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Exploring Scientific Temper among Digital Users of Science and Humanities Stream

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Abstract: ***The study aimed to explore scientific temper among university digital users. A sample of 250 students were selected through a random sampling method. A descriptive survey method was employed to capture university students' current state of scientific temper through a self - made questionnaire. T - test was calculated to determine the differences in scientific temper between digital users of the Science and Humanities stream. Results revealed significant differences in scientific temper between science and humanities digital users. Science stream digital users consistently exhibited higher levels of scientific temper across the dimensions of open - mindedness, curiosity, and rationality compared to their humanities counterparts. This trend was also observed among male and female participants across urban and rural backgrounds. Urban students exhibited higher scientific temper than rural students. The results underscored the importance of fostering scientific temper through science education and digital engagement.***

Keywords: Scientific Temper, Digital Users, Science and Humanities Streams

1. Introduction

Science is the systematic organization of knowledge. It offers us the tools to observe and understand the world through a unique lens. It empowers the application of fundamental ideas, aiding in constructing concepts that inform more informed personal and professional decisions. This engagement with science promotes social inclusion and recognizes its growing popularity globally (UNESCO, 2013). As specialists in their respective fields, scientists advance knowledge through systematic study. Indeed, the 21st century's most significant achievement is the advancement of science, which has played a crucial role in the evolution of civilized society and the development of human culture. Scientific information encourages a global perspective while advocating for local action, thus weaving a comprehensive understanding of the intricate networks sustaining human interaction and thought. Discerning valuable and accurate information is paramount in today's information - rich society. Developing a scientific temper characterized by critical evaluation and inquiry rather than passive acceptance is essential. This involves adopting a mindset prioritising logic and reasoning, embracing argumentation, discussion, and analysis as integral components.

The Internet has become an indispensable tool for research and communication, offering unparalleled opportunities for global connectivity and information access. It enhances lives by providing swift access to social, educational, and recreational resources, significantly impacting higher education. Key educational benefits of the Internet include facilitating online interactive learning, fostering cross - cultural collaboration, enabling online research, serving as an information repository, promoting innovation, increasing interest in learning, and encouraging global education (Dogruer et al., 2011; Jaswal & Behera, 2023). In digital education, users leverage Information and Communication Technology (ICT) to gain knowledge through search engines, web browsers, email, and various software applications. These digital users are more informed, connected, and engaged, marking a significant shift in learning dynamics.

Scientific temper emphasizes thinking. For example, the need to teach handicrafts scientifically is ensured when students understand the 'why' and 'how' behind the processes. Scientific temper emphasizes humanism and skepticism. Scientific temper is a way of life. Scientific temper comprises several components, such as scientific literacy (understanding scientific ideas, concepts, and principles), scientific attitude (exhibiting curiosity, open - mindedness, objectivity, and a rejection of superstitions), scientific thinking (applying scientific methods to problem - solving and reasoning), scientific methods (employing systematic approaches to gather and analyze information), scientific perception (critically observing and evaluating phenomena), and scientific habit (developing a consistent practice of logical and rational thinking).

Rationale of the Study

India is one of the developing countries in the world whose constitution has adopted, in Article 51A of the Indian Constitution, the inculcation of scientific temper as a fundamental duty of its citizens to develop the scientific temper, humanism and spirit of inquiry and reforms. This vision is echoed in the importance of science education to foster productivity, democracy, social unity, and moral values. The New Education Policy 2020 (MoE, 2020) advocated for a child - centred and activity - oriented curriculum to cultivate the scientific temper from a young age. Therefore, it is emphasised that inquiry, creativity, objectivity, and critical thinking be cultivated through school education. Hence, the role of school education in addressing social issues and promoting rational thought cannot be denied.

Promoting scientific temper involves explaining and demonstrating scientific methods and thinking. Carin and

Sund (1970) highlighted the effectiveness of experiential learning, suggesting activities like factory visits and participation in science fairs to engage students with real - world applications of scientific concepts. Technology in the classroom further enhances this engagement, fostering scientific thinking. A person with a scientific temper employs systematic observation, verification, hypothesis formation, and testing.

