



## THE SCHOOLS AND DEVELOPMENT OF SCIENTIFIC TEMPER: A STUDY OF GOVERNMENT SCHOOLS

Pradeep Kumar

Assistant Professor, MANUU College of Teacher Education Sambhal.

### ABSTRACT

*This is the age of scientific and technological development. The explosion and advancement of scientific knowledge has brought about remarkable changes in the global scenario during recent years. This scientific knowledge must be disseminated among the masses so that scientifically aware individuals can be produced to form a learned society, which makes a nation progressive. But there are still some hurdles between the sciences and its understanding among society.*

*Science communication and popularization activities can promote scientific awareness in the public and develop scientific temper. Spreading scientific awareness through schools and other formal educational agencies is a good step for promoting and developing scientific temper in the younger generation. This paper is aimed to study the mindset of teachers and their opinion about including science popularization in the school curriculum.*



**KEY WORDS :** public and develop scientific temper , promoting and developing scientific temper.

### 1. INTRODUCTION

This is the age of science and technology. Science is expanding rapidly in all dimensions and has become interdisciplinary today. The 'knowledge explosion' in the field of life science, medicine, communication, electronics, drug research, nuclear energy, earth sciences and agriculture has produced high impact our life. Issues like environment, public health, AIDS, biotechnology, recombinant DNA technology, global warming, space science, cloning and test tube baby are being increasingly talked about in the media today.

However, despite excellent advancements in scientific research, one still finds human suffering on a large scale. Superstitions and unscientific thinking are huge problems in the Indian society. Lack of scientific temper among the common man is the only reason behind it (Gupta et. al. 2008). Therefore, it is needed to spread awareness among the people of the nation about the developments field of science & technology so that they can be equal partners in country's development. This can be achieved by communicating science and technology advancements to the people and thus developing scientific temper within them.

Scientific temper is a refinement of the thinking that occurs naturally within human beings. Refining this natural process of thinking by inculcating certain habits and skills sharpen our observations, and thus develops scientific temper (Kalbag 1991).

The communication of scientific and technological information is among the most important aspects of science, research and development as this process leads to change in the public mindset using scientific information. Combined with the improvement of literacy and scientific information, science communication can be helpful in removing the superstitions and social evils from society.

In India, mass illiteracy and gradually declining interest for science in the society are big problems. In this context, schools have to play a major role in overcoming these problems and school science will be the key for success.

Jenkins highlighted the expectations from Schools and science education as *“School science education needs to respond to a changed social context and to help prepare young people to contribute as citizens to shaping the world in which they will live”* (Jenkins, 1999).

UNESCO also realized its importance and described the scientific awareness and literacy as ‘The capability to function with understanding and confidence, and at appropriate levels, in ways that bring about empowerment in the man-made world and in the world of scientific and technological ideas’ (Holbrook, 2010).

The communication media like print and electronic media have great responsibility of imparting scientific knowledge among the society and the nation to make a well aware society. Since India is mainly an agricultural country, resources like electronic and print media are not within reach of everyone and everywhere.

In such a situation, formal educational agencies and institutions can be better option for imparting scientific information and inculcating scientific temper in India. Dissemination of scientific knowledge in the society through increasing numbers of schools, colleges, technical and vocational institutions and universities can be a good move in the direction.

The School have emerged in the past decade from a place, where students receive ready-made knowledge to a place where they learn how to use and develop knowledge for their logical, reasoning and observing skills (Lindahl and Lundin, 2016).

The importance of awareness and developing scientific temper is also envisioned in The Indian Constitution. The Indian Constitution states in the Article 51A (h) that it is duty of citizens to develop the scientific temper, humanism and the enquiry spirit, and reform (Verkey, 2004).

## 2. SUGGESTIONS AND RECOMMENDATIONS ON SCIENTIFIC TEMPER BY INDIAN EDUCATIONAL COMMITTEES, COMMISSIONS, AND REPORTS-

In India, after the independence several commissions and committees were formed on education. These all emphasized that there is a need to develop scientific temper in the youngsters. For instance-

- **The Kothari commission (1964-1966)** stated that the science education must be a necessary constituent of school education. Science education should also form a part of University education. Kothari Commission made recommended activity based and child centered syllabus at schools level to develop scientific concepts and understandings and thus the scientific temper.
- **National Education Policy (1986)** emphasized that science education must be of high priority to increase the economical growth of the country. It also made recommendation to include Science and Math as an integral part of instruction during schooling.
- **Modified National Education Policy 1986 (Plan of action 1992)** according to the Modified NPE 1986, science education can nurture the child abilities like creativity, spirit of inquiry, the courage to question, and objectivity. It recommended that programmes of science education should be effective enough to enable learners to acquire skills like decision making, problem solving and enabling to discover the relationship of science with aspects of our daily life.
- **The 11<sup>th</sup> Five Year Plan of India (2007-12)** focused on to enable teachers for promotion of science. This Plan made efforts to prepare a bunch of scientific experts and to identify bright students and nurture them to choose science and research for career. New Science technology and innovation policy 2013 was also launched during this period (Planning Commission, 2009).
- **National Knowledge Commission (2009)** advocated using science and technology as media for development and for benefit of the underprivileged people. This also stated that present teaching strategies at school and college levels are not enough to inculcate scientific temper within learners (National Knowledge Commission, 2007).

• **Science technology and innovation policy (2013)** envisioned the objectives to spread and promote scientific temper in the society, skills enhancement for science application among the youth, making scientific innovation and research career attractive for young talented bright minds, and bringing the nation within the top 5 global scientific powers by 2020 (Ministry of Science and Technology, 2013).

During the last decade there was a decline in the numbers of school students opting for science after their schooling (High School and Higher Secondary examinations). This declining charm of science and the unwillingness of younger generation to pursue science as a career option has been a bias of concern for the Governments of India. Science education in the nation is still far from achieving the goal of developing a scientifically aware society.

