

RESEARCH ARTICLE

STUDY OF THE SCIENTIFIC TEMPER OF SENIOR SECONDARY SCIENCE STUDENTS

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Abstract

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Key words:-Scientific Temper, Senior Secondary Science Students

..... This research aims to study the scientific temper of senior secondary science students in the context of the locality, gender and subject groups. Investigator developed a standardized tool for measuring the scientific temper, consists of 100 test items related to six dimensions of scientific temper. The tool's reliability, cross validity and concurrent validity were found 0.68, 0.72 and 0.68 respectively. A sample of 600 was selected randomly from the population and the tool was administrated on the sample to compare the scientific temper in the context of the locality, gender and subject group. Descriptive and inferential statistical analysis of the raw score revealed that the scientific temper of urban senior secondary science students is significantly higher than their rural counterpart and the scientific temper of PCM (Physics, Chemistry and Mathematics) subject group students is also significantly higher than PCB (Physics, Chemistry and Biology) subject group students but the scientific temper of boys and girls of senior secondary science students does not differ significantly.

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Introduction:-

The current century is best called the age of explosion of knowledge. Advancement made in the field of science and technology is a great human achievement. Knowledge of the science is self-accumulating, self-accelerating, selfgrowing, self-pervading and self-correcting. It tries to provide a body of information through procedures that are demonstratively objective but often wiped out a subjective context. It inculcates characteristics of open-mindedness. free from superstition, curiosity, inquiry, collection of data, demand for verification and proofs, logical reasoning, suspended judgment, acceptance of warranted conclusions and willingness to change one's opinion within the light of the latest evidence. Science has countless benefits, but the best is that it is the most fascinating, difficult, thrilling, and delightful endeavour that mankind has invented. If one considers the most progressive art created in the past for the development of humankind, it is always termed as "Science". Science education has a very important role to play within the all-around cultural and societal development of humankind and for evolving a civilized society. The essence of the scientific spirit is to think globally and act locally since the cognitive domain is universal while the fruit of science has some site-specificity. Science untangles the threads that make the tapestry of our living world. It tries to figure out how the threads merge in the overall ecological networks creating and maintaining humankind and also contributes to the thought process of the person. Probably, it may also be the spirit that may reverse the steady downward trend of our world's health and wealth. The teaching of science at different levels of school has the same objectives as other school subjects but additionally, science inculcates certain values peculiar thereto which no other subject can offer. But, besides satisfying the normal criteria for its inclusion in the curriculum like academic, cultural, spiritual, aesthetic, disciplinary, utilitarian, and vocational values -science teaching provides training in the

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scientific method and also helps to develop scientific temper, scientific aptitude & scientific creativity among its learners. These qualities imbibed by the learner through science are of great value to a citizen living in the present age. For the advancement of culture and civilization in the right direction, the development of scientific temper among the younger generation is now considered a vital task in our Education Policies. India gives great value to the development of "Scientific Temper" among its people, which was appropriately incorporated into the constitution. In the modern Indian context, the idea of inculcating scientific temper had been argued most forcefully by Pt. Jawaharlal Nehru, first prime minister of India, described it almost as a panacea for all the ills of India and the sine qua non for the development of India. He places two major arguments in support of giving such primordial importance to the task of imparting scientific temper in every Indian citizen. These are- (a) protection against the superstitious beliefs of the traditional Indian society (b) It is the only way of thinking through which Indians can achieve the scientific and technological capabilities that are critical for India's development as a developed nation. He strongly believed in reorienting Indian minds to adopt new ways of thinking and liberating the Indian mind from the clutches of superstitious beliefs which work against "Modernisation". He was explicit in stating that we need to bring a "new set of values" to Indian life. Development of "scientific temper" is at the core of any such effort to usher in the "new set of values". These ideas of Nehru have set the tone of all our educational policies thereafter, which consistently "extol" the worth of inculcating scientific temper as a core value in all children through an educational process. Successive governments also took necessary steps to establish scientific institutions that foster such a temper and lead to technical excellence in this country. According to the National Policy of Education, 1986 -"Science education is going to be strengthened, to develop within the child, well-developed abilities and values like the spirit of inquiry, creativity, the courage to questioning and our aesthetic sensibility. Science education programmes are going to be designed to enable the learner to accumulate problem-solving and decision-making skills and to get the connection of science with health, agriculture, industry and other aspects of daily life." Thus, our science education programmes should be such to develop the qualities of scientific creativity, scientific aptitude & scientific temper among its learners. These qualities or outcomes of learning must be achieved to develop a national moreover individual personality. It's quite evident that processes that occur as a part of formal school education have a significant role to play in the development or achieving of these outcomes.