In today's world, the term "scientific temper" is well - known and widely discussed. It refers to a state of mind that thinks logically and rationally, rejecting beliefs or concepts that lack a reasoned foundation. Essentially, it embodies rational thinking (Gopalakrishnan & Galande, 2021). Scientific thinking is a psychological attitude that is not influenced by routine science but requires changing one's values and moral and ethical frameworks (Panchapakesan, 2017). Family and society essentially decide this. Values and wisdom are outside natural Science. The ethical framework essentially decides our attitudes and behaviours. Students exhibit a scientific temper when they apply scientific decision - making methods in daily life. Cultivating a scientific temper is crucial for success, as it fosters a patriotic spirit and helps individuals avoid being misled. It equips us to make rational, logical, curious, and open - minded decisions, allowing us to discern right from wrong and seek the truth (Tripathy, 2020). School education is instrumental in developing a scientific temper, encompassing knowledge of scientific subjects, laws, and theories, alongside cultivating a question - seeking mind, rationality, objectivity, and open - mindedness. Individuals with scientific temper apply logic and reasoning, establish cause - and - effect relationships, and avoid biases and preconceived notions (Ahuja, 2017). While knowledge is powerful, its actual value lies in its application. Science involves discovering and using evidence to support claims and understanding its everyday relevance is essential (Aditri, 2021). It is a social science that helps make suitable choices and cultivate a scientific temper. Scientific temper involves looking at a problem, considering the various options and deciding what to do (Panchapakesan, 2017). Scientific temper uses scientific methods in areas other than natural Science, like sociological and ethical issues. Acquiring a scientific temper is a change in human behaviour, hence not a part of Natural Science. It is strengthened not by studying basic natural sciences but by applying scientific methods to human behaviour. The curriculum of all students needs to include social Science and humanities to strengthen their scientific temper. Thus, a scientific temper in every student's curriculum is essential for meaningful education.

Numerous studies have examined the scientific temper among various student demographics, including urban and rural, male and female, and different academic streams. For instance, adolescents in the science stream tend to have a better scientific temper than those in the social sciences, as science education promotes inquiry (Maqbool & Sofi, 2013). Scientific temper correlates positively with achievement in science subjects, enhancing academic performance (Ahuja, 2017). Gender differences in scientific temper are debated, with some studies finding no significant difference (Bhatnagar, 2021; Singh & Shukla, 2022), while others report higher scientific temper among males (Aezum & Wani, 2013; Thakur & Bhan, 2019) or females (Kapri, 2017). Urban and rural differences also vary, with some studies showing no significant difference (Aslam et al., 2016) and others indicating higher scientific temper among urban students due to better educational opportunities (Aezum & Wani, 2013; Jahanger & Dhar, 2019; Bhatnagar, 2021; Singh & Shukla, 2022). On the contrary, Mehraj (2018) found higher scientific temper among rural junior high school students.

Education and technology are mutually reinforcing. Education advances technology, and technology makes education more accessible and effective (National Education Policy 2020) [MoE, 2020]. Digital technologies, integrated into daily life, significantly influence education (Jaswal & Behera, 2022). Digital users, characterized by being informed, connected, and quick to seek relevant information, reflect these traits. Students share similar characteristics: curious, investigative, logical, and problem solvers, embodying the spirit of scientific temper. National Education Policy 2020 (MoE, 2020) emphasizes cultivating scientific temper in the curriculum. It aims to develop rational, empathetic, resilient, and creative individuals with sound ethical principles, fostering an inclusive, multicultural society and engaged citizens. National Curriculum Framework 2005 (National Council of Educational Research and Training, 2006) calls for a shift from rote learning to inquiry - based education. It promotes extracurricular activities to foster creativity and scientific curiosity.

The science curriculum fosters exploration and hands - on activities at the primary level and active involvement in learning scientific concepts through real - life applications at higher levels. Humans are rational beings capable of logical thinking and action. Developing rational thinking begins with asking fundamental questions about natural phenomena, fostering curiosity, innovation, and creativity. Scientific temper embodies this spirit of inquiry (Mahanti, 2016). While scientific temper is inherent, societal influences and conventional education can diminish it. Science is essentially a transmission of skills of experimental and accepted ideas. It cannot present alternatives to choose from and raise discussions.