To overcome this decrease in interest for science, the Indian government has decided to support science popularization using the educational sector. Science popularization and communication activities are being conducted at schools and colleges to fulfill these objectives. Initiatives like VIPNET clubs of Vigyan Prasar in schools, Children Science congress etc. have proved effective towards the goals. Efforts continue to attract students towards science and technology by dispensing various scholarships. The initiatives like 'Contact program for talented school children' by National Council for Science and Technology Communication (NCSTC), Inspire Award scholarship scheme, and Kishore Vaigyanic Protsahan Yojana (KVPY), INSPIRE award scheme, State- Level Science & Environmental Fair (SSEF) Children's Science Congress and various other scholarship and fellowship schemes of government including long and short term have been introduced to attract, encourage and create interest among students for science at school level in recent years. The 'Innovation in Science Pursuit for Inspired Research' (INSPIRE) scheme is an ambitious programme of Department of Science & Technology (DST), Government of India. The scheme is focused upon the students of 10-32 years age and it has 5 components. The first component, INSPIRE Awards - MANAK (Million Minds Augmenting National Aspirations and Knowledge) is governed by National Innovation Foundation (NIF) and DST of India. This scheme is aimed to motivate students to pursue Science and research as a career. In this scheme student are encouraged to develop innovative ideas through schools in any of the Indian language.

Similarly, introduction of science popularization and communication programmes like VIPNET school science clubs and others was initiated as effective schemes. These worked positively towards development of scientific temper among the schoolchildren.

Childhood is the best stage to develop scientific temper and during this stage the child learns to respond to the things of daily life. The virtues of scientific temper- truthfulness, enquiry skills, humility, perseverance, and positive approach, are necessary for holistic development of children and the society. Inculcation of these values should be essential part of the school education.

Education has an important role in developing those components which in turn nurtures scientific temper within the schoolchildren. It is essential that school curricula should respond adequately to this important need. Lindahl, and Lundin (2016) suggested that 'science education should foster skepticism and critical reasoning in students, with enabling them to build trust in expert knowledge on a sound basis, at least temporarily'.

This needs inculcation of certain values like objectivity, honesty, spirit of inquiry, courage to question, and truthfulness which are necessary for the development of various characteristics constituting scientific temper. In this direction, some special measures were taken in recent years. For instance, enriching the school syllabi with interactive experiments and learning by doing approach.

Activities and programmes for science communication and popularization need to be included in the curricula at school level. The National Curriculum Framework 2005 has identified the group activities, surveys, peers and teachers discussions, organization and exhibitions, etc. as important components of instruction and pedagogy to develop scientific attitude in schools and the neighborhood (Dhar PL, 2009).

The present paper is related with the issue dealing with the role of educational sector (secondary schools in particular) and Government, mindset of teachers, and infrastructure and other problems of schools as well as the development of scientific awareness within the people and society.

### 3. OBJECTIVES OF THE STUDY

The education sector is the prime concern of the Governments today as it is the key for the development of any nation. Science popularization and communication through schools may play an amazing role for developing scientific outlook among the children as they are the hope for future. India has a variety of schools within its rich school educational system and thousands of schools teachers, and they can lead this revolution to make a scientifically aware society.

The following objectives were developed to conduct the study:

- 1- To find out the opinion of teachers about including activities for science communication and science popularization in schools for developing scientific temper.
- 2- To study the views of teachers about importance of educational sector for developing scientific temper in society by dissemination of the scientific knowledge.
- 3- To find out the level of awareness of teachers about science communication and popularization, and its role in developing scientific temper in the society.
- 4- To determine the knowledge and interest of teachers about the necessary resources for dissemination and development of scientific knowledge among students.
- 5- To find out the views of teachers about the suitability of government efforts towards developing scientific temper by promoting science popularization and communication.

### 4. LIMITATIONS OF THE STUDY

The study was limited to the Moradabad district of Uttar Pradesh only. Only secondary school teachers of government and government aided schools were included under the study.

### 5. METHODOLOGY

Surveys method has been chosen for the present study. The basic data was collected from Senior Secondary school teachers having regular appointment in government and government aided schools (Affiliated to Uttar Pradesh Board) of Moradabad District of Uttar Pradesh. A sample of 60 teachers from the schools was selected. For data collection, a self prepared questionnaire was used.

### 6. RESULTS AND ANALYSIS

The collected data were analyzed to derive significant results. The results of the study are shown below:

In response to question 1 regarding the importance of schools in developing scientific temper among society, 92% of the participants responded positively while 8% disagreed (Figure 1).

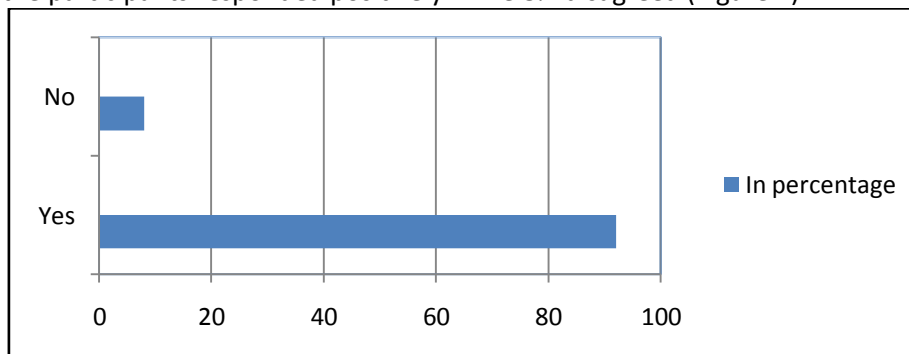
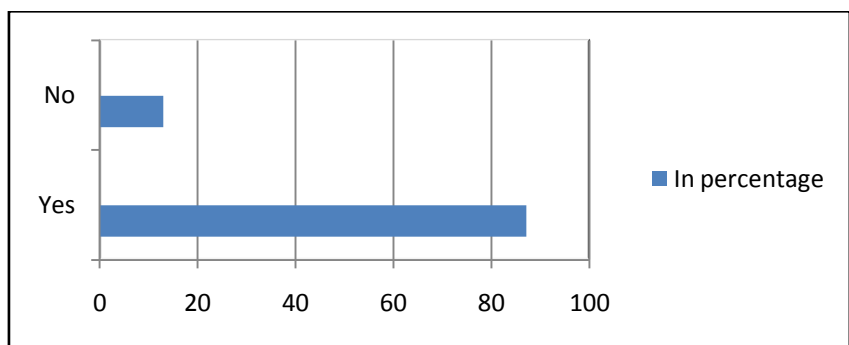


