A Study of Scientific Attitude Among Secondary School Students

Suraj Bhan[*] • **Geeta Khanduri**

Department of Education, Hemvati Nandan Bahuguna Garhwal University (A Central University) Srinagar Garhwal, Uttarakhand (India).

[*]Corresponding Author Email Id: surajbhan016@gmail.com

Abstract: In the 21st century when science is at a high level of progress, with the aim of promoting interest in science and scientific thinking among students, the researcher has attempted to understand the scientific attitude of students of secondary schools. The aim of this research work is to assess the level of secondary school students towards scientific attitude and to study the scientific attitude of secondary school students according to gender, stream, locality, type of institution, class, medium and family. For the research work, the researcher selected 154 students of secondary school of district Chamoli, Uttarakhand by random method. Using the scientific attitude scale of Dr. Sukhwant Bajwa and Dr. Monica Mahajan, which has 49 items related to (rationality, curiosity, open-mindedness, belief in scientific method and average towards superstition), data has been collected and the data has been analyzed by SPSS and Excel, which concluded that scientific attitude of students on the basis of gender, locality, institution, medium was found to be significant, whereas no significance was found on the basis of stream, class and family towards scientific attitude of students.

Introduction

One essential component of the scientific method is the scientific attitude, which is defined by a way of thinking that values investigation, scepticism, and receptivity to new information. It reflects a methodology that challenges presumptions, looks for proof, and bases judgments on facts rather than biases or preconceptions. Anybody who solves problems and thinks critically needs to have this mindset, not just scientists.

Rationality fosters critical thinking skills, enabling students to analyse information objectivity, identify biases and make informed decisions. It also helps students to develop resilience by viewing challenges as opportunities for learning and growth. A scientific mindset encourages them to experiment, adopt, and overcome obstacles, promoting a sense of accomplishment and self- efficiency. It helps students understand the causes and efforts of stress by applying scientific method to manage stress, such as mindfulness techniques or exercise, they can improve their mental and emotional well-being. Rationality encourages students to base decisions on evidence and logical reasoning rather than emotional and impulses.

Curiosity is a fundamental human trait that drives us to explore, learn and make sense of the world around us. Its's the desire to know, understand and seek out new information and experiences. Desire for understanding new situations that are not explained is a core element of curiosity. When we encounter something unfamiliar or unexplained, curiosity motivates us to seek answers and bridge the gap in our understanding. We want to know the underlying causes and mechanisms behind what we observe. This drive to uncover the "Why" and "How" fuels scientific inquiry, problems-solving and innovation.

Open-Mindedness is a complex and multifaceted concept that has been studies extensively in psychology and philosophy and

philosophy. It is generally understood as the willingness to consider new ideas and experiences, and to revise one's beliefs in the face of new evidence. Desire for new things and ideas is an important aspect of open-mindedness. It involves being curious and interested in the world around us, and being willing to try new things and learn new things. This can lead personal growth land development, as well as a greater understanding of the world.

The scientific method encourages students to analyse situations, identify problems, formulate hypotheses and test solutions also using the evidence -based Decision making. The scientific method empowers students to take an active role in understanding and influencing their own well-being. By conducting experiments and analysing results, they gain a sense of control over their own lives and develop confidence in their ability to make positive changes.

In will enable parents, teachers and students to understands the superstitions attitude of the students. The present attitude study of the investigator explored the level of superstition and scientific attitude in students are at the age of moral and character development, they need proper attitude to develop. Superstition scale by a **Grewal (2012)** was used to collect the data. The results showed the there is no difference in the level of superstition and scientific attitude among male and female school students. There is negative and significant relationship between scientific attitude and superstition. The more scientific the approach, the less will be the belief in superstitions.

Govindarajan (2014) investigated the scientific attitude among secondary students in Namakkal district. For which, survey method was followed and scale of attitude towards science learning was used to collect the data from secondary level school students. The study resulted that on the basis on gender, male and female students had no significant difference in their scientific attitude and

government and private school students has significant difference in their scientific attitude. **Erika et al (2020)** intended to study scientific attitude of students of SMPN 17 Jambi city. This was based on two indicators of science learning, which were on adoption and interest in science learning. In this study, survey method was used. As the resultant the indicators indicated that majority of students have enough interest and good scientific. **Rajendran & Anandarasu (2020)** explored to find the level of scientific attitude of B.Ed. trainees for this, survey method and simple random sampling technique was used to select 941 B.Ed. trainees from Peramblur district, TN, India. The results express that most of B.Ed. trainees has average level of scientific attitude. **Nisha and Prema (2022)** studied the school students' level of scientific attitude. In the study, survey method was used and 227 students were selected as sample by using convenient sampling technique. The findings indicate high level and no significant difference, in scientific attitude of school students on the basis of their gender and age.