On the other hand, social Science helps people make suitable choices and cultivate a scientific temper. Thus, incorporating scientific temper into the school curriculum at all levels is essential. The curriculum guides students to apply their knowledge effectively and cultivate inquiry and reflection skills (Behera, 2011).

The future of education is digital. In the digital age, it is the need to achieve a 360 - degree digital excellence. Digital users should be adaptable to icon identification, digital navigation, and user control methods like storage and retrieval. In addition, coding, scanning, creating digital texts and critical skills such as analysing, evaluating online information, accessing and synthesising and other digital skills. Scientific temper helps students critically evaluate and integrate digital information, ensuring its ethical and social usage (Behera, 2021). There is a need to foster a scientific approach, the adventurous and yet critical temper of science, the search for truth and new knowledge, the refusal to accept anything without testing, and the reliance on observed facts and not on pre - conceived theory among the students (Behera, 2018).

Students should not remain rooted in superstitions and blind faith in supernatural powers. Ironically, digital technology can be pivotal in teaching the student population a rational outlook and scientific thinking. Therefore, promoting scientific temper among digital users is crucial for a progressive and enlightened society.

Research Questions

The study focused on investigating the scientific temper of digital users. Based on the rationale described above, the study examines the following research questions:

- Is there a difference in scientific temper between digital users of the Science and Humanities stream?
- Is there a difference in scientific temper between rural digital users of the Science and Humanities stream?
- Is there a difference in scientific temper between urban digital users of the Science and Humanities stream?
- Is there a difference in scientific temper between male digital users of the Science and Humanities stream?
- Is there a difference in scientific temper between female digital users of the Science and Humanities stream?

Hypotheses

Ho 1: There is no significant difference in the mean scores of scientific temper between digital users of the Science and Humanities stream.

Ho 2: There is no significant difference in the mean scores of scientific temper between rural digital users of the Science and Humanities stream

Ho 3: There is no significant difference in the mean scores of scientific temper between urban digital users of the Science and Humanities stream

Ho 4: There is no significant difference in the mean scores of scientific temper between male digital users of the Science and Humanities stream.

Ho 5: There is no significant difference in the mean scores of scientific temper between female digital users of the Science and Humanities stream.

2. Methodology

The study aims to describe the scientific temper among university digital users. A descriptive survey method was employed to capture university students' current state of scientific temper. A sample of 250 students were selected through a random sampling method. Fifty - nine males and 75 females in the science stream and 69 males and 47 females in the humanities stream were the study sample.

Tools Used

Scientific Temper Questionnaire

A self - made questionnaire measured scientific temper among Indian university digital users. The questionnaire was based on a 5 - point Likert Scale with 30 items. The dimensions of the questionnaire were open - mindedness, curiosity and rationality. The sound characteristics of the tool were ensured. The Content Validity Index (CVI) and Content Validity Ratio (CVR) values surpassed acceptable thresholds (CVI > 0.78 and CVR > 0.75). Internal consistency, indicated by Cronbach's alpha ($\alpha = 0.821$), signified high reliability.

Interview Schedule

The study was mainly focused on quantitative analysis. The qualitative data were obtained to interpret the quantitative results. The results obtained from statistical analysis were supplemented with interview results. One of the researchers interviewed a subset of participants from both science and humanities groups. Fifty - two participants gave their informed consent to participate in the interview.

3. Results

Statistical Analysis

The means and standard deviations of each measured variable, along with skewness and kurtosis values, are presented in the respective tables.

Ho 1: There is no significant difference in the mean scores of scientific temper between digital users of the Science and Humanities stream.

Table 1: Summary of Statistics on the Scientific Temper of Digital Users

Variable	Digital Users Stream Wise	N	M	SD	S_k	Ku	df	t - value	Remarks
Scientific Temper	Science	134	116.72	13.90	- 0.07	- 0.47	248	4.27	Significant
	Humanities	116	108.47	16.26	0.16	0.12			

An independent samples t - test was conducted to compare scientific temper scores between digital users of the Science and Humanities streams. There was a significant difference in the scores between science digital users (M = 116.72, SD = 13.90) and Humanities digital users (M = 108.47, SD = 16.26); t (248) = 4.27, p <.05. It concludes that digital users from science stream exhibit a higher level of scientific temper compared to digital users of humanities stream.