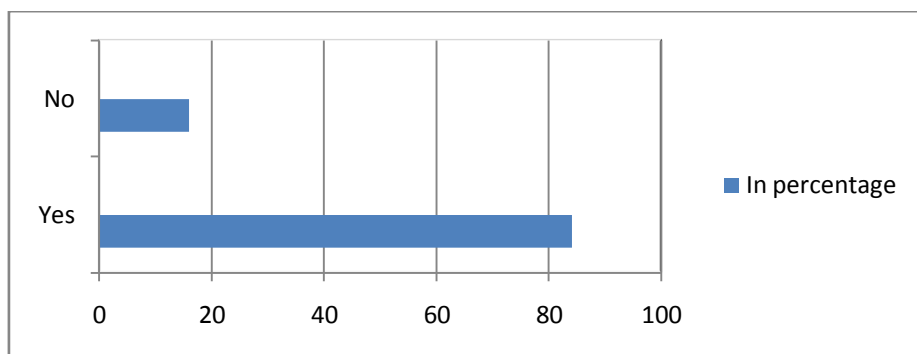
Figure 1: Can schools be an effective medium to develop scientific temper in society

The responses of teachers regarding the inclusion of science communication related activities in the school curriculum are represented in Figure 2. Majority (87%) of the respondents were agreeing that science popularization and communication should be added into the school curricula.



**Figure 2: Should science communication be included in school curriculum**

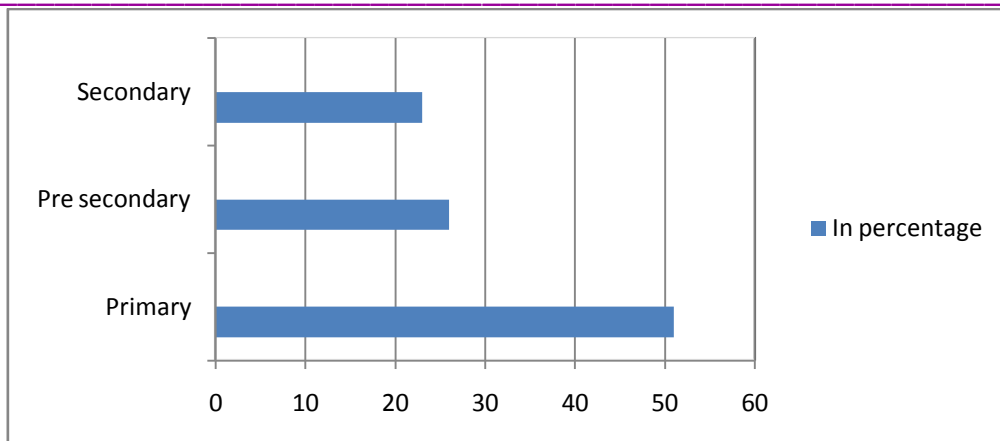
Figure 3 represents the percentage of teachers supporting introduction of extracurricular activities for science popularization besides classroom teaching in schools. 84% teachers under the study think that such activities must be started at school besides classroom teaching.



**Fig. 3: Need of extra activities for science popularization besides classroom teaching at schools**

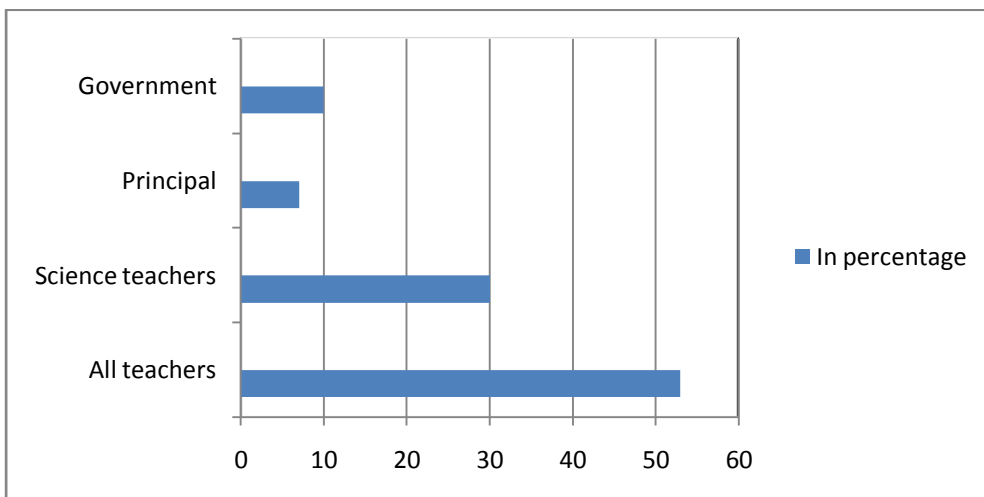
Figure 4 shows the preferred school educational level to start science popularization and communication activities. 26% teachers under the study think that science communication should be started at pre secondary level (class 6-8), while 23% teachers agreed that it should be initiated at secondary level (class 9-10). 51% respondents thought that these activities can be started at primary educational level (class 1-5).

The National Curriculum Framework 2005 has stated that the child should be engaged in learning the principles of science via simple experiences, hands on activities and simple technological modules at upper primary educational level (NCERT, 2005). Scientific concepts must be developed through experiments and activities at this level.



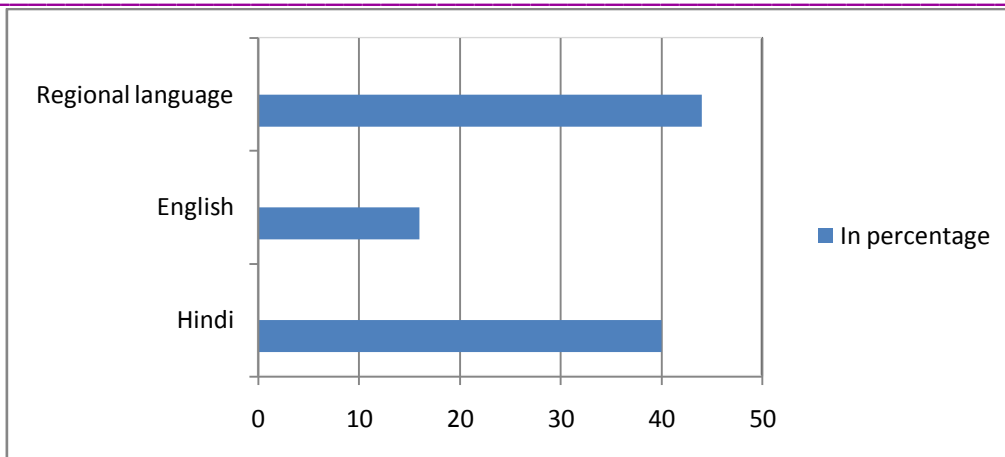
**Fig. 4: Preferred educational level to start science communication and popularization activities**

The views of teachers about bearing the responsibility for organizing science popularization and communication activities at schools are represented in Figure 5. 53% teachers stated it as the responsibility of all teachers of school, while 33% think it is the responsibility of the government. 7% teachers assumed it as responsibility of principals with equal number of responses for science teachers.



