN DEMOGRAPHIC VARIABLES

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## **Abstract**

*Realizing the role of science and scientific method in the economic and spiritual development of the nation, Jawaharlal Nehru popularized the phrase ‘scientific temper in the Indian context through his celebrated book “The discovery of India.” Scientific temper is a way of life characterized by the application of a scientific method for dealing with day-to-day issues and problems. Every person needs to develop a scientific temper irrespective of his/her religion, caste, or culture to get rid of the society from irrational beliefs and illogical customs and traditions, and to bring progress and prosperity. It has got recognition in the Constitution of India, as the development of scientific temper is a fundamental duty of citizens under Article 51A. The present study investigates the scientific temper of undergraduate students about demographic variables such as gender, locale, and stream of course. The study follows the survey method to gather data and appropriate statistical procedures for the analysis of data. The results indicate that urban students and science stream students possess comparatively high levels of scientific temper. The findings of the study point toward the need of enhancing scientific temper and outlook among the target population.*

**Key Words:** *Scientific Temper, Undergraduate Students, Demographic Variables*

## **Introduction**

Amidst modern facilities and technical support, people still maintain many superstitions and evil practices that are detrimental to the progress of society and the nation. Even highly educated people are associated with such irrational beliefs and attitudes. India has a diverse culture, with people in each culture following their customs and traditions without adequate empirical evidence and support, for everyday life. These irrational views prevent them from adopting scientific thinking and from relying on empirical evidence; people yet possess superstitions related to health, diseases, and death. The result is nothing but a continuum of people in its uncivilized lifestyle. The superstitions and prejudices that exist in society prevent people from doing ‘for themselves but force them to entrust most of their responsibilities to superhuman and supernatural beings’. Thus one believes what happens in his/her life is determined by fate – if fate is favourable then good things will happen in his/her life and vice versa.

## Significance of Scientific Temper in Development of the Nation

For eradicating irrational and dogmatic beliefs and to build a society that follows a scientific outlook and humanitarian values, the role of scientific temper is decisive. Scientific temper is a way of life that employs largely the scientific method which includes observation of physical phenomena, developing hypotheses, gathering empirical evidence and information, experimenting and analyzing, as well as communicating. Pandit Jawaharlal Nehru, the first Prime Minister of India, who was well aware of the people of India and their irrational outlook and its consequences suggested and supported the development of the scientific temper. Nehru, the prophetic visionary wrote in '*The discovery of India*'-- "The scientific approach, the adventurous and yet the critical temper of science, the search for truth and new knowledge, the refusal to accept anything without testing and trial, the capacity to change previous conclusions in the face of new evidence, the reliance on observed fact and not on pre-conceived theory, the hard discipline of the mind, all this is necessary, not merely for the application of science but for life itself and the solution of its many problems. The scientific approach and temper are or should be, a way of life, a process of thinking, a method of acting and associating with our fellowmen" (Nehru, 1981, p. 512).

Since the publication of '*The discovery of India*' in 1946, the concept of scientific temper and its importance have been seriously discussed on various platforms. The constitution of India emphasizes the significance of scientific temper in the fundamental duties in article 51A : "It shall be the duty of every citizen of India (h) to develop the scientific temper, humanism and the spirit of inquiry and reform" (Government of India, Ministry of Law and Justice, 2020, p. 36). Ramachandran (2020) rightly pointed out that scientific temper and outlook are essential for solving problems related to resources, energy, and natural disasters in our country. Fostering scientific temper will help in dealing with several social issues objectively and with open-mindedness (Sharma, Akhter, & Mir, 2019). Thus it is necessary to give due importance to the discussion on scientific temper in the context of developing India.