Overall Secondary pupils are expected to become more scientifically literate, but first they need to have a scientific disposition. This perspective encourages critical thought, skepticism and curiosity in students, all of which are central to making sense of challenging scientific concepts and phenomena. A scientific mindset cultivates critical thinking and teaches students how to approach issues in a positive and methodical manner, form hypotheses, determine causality, and conduct experiments. Not only does this method deepen their knowledge of the subject, it can also foster awe for the natural world. Beyond that, a scientific mindset fosters evidence-based reasoning, which also can empower students to make informed decisions in their daily lives. These skills are critical as they navigate a world that is increasingly complex and rife with both misinformation and accurate information. Ultimately, fostering a scientific mindset.

Objectives

1. To assess the level of secondary school students towards the scientific attitude.
2. To study gender, stream, locality-wise, type of Institute, class, medium and family secondary school students towards the scientific attitude.

Hypothesis

H_0-1. There is no significant difference between male and female secondary school students toward the scientific attitude.

H_0-2. There is no significant difference between art and science secondary school students toward the scientific attitude.

H_0-3. There is no significant difference between rural and urban secondary school students toward the scientific attitude.

H_0-4. There is no significant difference between government and private secondary school students toward the scientific attitude.

H_0-5. There is no significant difference between class 11th and class 12th secondary school students toward the scientific attitude.

H_0-6. There is no significant difference between Hindi medium and English medium secondary school students toward the scientific attitude.

H_0-7. There is no significant difference between nuclear and joint family secondary school students toward the scientific attitude.

Methodology

In this study, it was employed survey due to its descriptive method.

1. **Sample:** The present study was carried out on 154 belongs to secondary school students in Chamoli district of Uttarakhand the sample was randomly stratified selected from stream.
2. **Tool Used:** The investigator used the tool of scientific attitude scale (SAS-BM) designed by Dr. Sukhwant Bajwa and Dr. Monika Mahajan to collect the required information. for data collection the secondary school students in their area. There was total 49 items in components (Rationally, Curiosity, Open Minded, Faith in Scientific Method and Average to Superstition.) in this tool.
3. **Statistical Techniques:** t-Test was used by the researcher in analysing the data, with conclusions drawn by the researcher using SPSS and Excel software.

Analysis and interpretation of data

Table-1: Percentage analysis of secondary school students toward the scientific attitude.

Score	No. of Respondents	Percentage	Lavel of Attitude
184 Above	03	01.95 %	Very high scientific attitude
177-183	05	03.25 %	High scientific attitude
165-176	30	19.48 %	Average scientific attitude
160-164	21	13.64 %	Low scientific attitude
159 Below	95	61.69 %	Very low scientific attitude

Table 1 Show that 95 (61.69 %) of secondary school students have a very low level of scientific attitude, 21 (13.64 %) of secondary school students have a low level of scientific attitude, 30 (19.48 %) of secondary school students have an average level of scientific attitude, 05 (3.25 %) of secondary school students have a high level of scientific attitude, 03 (1.95 %) of Secondary school students have a very high level of Scientific attitude. It shows that most of the secondary school students had a very low level of attitude towards the scientific attitude.
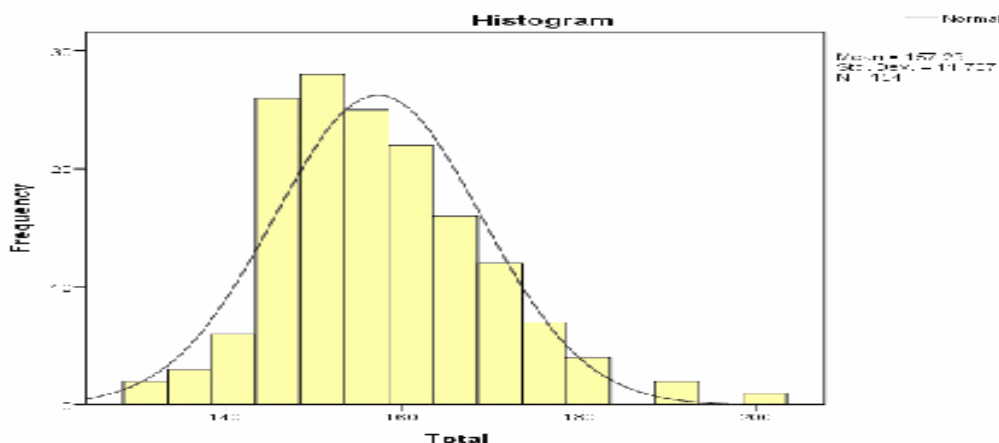
Fig 1: Analysis of secondary school students toward the scientific attitude based on the cut-off point.