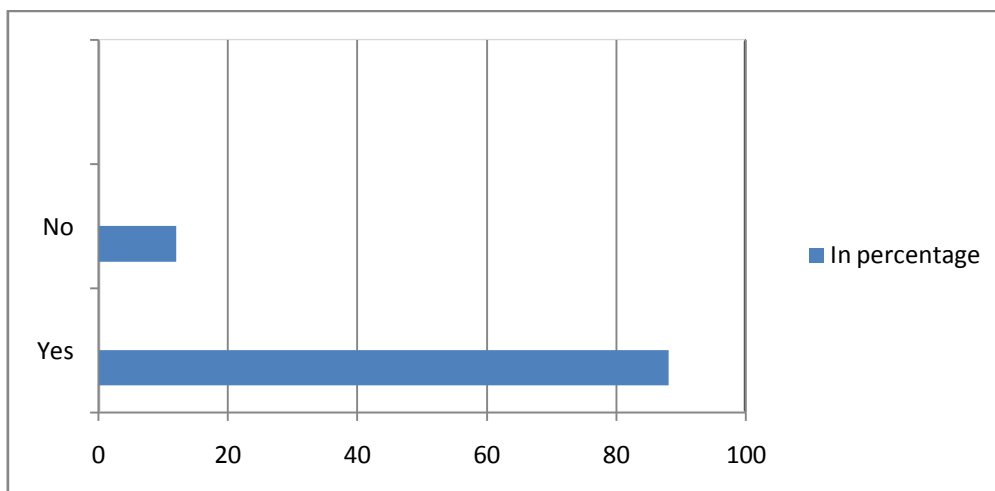
**Fig. 5: The responsible Agency for science communication activities at school**

The result of Figure 6 indicates the choice of instruction medium of language for science communication activities. 40% teachers preferred Hindi as instruction medium while 44% teachers supported the regional language, followed by only 16% teachers who preferred English medium.



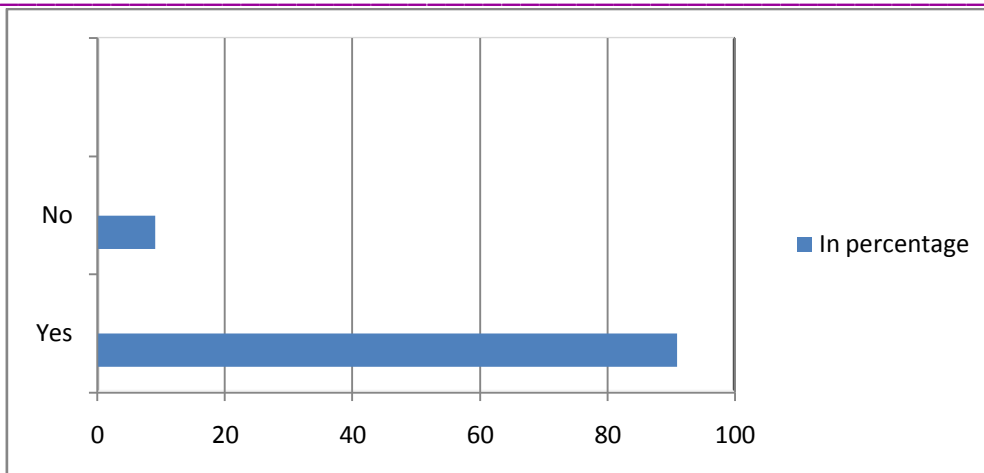
**Fig 6: Preferred language medium for science communication at school level**

The opinion of teachers about the provision for special training towards science communication activities at school is shown in Figure 7. 88% teachers feel the need of special training for teachers to organize science popularization and communication activities at the block or the district level.



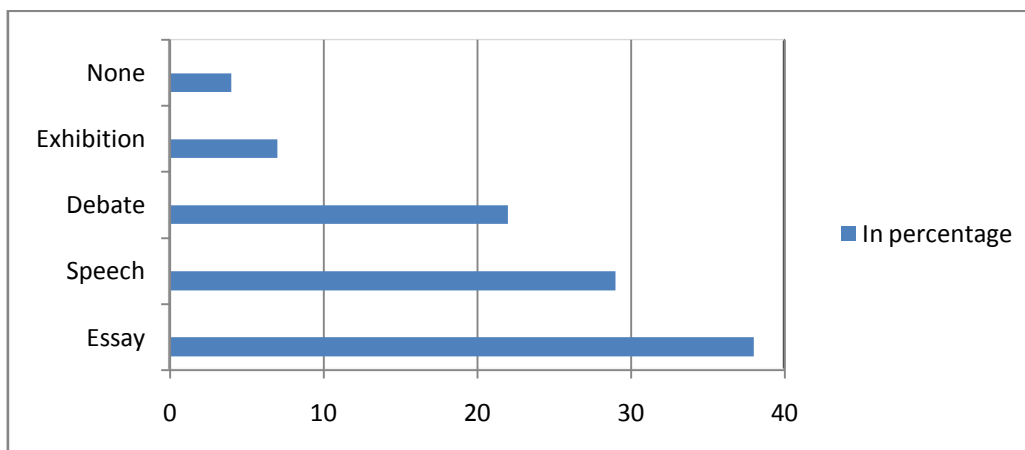
**Fig. 7: Need of special training for teachers for science communication**

Figure 8 shows the opinion of teachers about including science communication and popularization activities in the curriculum of teachers training programmes as B.Ed., B.T.C., M.Ed. and JBT. 91% teachers feel that such activities should form a part of the curriculum or as a project in teachers training programmes like B.Ed., BTC, M.Ed. and JBT, while only 9% teachers think that it is not necessary.