Recent studies on scientific temper conducted in the Indian context show no agreement in findings related to gender differences in scientific temper. Rajendran and Anandarasu (2020) found that female student teachers possess more scientific temper compared to males though both categories possess average levels of scientific temper. In his study, Aggarwal (2020) noticed that female teacher from secondary schools has more scientific attitudes than male teachers. But certain studies report the superiority of male students in the possession of scientific temper (Thakur & Bhan, 2019; Joshua, 2015; Aezum & Wani, 2013). Kapri (2017) found that senior secondary school students possess the same level of scientific temper irrespective of gender. Mehraj (2018) found a significant difference in the scientific temper of rural and urban secondary school students.

### The rationale of the study

One of the major aims of education is to develop scientific temper and scientific attitude among students. Hence science has got a significant place in the school curriculum. Up to the secondary level science is taught as a compulsory subject. Students are given opportunities to verify scientific facts and concepts to train them in the scientific method, which is of course a prerequisite for problem-solving in this complex world. A person with a scientific temper utilizes the scientific method in solving his/her day-to-day problems and answering genuine questions. Thus in essence the purpose of science education in schools is to foster scientific temper and scientific attitude among the learners. Development of scientific temper is not reserved for science students only. Everyone should develop scientific temper and scientific attitude; then only people can enjoy real freedom and can contribute to the progress of the nation. Manifestation of scientific temper does not mean the sole negation of traditional beliefs and customs but it is the process of redefinition of such customs in the light of science and scientific knowledge. Now a days we witness various incidents in which people exhibit unscientific ways of thinking and use irrational and baseless procedures for dealing with human problems. The expansion of social media creates a new problem in India : mythologization of science - where ancient myths are transformed into historical facts and social groups forward numerous superstitious

and irrational beliefs accordingly (Gopalkrishnan & Galande, 2021). Thus it is imperative to promote scientific thinking and scientific attitude to develop scientific temper among youngsters for the benefit of the nation.

After school education, learners attend university education intending to get into a profession of their choice. A scientific outlook and scientific temper will be assistive for them in their vocations and professions. The objective of the present study is to assess the scientific temper of undergraduate students concerning their gender, locale, and stream of course.

### Hypotheses

1. There will be a significant difference in the scientific temper of undergraduate students based on gender – male/female
2. There will be a significant difference in the scientific temper of undergraduate students based on locale – rural/urban
3. There will be a significant difference in the scientific temper of undergraduate students based on the stream of course –arts/science/commerce

### Method

A survey method was followed for the conduct of this study in which a sample of 200 undergraduate students was selected randomly from two colleges situated in Ernakulam district of Kerala state. The scientific temper of students was quantified by using a Scientific Temper Inventory standardized by K. S. Misra in 2020. The Scientific Temper Inventory was a five-point rating instrument consisted of 28 items in the form of statements under the following seven dimensions : critical mindedness, open-mindedness, respect for evidence, suspended judgment, willingness to change opinions, questioning attitude, and objectivity. The data were analyzed employing appropriate statistics.

### Results and Discussion

#### 1. Comparison of scientific temper of undergraduate students based on gender

To compare the scientific temper of male students and that of female students, the mean scores obtained by each category were subjected to an independent sample t-test. The results are shown in Table 1.

Table 1

*Results of Independent Sample t-Test for Comparison of Scientific Temper of Undergraduate Students Based on Gender*

Category	Number	Mean	Standard Deviation	<i>t</i>
Female	118	96.04	12.60	1.449 ( <i>p</i> = .1488)
Male	82	98.45	9.86	

The mean scores of scientific temper scores are in the range of average scientific temper, 79-108 as mentioned in the manual of the inventory (Misra, 2020); it can be assumed that the undergraduate students possess an average or medium level of scientific temper. Table 1 shows that there is no significant difference in scientific temper of male and female students,  $t = 1.449$ ,  $p = .1488$ , although male students ( $M = 98.45$ ,  $SD = 9.86$ ) attaining higher scores than female students ( $M = 96.04$ ,  $SD = 12.60$ ). Hence it may be inferred that gender does not influence the scientific temper of undergraduate students; both male and female students possess comparable levels of scientific temper.

## 2. Comparison of scientific temper of undergraduate students based on locale

To compare the scientific temper of rural students and that of urban students, the mean scores obtained by each category were subjected to independent sample *t*-test. The results are shown in Table 2.