Fig. 1 shows that the number of respondents, mean score, and standard deviation (SD) were 154, 157.29, and 11.70 respectively. The skewness and kurtosis values were 0.715 and 1.135 respectively.

From Table 2 it is evident that according to gender, the number of respondent's, mean scores, and standard deviations (SD) obtained were as follows: for males, 78 respondents with a mean of 155.14 (SD=12.26) and for females, 76 respondents with a mean, 159.50 (SD=10.74). The obtained t-value of 2.344,

with a degree of freedom (df) of 152, was found to be statistically significant at 0.05 level of significance. Hence the null hypothesis (H_0-1), which states that "There is no significant difference between male and female secondary school students toward the scientific attitude." is rejected. Therefore, it may be inferred that female student demonstrated a better scientific attitude than male students among secondary school students, and this difference was statistically significant.

Table 2: Analysis of hypothesis in secondary school students toward the scientific attitude.

Demographic variable	Classified/ Grouped	No. of Respondents	Mean	Standard Deviation (SD)	Degree of Freedom (df)	t-value	Level of Significance
Gender	Male	78	155.14	12.26	152	2.344	S
	Female	76	159.50	10.74			
Streams	Art	77	156.55	11.64	152	0.791	NS
	Science	77	158.04	11.80			
Locality	Rural	96	155.84	10.26	152	1.994	S
	Urban	58	159.69	13.52			
Institute	Government	108	155.59	10.15	152	2.823	S
	Private	46	161.28	14.05			
Class	11th	64	157.11	11.43	152	0.163	NS
	12th	90	157.42	11.96			
Medium	Hindi	101	155.26	10.23	152	3.058	S
	English	53	161.17	13.36			
Family	Nuclear	82	158.38	12.11	152	1.230	NS
	Joint	72	156.06	11.17			

* Significant level- 0.05 (S- Significant, NS- No Significant)

According to streams, the number of respondent's, mean scores, and standard deviation (SD) obtained were as follow: for art, 77 respondents with a mean of 156.55 (SD=11.64), and for science, 77 respondents

with a mean of 158.04 (SD=11.80). The obtained t-value of 0.791, with a degree of freedom (df) of 152, was found to be statistically insignificant at 0.05 level of significance. Hence the null hypothesis (H_0-2),

which states that "There is no significant difference between arts and science secondary school students toward the scientific attitude," is accepted. Therefore, it may be inferred that although science students scored slightly higher than arts students in scientific attitude, the difference was not statistically significant.

According to locality, the number of respondent's, mean and standard deviation (SD) score obtained were as follow: for rural, 96 respondents with a mean of 155.84 (SD=10.26), and for urban, 58 respondents with a mean of 159.69 (SD=13.52). The obtained t-value of 1.994 with a degree of freedom (df) of 152, was found to be statistically significant at 0.05 level of significance. Hence the null hypothesis (H_0-3), which states that "There is no significant difference between rural and urban secondary school students toward the scientific attitude." is rejected. Therefore, it may be inferred that although urban students scored slightly higher than rural students in scientific attitude, the difference was statistically significant.

According to institutions type, the number of respondent's, mean and standard deviation (SD) score obtained were as follow: for government school, 108 respondents with a mean of 155.59 (SD=10.15) and for private school, 46 respondents with a mean of 161.28 (SD=14.05). The obtained t-value of 2.823 with a degree of freedom (df) of 152, was found to be statistically significant at 0.05 level of significance. Hence the null hypothesis (H_0-4), which states that "There is no significant difference between government and private secondary school students toward the scientific attitude." is rejected. Therefore, it may be inferred that although private school students scored slightly higher than government school students in scientific attitude, the difference was statistically significant.