Ho 2: There is no significant difference in the mean scores of scientific temper between rural digital users of the Science and Humanities stream

Table 2: Summary of Statistics on Scientific Temper between Rural Digital Users

Variable	Rural Digital Users Stream Wise	N	M	SD	S_k	Ku	df	t - value	Remarks
Scientific Temper	Science	60	104.45	21.41	- 0.18	- 0.34	115	3.28	Significant
	Humanities	57	93.95	12.20	0.17	- 0.15			

An independent samples t - test was conducted to compare scientific temper scores between rural digital users of the science and humanities stream. There was a significant difference in the scores of rural digital users of Science (M = 104.45, SD = 21.41) and humanities rural digital users (M = 93.95, SD = 12.20); t (115) = 3.28, p <.05. Table 2 shows that

rural digital users of Science exhibit a higher level of scientific temper compared to rural digital users of humanities stream.

Ho 3: There is no significant difference in the mean scores of scientific temper between urban digital users of the Science and Humanities stream

Table 3: Summary of Statistics on Scientific Temper between Urban Digital Users

Variable	Urban Digital Users Stream Wise	N	M	SD	S_k	Ku	df	t - value	Remarks
Scientific Temper	Science	74	118.16	13.90	- 0.08	- 0.58	130	3.25	Significant
	Humanities	58	109.44	16.26	0.08	- 0.02			

An independent samples t - test was conducted to compare scientific temper scores between urban digital users of the science and humanities stream. There was a significant difference in the scores of urban digital users of Science (M = 118.16, SD = 13.90) and humanities (M = 109.44, SD = 16.26); t (130) = 3.25, p <.05. It was found that urban digital users of science stream exhibit a higher level of scientific temper as compared to urban digital users of humanities.

Ho 4: There is no significant difference in the mean scores of scientific temper between male digital users of the Science and Humanities stream.

Table 4: Summary of Statistics on the Scientific Temper between Male Digital Users

Variable	Male Digital Users Stream Wise	N	M	SD	S_k	Ku	df	t - value	Remarks
Scientific Temper	Science	59	116.0	14.42	0.09	- 0.79	126	2.52	Significant
	Humanities	69	109.56	14.36	0.23	0.33			

An independent samples t - test was conducted to compare scientific temper scores between male digital users of science and humanities streams. There was a significant difference in the male digital users of Science (M = 116.0, SD = 14.42) and humanities (M = 109.56, SD = 14.36); t (126) = 2.52, p <.05. It is inferred that male digital users of Science exhibit a higher degree of scientific temper compared to digital users of humanities.

Ho 5: There is no significant difference in the mean scores of scientific temper between female digital users of the Science and Humanities stream.

Table 5: Summary of Statistics on Scientific Temper between Female Digital Users

Variable	Female Digital Users Stream Wise	N	M	SD	S_k	Ku	df	t - value	Remarks
Scientific Temper	Science	75	117.29	11.73	- 0.26	- 0.11	119	4.41	Significant
	Humanities	47	106.84	13.33	- 0.06	0.56			

An independent samples t - test was conducted to compare scientific temper scores between female digital users of the science and humanities stream. There was a significant difference in the scores of female digital users of Science (M = 117.29, SD = 11.73) and humanities (M = 106.84, SD = 13.33); t (119) = 4.41, p <.05. The result exhibits the large extent of scientific temper among female digital users of Science as compared to humanities.

Interview Results

The first category of students' scientific temper was open - mindedness, depicted in Table 6. There were 12 digital users from the science stream and six from the humanities stream in the category of open - mindedness. All the participants in the science stream stated that they addressed the need to use reasoning around the globe. They are aware of real - life situations with significant environmental, technological and scientific impacts on life and everyday decisions that affect personal lifestyle. The following excerpt is representative of the users' analysis of data:

"We use information, knowledge, facts and ideas to think about the natural environment. Our purpose in dealing with life situations is to see and know about the natural phenomenon".