Science has become a priority area in education, both at the compulsory education level as well as at the level of specialization. Science education performs a two-fold task. The prime objective, an individualistic perspective is that the cultivation of a scientific temper, which incorporates a spirit of enquiry, a disposition to reason logically and dispassionately, the ability to judge beliefs and opinions based on available data, the willingness to dismiss baseless facts and principles, the courage to accept facts, no matter how disturbing or disagreeable they may be, and, finally, the ability to recognize the limits of reasoning power itself. It is also expected of science education that it might give individuals a firm grasp of the concepts and processes of science and impart to them the power to use the scientific method of problem-solving and the techniques of observation and experimentation in handling problem of comprehension of life. At the societal level, one of the foremost objectives of science education is to equip individuals to participate in the creation of a society that's free from poverty, hunger, disease and evils like violence, exploitation, oppression, etc. Researches in science education must be reviewed in the context of these aims and objectives. Today where knowledge is multiplied exponentially, science education won't be ready to justify itself by remaining merely contented to impart a specific quantum of the scientific knowledge domain, however large it's going be the quantum. Since the speed at which knowledge in science today gets obsolete is incredibly high compared to that in the 1940s or 1950s, the stress of science education must be on the development of abilities and dispositions of mind instead of merely the transfer of dead subject knowledge.

Concept of the "Scientific Temper"

Scientific temper is the trait of an individual through which he/she scientifically interact with the external world. The scientific temper includes proposing problems, refining and defining them more productively, setting up hypotheses and their testing with the help of controlled experiments, thinking out new solutions, discarding personal opinion in the light of new evidence and suspending judgment in case of conflicting evidence, discarding even the principle of authority, if found necessary, and in short, distinguishing among scientific information, popular information and beliefs etc. In other words, it is the way of an individual's thinking critically and rationally along with the ability to question. He/she does not satisfy with the answer just because it is uttered by or with authority. Since the scientific temper has many dimensions and these dimensions must be specified. To make a scientific selection of the dimensions of scientific temper, relevant and meaningful dimensions were chosen and sent to five experts in the field by the researcher for approval. Experts were unanimous (100 % approval) of the following dimensions of scientific temper –

- 1. Scientific information
- 2. Free from superstitions
- 3. Reasoning and logical ability
- 4. Problem-solving ability
- 5. Cause finding ability
- 6. Curiosity

Objectives:-

- 1. To compare the scientific temper of senior secondary science students in the context of the locality.
- 2. To compare the scientific temper of senior secondary science students in the context of gender.
- 3. To compare the scientific temper of senior secondary science students in the context of the subject groups.

Hypothesis

- 1. There is no significant difference in the scientific temper of urban and rural senior secondary science students.
- 2. There is no significant difference in the scientific temper of senior secondary boys and girls science students.
- 3. There is no significant difference in the scientific temper of senior secondary PCM and PCB group science students.

Delimitations

The following are the delimitation of the present study -1. The study is limited only to the senior secondary science students belonging to three administrative divisions of the Rajasthan State – Jaipur, Ajmer & Bikaner. 2. The study is limited to senior secondary science students of PCM (Physics, Chemistry & Mathematics) & PCB (Physics, Chemistry & Biology) subject groups only. 3. The sample of the study is 600 subjects.

Methodology:-

The present research is aimed to study the scientific temper of senior secondary science students. The following procedure has been adopted in the present study-

Population

The population of the present study comprises all senior secondary science students of three administrative divisions of the Rajasthan i.e. Ajmer, Jaipur and Bikaner.

Sample

A sample of 600 (300 urban and 300 rural) senior secondary science students had been selected randomly from three administrative divisions of the Rajasthan – Jaipur, Ajmer and Bikaner.



Sample Distribution

Fig-1:-

Research Design

Since the research has attempted to study the scientific temper of senior secondary science students, the descriptive survey method was appropriate for the present study. The following self-made standardized tool has been used for the collection of data under the present study-

Tools

For collecting the relevant data related to the scientific temper of senior secondary science students a standardized tool was developed by the investigators in the Hindi language which was reviewed by the experts. The tool was modified and finalized based on the suggestions of the experts. The tool has six dimensions. After a pilot study and item analysis, test items were corrected, modified and rejected. A total of 40 items had been rejected from the initial pool of 140 test items. Finally, there were 100 items in the tool related to six dimensions: Scientific information (20 items), Free from superstitions (15 items), Reasoning and Logical Ability (15 items), Problem-solving ability (15 items), Cause finding ability (15 items) and Curiosity (20 items). To establish the quality indexes and norms, the tool was administrated on the sample of a representative group of the population. The reliability of the tool was found with the help of two techniques – (1) cross-validation and (2) concurrent validity. The overall cross-validation was found 0.72. The "Concurrent Validity" of the scale was found 0.68 with the "Scientific Aptitude Test Battery" of Dr K.K. Agarwal and Dr Saroj Aurora. After the collection of relevant data by the tool, data were analysed by using both descriptive and inferential statistics.