**Fig. 8: Should science communication be a part of teachers training programmes curriculum**

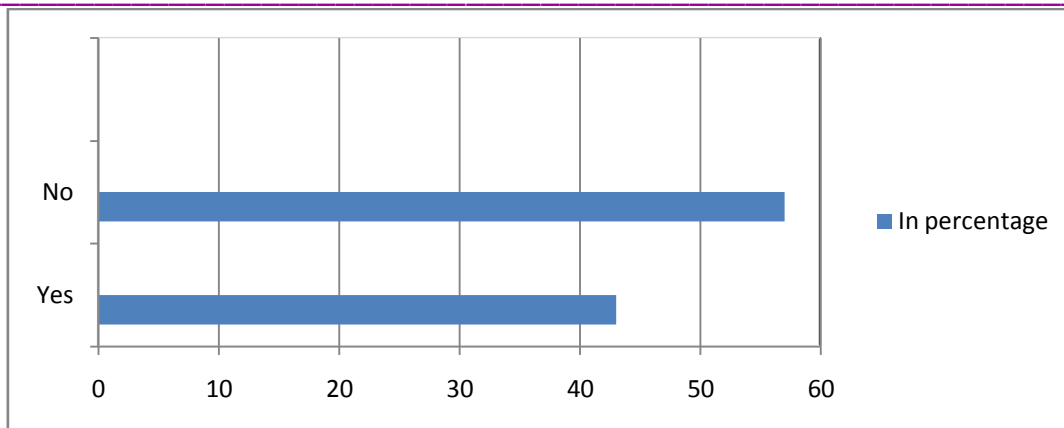
Figure 9 shows the types of scientific programmes organized at the school. 38% teachers said that science essay competition took place at their schools, while 29% accepted that science speech competition were held at their schools followed by 22% responses for science debate and only 7% responses for science exhibition competitions. 4% respondents said that no scientific programme organized in their school.



**Fig. 9: Type of science communication activities organized at school level**

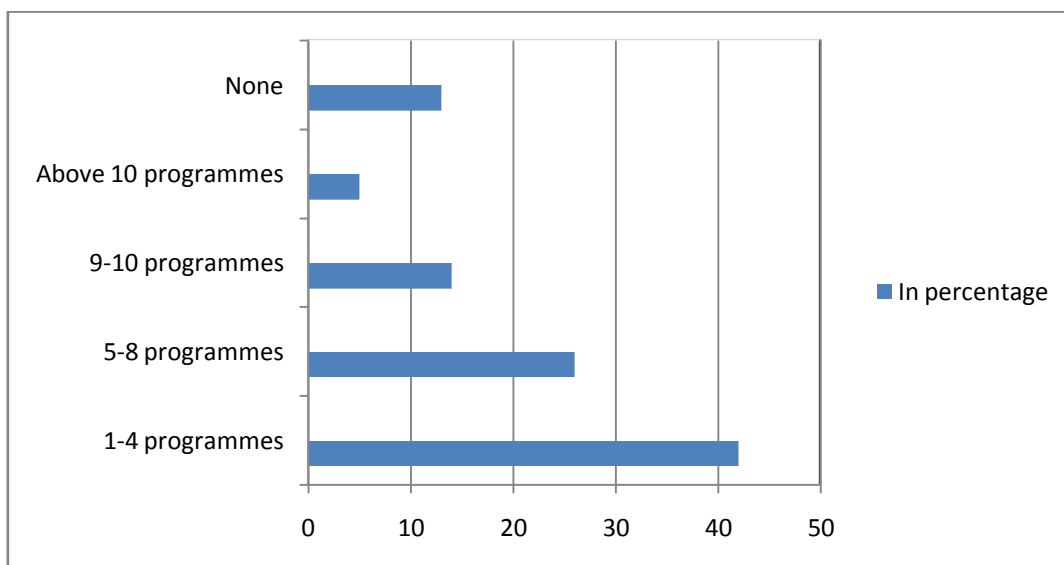
Figure 10 shows the functioning status of science clubs at schools. Only 43% teachers accepted that science clubs are active at their schools while 57% of teachers said there was no activity of science clubs at their schools.





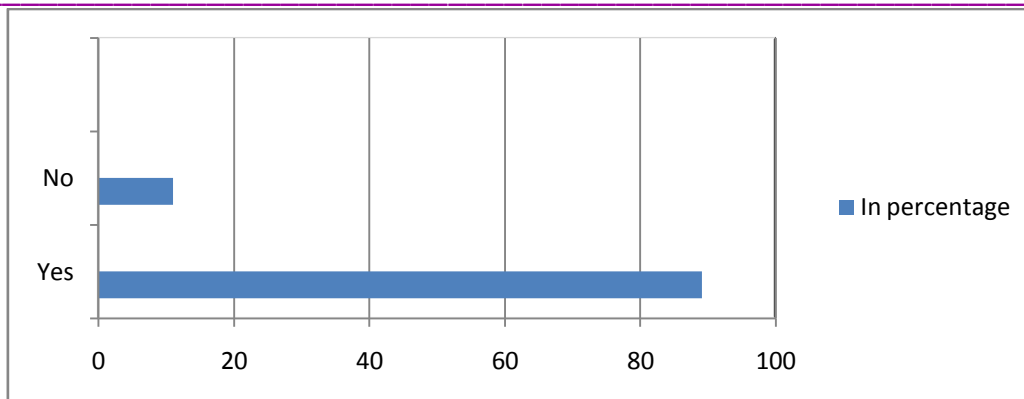
**Fig. 10: Status of science clubs functioning at schools**

Figure 11 shows the status of scientific programmes organized by student's science clubs in schools within the last year. 42% school teachers mentioned that 1-4 programmes took place at their schools last year, followed by 26% responses for 5-8 programmes. Only 14% teachers indicated this number up to 9-10. 13% respondents said that there was no programme organized last year. While some schools (5%) accepted that more than 10 programme were held in last year. This is really not a good situation overall.