Table 6: Interview Results

Category	Codes	No. of students in the Science Stream	No. of students in the Humanities Stream
Open - mindedness	Dealing with life events	3	1
	Dealing with the global environment	2	1
	Dealing with Science and technology	3	2
	Scientific knowledge, facts, and ideas	4	2
Curiosity	Science exhibitions	4	2
	Scientific names	3	-
	Scientific podcasts	1	-
	Science events	2	1
	Working in a science laboratory	3	-
	Science quiz	2	1
	Science riddles	1	-
	Watching Science channels on TV	1	-
Rationality	Originality of e - contents	2	-
	Belief with Logic	1	-
	Scientific phenomena	1	-

	Problem - solving	4	1
	Scientific cause	3	1

The second category was related to curiosity. The digital users' responses in this category generally showed similar trends. Seventeen users from the science stream and four from the humanities stream were curious about some scientific activities. Six participants (4 from Science and two from the humanities stream) said they are interested in participating in science exhibitions, events and quizzes. They have fun doing science riddles, listening to science podcasts and watching science channels on TV. In the following excerpt, one user from the science stream expressed that understanding the science concepts helps to sense events scientifically:

"I sometimes had difficulty following the lecture in our formal classroom learning. So, I had misconceptions on some topics. It becomes easy when I do experiments in the laboratory. It helps me understand the concepts clearly. I was interested in participating in science activities like quizzes, events and exhibitions. I was curious to learn more about scientific activities".

The last category was related to digital users' rationality.11 digital users from the science stream and two users from humanities mentioned logic and reasoning to understand real - life situations. They commented that logic, originality and scientific cause & effect are the qualities of understanding scientific phenomena. Most students explained that problem - solving sessions facilitate understanding the scientific concepts in nature.

One participant argued that "one who acts can 'give application' to the knowledge. This is not based on observation but due to rational thinking. In his view, one knows empirically what he is doing and why he is doing it. This claim can be believed due to reasons".

4. Discussion

The results indicate a significant mean difference in scientific temper between digital users of the science and humanities stream. Digital users of Science exhibit high scores in scientific temper. This result aligns with the findings of Maqbool & Sofi (2013) that science stream students demonstrate a better scientific temper. The general interpretation could be that the nature of science education emphasizes inquiry and evidence - based learning. Such learning develops a scientific temper characterized by critical evaluation and inquiry rather than passive acceptance without logic. This involves adopting a mindset prioritizing logic and reasoning, embracing argumentation, discussion, and analysis as integral components.

Further, the analysis and interpretation revealed that digital users were strengthened not by studying basic natural sciences but by applying scientific methods to human behaviour. Urban digital users of the science stream demonstrated higher scientific temper value than their counterparts in humanities. The findings are consistent with the study findings of Biswal and Pandey (2022). This may be attributed to better educational resources and exposure to scientific activities in urban areas. Table 4 contains an overview of scores of male digital science stream users who achieved high scientific tempers. It depicts a higher score in scientific temper by male digital users of the science stream compared to their humanities counterparts. The result is supported by the study findings of Lokhande & Shinde (2023).

Similarly, female digital users of the science stream scored high in scientific temper compared to their humanities counterparts. The findings are consistent with the study results of Acharya & Mohanty (2022) and Kour (2015). In conclusion, the study highlights the importance of fostering scientific temper through digital engagement to enhance students' rational thinking, curiosity, and open - mindedness.

5. Conclusion

The study concluded that there are significant differences in scientific temper among university digital users; particularly between science and humanities digital users. Science stream digital users consistently exhibited higher levels of scientific temper across the dimensions of open - mindedness, curiosity, and rationality compared to their humanities counterparts. This trend was observed among male and female participants across urban and rural backgrounds. The findings suggest that science education, emphasising inquiry and evidence - based learning, fosters a scientific temper. The results highlight the importance of integrating scientific methods and critical thinking skills into the curriculum, especially in humanities education, to cultivate a more rational, curious, and open - mindedness. The study highlights the need for targeted educational strategies to enhance higher education's scientific literacy and critical thinking skills, leveraging digital platforms to promote scientific engagement and literacy among all users.

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