According to class, the number of Respondent's, mean and standard deviation (SD) score obtained were as follow: for class 11th, 64 respondents with a mean of 157.11

(SD=11.43) and for class 12th, 90 respondents with a mean of 157.42 (SD=11.96) the obtained t-value 0.163 with a degree of freedom (df) of 152, was found to be statistically insignificant at 0.05 level of significance. Hence the null hypothesis (H_0-5), which states that "There is no significant difference between class 11th and class 12th secondary school students toward the scientific attitude." is accepted. Therefore, it may be inferred that although class 12th students scored slightly higher than class 11th students in scientific attitude, the difference was not statistically significant.

According to medium, the number of respondent's, mean and standard deviation (SD) score obtained were as follow: for Hindi medium, 101 respondents with a mean of 155.26 (SD=10.23) and for English medium, 53 respondents with a mean of 161.17 (SD=13.36) the obtained t-value 3.058 with a degree of freedom (df) of 152, was found to be statistically significant at 0.05 level of significance. Hence the null hypothesis (H_0-6), which states that "There is no significant difference between Hindi medium and English medium secondary school students toward the scientific attitude." is rejected. Therefore, it may be inferred that although English medium school students scored slightly higher than Hindi medium school students in scientific attitude, the difference was statistically significant.

According to family, the number of respondent's, mean and standard deviation (SD) score obtained were as follow: for nuclear family, 82 respondents with a mean of 158.38 (SD=12.11) and for joint family, 72 respondents with a mean of 156.06 (SD=11.17) the obtained t-value 1.230 with a degree of freedom (df) of 152, was found to be statistically insignificant at 0.05 level of significance. Hence the null hypothesis (H_0-6), which states that "There is no significant difference between nuclear family and joint family secondary school students toward the scientific attitude." is accepted. Therefore, it

may be inferred that although nuclear family students scored slightly higher than joint family students in scientific attitude, the difference was not statistically significant.

Results

1. Female students demonstrated better scientific attitude than male students among secondary school students in relation to their gender, and the difference was statistically significant.
2. Science was better than art in scientific attitude among secondary school students in relation to their streams and it was statistically no significant.
3. Urban students demonstrated better scientific attitude than rural students among secondary school students in relation to their locality, and the difference was statistically significant.
4. Private school students demonstrated better scientific attitude than government school students among secondary school students in relation to their type of institution, and the difference was statistically significant.
5. Class 12th students demonstrated better scientific attitude than Class 11th students among secondary school students in relation to their class, but the difference was not statistically significant.
6. English medium students demonstrated better scientific attitude than Hindi medium students among secondary school students in relation to their medium of instruction, and the difference was statistically significant.
7. Students from nuclear families demonstrated better scientific attitude than those from joint families among secondary school students in relation to their family type, but the difference was not statistically significant.

Discussion and Conclusion

In summary, the scientific attitude is a vital framework for inquiry and understanding in both scientific and everyday contexts. It emphasizes curiosity, skepticism, open-mindedness, critical thinking, and ethical considerations. By cultivating this attitude, individuals can enhance their ability to navigate and contribute to an increasingly complex world, making informed decisions based on reliable evidence. In conclusion, the study reveals that the scientific attitude among secondary school students is shaped by various demographic factors like gender, locality, type of institution, medium of instruction, family structure and class. Female students demonstrated more positive scientific attitude than male students, while urban students, private school attendees, and those studying in English medium showed higher levels of scientific attitude compared to their counterparts. However, stream selection, class level, and family type showed no statistically significant differences. The findings suggest that additional factors like quality of teaching, the learning environment, and students' motivation and interest in science may play a major role in determining science achievement. While this study does not challenge previous research asserting the importance of scientific attitude in science achievement, it emphasizes the need for further exploration into additional determinants that may significantly affect science performance. The concerns arising from these findings indicate the necessity for educational policymakers and institutions to adopt a comprehensive strategy that foster a positive scientific attitude. Future research should investigate other variables that could enhance student's academic outcomes in science, thereby contributing to academic success.

Acknowledgements

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