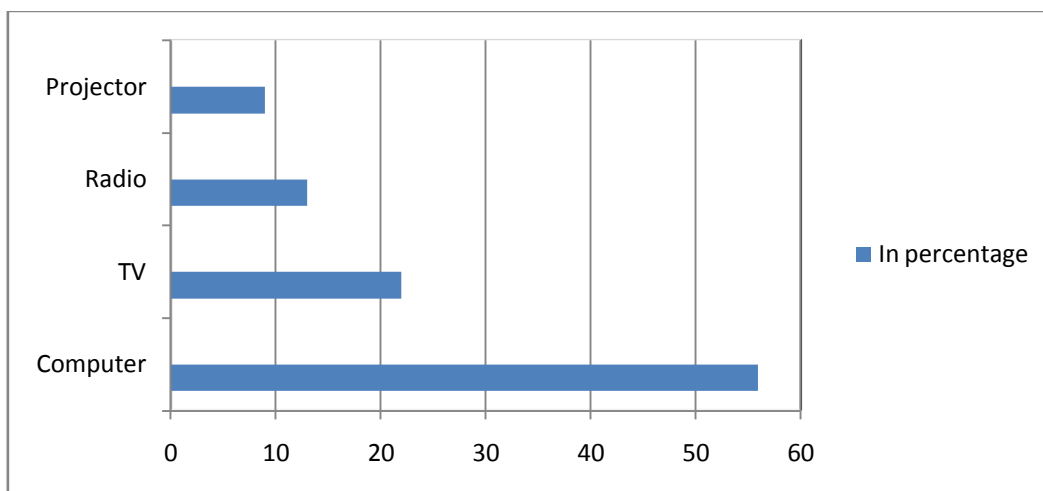
**Fig. 11: No. of programmes held by school science club last year**

Figure 12 expresses the view of teachers regarding importance of computers to develop scientific temper in schoolchildren. 89% teachers under the study accepted that computer is helpful to develop scientific attitude and enhancing practical based learning in schoolchildren while only 11% responded negatively.



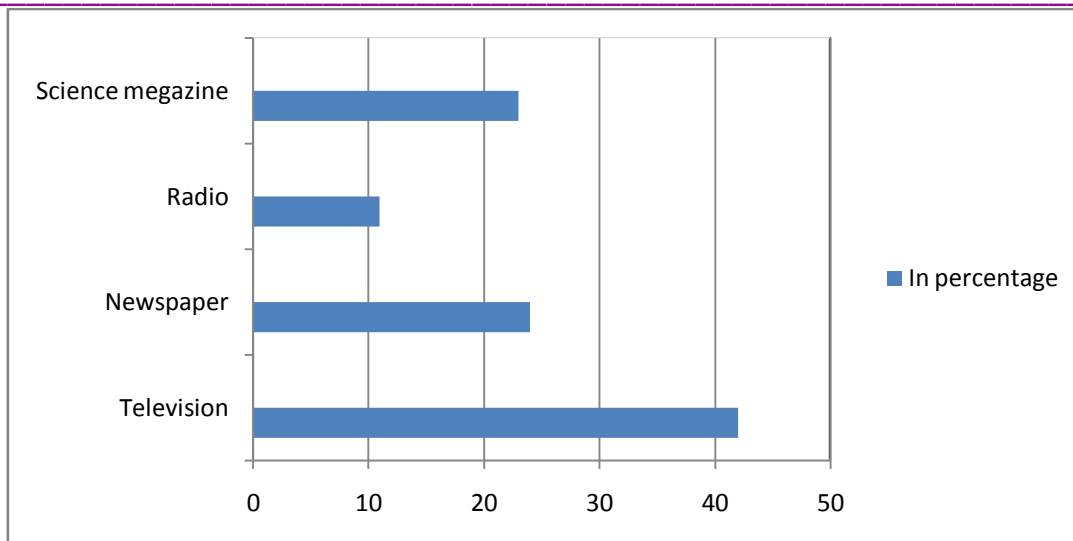
**Fig. 12: Is computer important for developing scientific attitude in schoolchildren**

Figure 13 gives an idea of opinion of teachers about the necessary science communication media. 56% teachers voted that computer, 22% selected television, 13% radio and 9% teachers thought only projector as the most necessary media for school science communication.



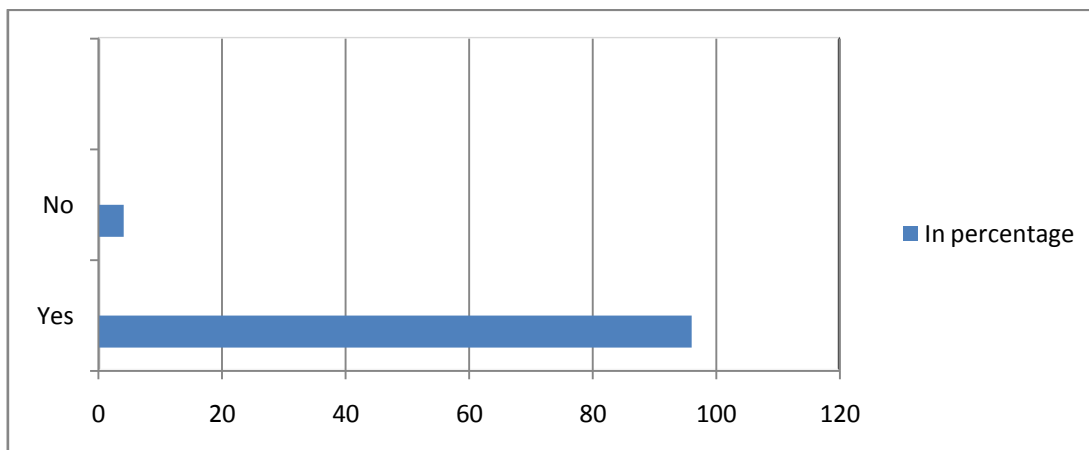
**Fig.13: Necessary communication medium for science communication at school**

Figure 14 indicates the preference of media for science communication by teachers for recent scientific knowledge. It is clear that television is the most popular science communication medium among teachers for spreading scientific knowledge (42% preference), followed by newspaper (24% responses), radio (11% responses), and science magazines (23% responses).