Analysis and interpretation

Comparison of the scientific temper of senior secondary science students in the context of the locality

The scientific temper of senior secondary science students in the context of the locality is described in the following table as-

Type of	Ν	Mean (M)	Standard	C.R. Value	Level of Significance	
Group			Deviation		0.05	0.01
			(σ)			
Urban	300	113.38	16.89	5.5	-	Significant
Rural	300	105.84	16.66			

Table 1:-

Table-1 shows that the mean values of the scientific temper of urban and rural senior secondary science students are 113.38 and 105.84 respectively. The mean value of urban student (113.38) is higher than the rural student (105.84). Standard deviations of both groups urban and rural are 16.89 and 16.66 respectively. The calculated C.R. value 5.5 is higher than the table value of C.R. (2.58) at a 0.01 level of significance. Therefore, the difference between means of the scientific temper of urban and rural senior secondary science students is significant at 0.01 level of significance. Hence null hypothesis "There is no significant difference in the scientific temper of urban and rural senior secondary science students." is rejected.







Comparison of the scientific temper of senior secondary science students in the context of gender

The scientific temper of senior secondary science students in context to the gender is described in the following table as-

Table	2:-
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Type of Group	Ν	Mean (M)	Standard	C.R.	Level of Significance	
			Deviation	Value	0.05	0.01
			(σ)			
Boy	300	111.41	17.05	1.35	Not	-
Girl	300	109.51	17.45		Significant	

Table- 2 shows that the mean value of the scientific temper of boy and girl students is 111.41 and 109.51 respectively. The mean value of the boy student (111.41) is higher than the girl student (109.51). The standard deviations of both groups are 17.05 and 17.45 respectively. The calculated C.R. value 1.35 is less than the table value of C.R. (1.96) at a 0.05 level of significance. Therefore, the difference between means of the scientific temper of boy and girl students is not significant at 0.05 level of significance. Hence null hypothesis "There is no significant difference in the scientific temper of senior secondary boys and girls science students" is accepted.







Comparison of the scientific temper of senior secondary science students in the context of the subject groups The scientific temper of senior secondary science students in the context of the subject group is described in the following table as-

Table-5						
Type of	Ν	Mean (M)	Standard	C.R. Value	Level of Significance	
Subject			Deviation		0.05	0.01
Group			(σ)			
PCM	300	112.78	17.9	2.99	-	Significant
PCB	300	108.63	15.99			

Table 2.

Table- 3 reveals that the mean value of the scientific temper of PCM and PCB group students are 112.78 and 108.63 respectively. The mean value of the PCM group (112.78) is higher than the PCB group (108.63). Standard deviations of PCM and PCB group students are 17.9 and 15.99 respectively. The calculated C.R. value 2.99 is higher than the table value of C.R. (2.58) at a 0.01 level of significance. Therefore, the difference between means of the scientific temper of PCM and PCB group students is significant at 0.01 level of significance. Hence null hypothesis "There is no significant difference in the scientific temper of senior secondary PCM and PCB group science students." is rejected.



Comparison of the scientific temper of senior secondary science students in the context of the subject group



Conclusion:-

The present research is an attempt to study and compare the scientific temper of senior secondary science students in the context of the locality, gender and subject group. The present study revealed that the scientific temper of urban senior secondary science students is significantly higher than their rural counterpart. The scientific temper of PCM group students is also significantly higher than PCB group students but the scientific temper of boys and girls of senior secondary science students does not differ significantly.

Educational Implications-

The observations and conclusions of the present study have valuable importance for educators, teacher educators, stakeholders, researcher personnel, curriculum designers, and, last but not least, students. It would be useful to present some of the current study's educational implications here – 1. Scientific temper is a way of living and a major outcome of science teaching and learning. The researcher, in the present study, has developed a standardized tool for measuring the scientific temper of the students. This tool may be useful in measuring the scientific temper of senior secondary science students of age group 15-20 years. 2. PCM group and urban senior secondary science students have a higher scientific temper in comparison to PCB group and rural students. Thus, there is a need to foster scientific temper among PCB group and especially in the science students of rural areas. It will be better to help students to correlate the concept of science from their daily life, giving more hands-on experiences, exposé students to more innovative scientific ideas which would help them to solve daily life problems scientifically rather than giving only dead knowledge. Allowing students to carry out activities, organize various co-curricular activities such as science fair, science exhibitions, scientific debate; science club and science quiz etc. and use of teaching-

learning materials, ICT and emphasis on learning by doing are some such measures that may be useful in fostering scientific temper among science students, especially in the schools located in the rural areas.

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