**Table 2**

*Results of Independent Sample t-Test for Comparison of Scientific Temper of Undergraduate Students Based on Locale*

Category	Number	Mean	Standard Deviation	<i>T</i>
Rural	100	95.53	9.727	4.468 ( <i>p</i> = .000013)
Urban	100	100.53	12.279	

Table 2 shows that there is significant difference in scientific temper of rural and urban students,  $t = 4.468$ ,  $p = .000013$  and urban students ( $M = 100.53$ ,  $SD = 12.279$ ) are superior to rural students ( $M = 95.53$ ,  $SD = 9.727$ ). Thus, it may be inferred that locale influences the scientific temper of undergraduate students; urban students possess a higher level of scientific temper when compared to their rural counterparts.

## 3. Comparison of scientific temper of undergraduate students based on stream of course

To compare the scientific temper of arts stream students ( $n = 70$ ), science stream students ( $n = 68$ ), and commerce stream students ( $n = 62$ ), the scores obtained by the three groups were subjected to a one-way analysis of variance (ANOVA). The results are shown in Table 3.

**Table 3**

*Results of ANOVA for Comparison of Scientific Temper of Undergraduate Students Based on Stream of Course*

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i> Ratio
Between-Groups	5692.8256	2	2846.4128	26.6348 ( $p < .00001$ )
Within-Groups	21052.9944	197	106.868	
Total	26745.82	199		

Table 3 shows that there is a significant difference in scientific temper among undergraduate students from different streams,  $F(2, 198) = 26.6348$ ,  $p < .00001$ . To facilitate pair-wise comparisons within ANOVA data and to ascertain the differing groups, Tukey's HSD (honestly significant difference) procedure has been employed. The HSD value calculated at the .05 level is 4.2342 and that at .01 level is 5.2848. The pair-wise difference in mean scores obtained by the three groups – Arts ( $M_1 = 92.93$ ), Science ( $M_2 = 104.46$ ), and Commerce ( $M_3 = 93.52$ ) were compared with the HSD values. The results of Tukey's HSD test are presented in table 4.

**Table 4***Results of Tukey's HSD Test for Pair-wise Comparisons*

Pair- wise Comparisons	Mean	Difference	Significance
Arts : Science	M <sub>1</sub> = 92.93 M <sub>2</sub> = 104.46	11.53	$p = .00000$
Arts : Commerce	M <sub>1</sub> = 92.93 M <sub>3</sub> = 93.52	0.59	$p = .94255$
Science : Commerce	M <sub>2</sub> = 104.46 M <sub>3</sub> = 93.52	10.94	$p = .00000$

Table 4 shows that there is a significant difference between arts and science students with regard to scientific temper. Science students possess a higher level of scientific temper compared to art students. Similarly, there is a significant difference between science and commerce students regarding scientific temper; science students show higher scientific temper. However, there is no considerable difference in the scientific temper of arts and commerce students; both groups possess similar levels of scientific temper.

### Conclusion

The findings of the study reveal that undergraduate students possess only an average level of scientific temper irrespective of gender. But some locale differences are noticed in scientific temper; the urban students are superior to rural students. Similarly, the influence of stream of course is evident. The science stream students are better in their possession of scientific temper compared to arts and commerce stream students. The results are partially contradictory to the findings reported in certain recent studies (Rajendran & Anandarasu, 2020; Aggarwal, 2020; Thakur & Bhan, 2019; Joshua, 2015) except Kapri (2017) and Mehraj (2018).

The undergraduate students in general possess a medium level of scientific temper. The results of the study indicate the need of enhancing scientific temper and scientific attitude among undergraduate students especially among students from rural areas and those studying other than science courses. Science students might have been exposed to experiments and more hands-on activities than others help them to develop a scientific outlook. But it is not to be confined among science students only. Therefore adequate measures need to be taken to enhance the scientific temper of undergraduate students irrespective of their gender, locale, or stream of course.

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