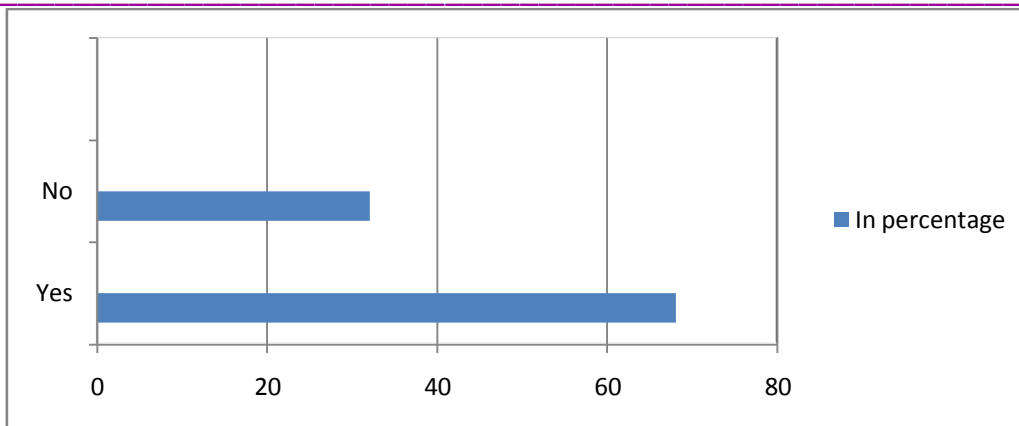
**Fig14: Preferred communication medium for scientific knowledge**

Figure 15 reveals the opinion of teachers about the effectiveness of programmes for science communication for the removal of orthodoxies and superstitions among the rural society of India. 96% teachers under the study accepted that science communication programmes are helpful to develop scientific temper within students and society and thus is helpful in overcoming the superstitions from the rural Indian society. While only 4% teachers did not think so.



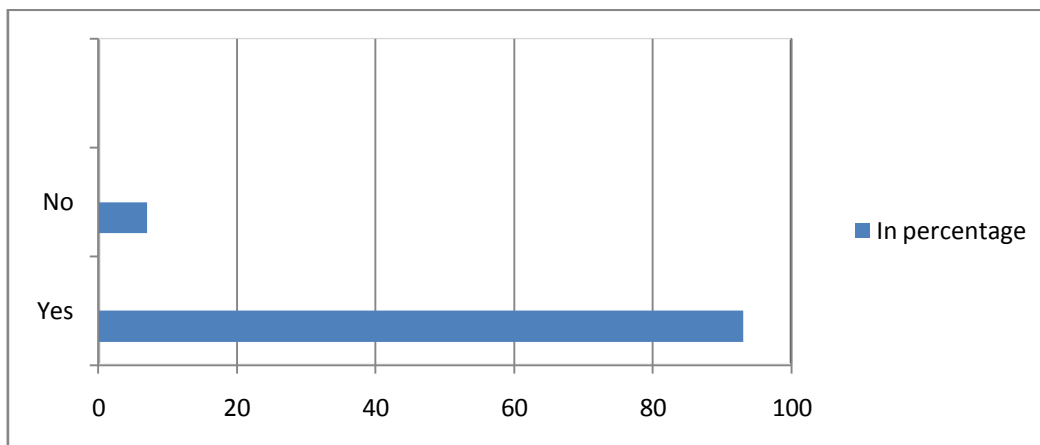
**Fig.15: Are science communication programmes effective in removal of superstitions among the rural society of India**

Figure 16 indicates the responses of teachers about participation of their schoolchildren in scientific competitions like Science Olympiads, Children science congress or other talent search exams. 32% teachers revealed that their students never participated in such competitions/ activities, while only 68% teachers responded positively to this question.



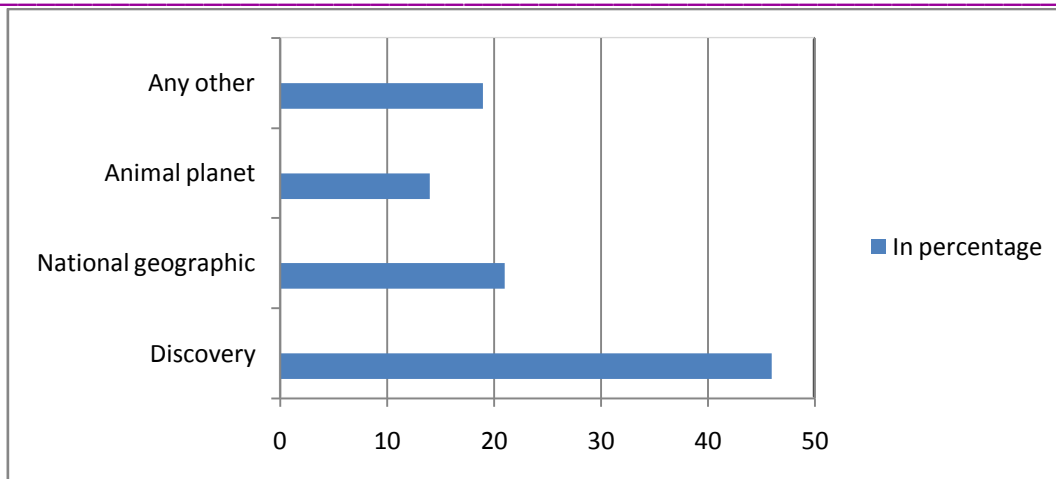
**Fig.16: Participation of schoolchildren in science Olympiads and talent search exams**

Figure 17 shows the response about the provision of government or education department towards providing a scientific magazine to schools for developing scientific attitude in schoolchildren. 93% teachers agreed that government or education department should provide a scientific magazine to schools while only 7% teachers responded negatively to this question.



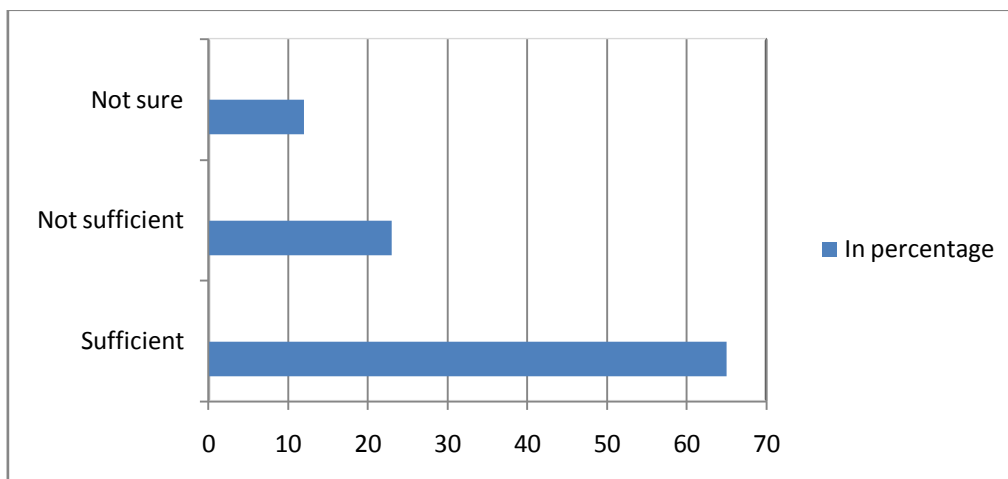
**Fig.17: Should Govt. or Education department provide a science magazine to schools to develop scientific attitude among schoolchildren**

Figure 18 shows the viewership choice of teachers of scientific channels as effective media for scientific information. Discovery channel is the highest popular scientific channel among the teachers with 46% liking it, while other popular scientific channels are Animal Planet (14% preference), and National Geographic Channel (with 21% preference).



**Fig.18: Choice of scientific channel**

Figure 19 indicates the outlook of teachers about the present efforts of government towards spreading scientific awareness. 65% participants agreed that present efforts of government are insufficient towards the development scientific awareness in schools, while 12% teachers responded to can't say option. 23% respondents accepted that these efforts are sufficient in India.



**Fig.19: Opinion about the Government efforts towards spreading scientific awareness**

**7. CONCLUSIONS**

The Educational system of India has provisions of developing scientific temper, but these provisions are not being implemented perfectly in schools due to several drawbacks. There is a lack of qualified science teachers and also the facilities are insufficient in secondary schools to make teachers and schools able for inculcating the scientific temper within students.

Schools are responsible agency for all-round development of our children. Children learn thinking, developing concept, evaluating, and developing concepts at school level. The study shows that schools can be used as important agency to disseminate scientific information and developing scientific temper within the society. The main conclusions of the study are shown below:

- 1) Schools and academic institutions can act as important media to develop scientific temper in the society by means of science popularization and communication activities.
- 2) The activities related to science popularization activities should be assigned place in the school curricula and extracurricular activities.
- 3) It is better to start the activities and programmes for developing of scientific awareness among students from the pre secondary school educational level (class 6-8).
- 4) There is a need to include the activities for the development of scientific temper in the curriculum as units or modules of pre service teachers' training programmes like D. El. Ed., B.Ed. and M.Ed.
- 5) Science clubs are not in well functioning state in a large number of schools, while it is well understood that such activities are effective enough to develop scientific outlook within children and to minimize superstitions in the society, particularly from rural areas. Non-formal channels like science and activity fairs at block, sub-district, district and state levels should be organized and the participation of schools should be encouraged.
- 6) Most teachers in the survey accepted that Govt. of India is making efforts for spreading scientific awareness in schools but these are insufficient.

### SUGGESTIONS

The Indian schools science education is undergoing a paradigm shift. Efforts are being made to develop scientific temper among younger generation and to attract students towards science as a career also. It is believed that school science education should be able to develop and support Inquiry skills and strengthened students by development of language, quantitative, and design skills. So we should work to achieve these benchmarks in our school science education programme. Schools can be an important promoter for the promotion of scientific skills in society by inculcating scientific temper within young children, our future citizens. Although there are certain challenges and Limitations present in the way of the Existing Education System to achieve the goals (Sharma and Gore, 12).

The schools should have greater emphasis on co-curricular, extracurricular and collaborative learning activities involving basic science concepts. The investigative ability among learners should be stimulated and creativity should be developed by the school educational system. The following suggestions can helpful in the connection of the above conclusions for achievement of the objectives:

- 1) Science communication and hands-on scientific activities should be assigned place within the school curriculum from the pre secondary classes besides classroom science teaching.
- 2) Special training should be arranged for science teachers so that these activities get promoted at school level.
- 3) Student science club should be formed compulsorily at schools and computers, projector and other media should be provided to every school.
- 4) Government should circulate a science magazine to schools for nurturing scientific thinking of students; preferably this magazine should be in the regional languages.
- 5) The activities of VIPNET science clubs of Vigyan Prasar (DST), eco clubs, children science congress etc. should be encouraged and every school should be affiliated with them.
- 6) The budgetary allocation towards education sector in general and school education in particular, must be increased as it will accelerate the efforts for developing scientific awareness.

### REFERENCES

- 1) Gupta et. al., (2008). An analysis of public opinion on science television channels. *Indian Journal of science communication*. 7(1), 10-14.
- 2) Kalbag S.S., (1991). Developing Scientific Temper- Vidnyan Ashram, A Draft.

- 3) Jenkins E. W., (1999). School science, citizenship and the public understanding of science. *International Journal of Science Education*, 21 (7), 703-710.
- 4) Holbrook J., (2010). Education through science education for all. *Science Education International*. 21(2), 80-91.
- 5) Lindahl M.G. and Lundin M., (2016). How do 15-16 year old students use scientific knowledge to justify their reasoning about human sexuality and relationships? *Teaching and Teacher Education*. 60, 121-130.
- 6) Varkey M.J., (2000). Science popularization and the Indian Constitution. *Current Science*. 78, 1054.
- 7) Planning Commission (2009). 11<sup>th</sup> five year plan. Government of India. Retrieved on 13.03.2018 from [http://planningcommission.nic.in/plans/planrel/fiveyr/11th/11\\_v2/11th\\_vol2.pdf](http://planningcommission.nic.in/plans/planrel/fiveyr/11th/11_v2/11th_vol2.pdf)
- 8) National Knowledge Commission (2007). National Knowledge Commission (NKC) report to the nation. Government of India. Retrieved on 13.03.2018 from <http://kshc.ac.in/perspectives/NKC%20Report%20to%20the%20Nation%202006.pdf>
- 9) Ministry of Science and Technology (2013). Science technology and innovation policy, Government of India. Retrieved on 13.03.2018 from <http://www.dst.gov.in/sites/default/files/STI%20Policy%202013-English.pdf>
- 10) Dhar P.L.,(2009). Developing Scientific Temper, *A draft*. Indian Institute of Technology Delhi. Retrieved on 13.03.2018 from <https://pldhar.files.wordpress.com/2009/09/scientific-temper.pdf>
- 11) NCERT (2005). National curriculum framework. *Position paper: National focus group on Teaching of Science*. National Council of Educational Research and Training New Delhi.
- 12) Sharma O.P. and Gore M.M., (2009). Developing Scientific Temper through School Education. Retrieved on 13.03.2018 from [https://www.academia.edu/5015946/Developing\\_Scientific\\_Temper\\_through\\_School\\_Education](https://www.academia.edu/5015946/Developing_Scientific_Temper_through_School_Education)