Journal of Scientific Temper
Vol 8(3&4), July-Dec 2020, pp. 146-160

ARTICLE

Creating Scientific Temperament through Children's Science Congress in Uttarakhand, India

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ABSTRACT

Science and Technology provide hands-on guidance in every field such as agriculture, medical sciences, health care, innovations, public utility services, internal and external security, education, entertainment; information and technology, etc. The awareness related to science through informing, educating, and sharing knowledge for promoting sustainable development is known as science communication. The basic aim of science popularization is to expose the society and upcoming generations to the virtues of scientific development and to help them understand the science in their daily life and surroundings as well. Motivating school children towards science is an important aim of science communication at the school level.

The National Council for Science and Technology Communication (NCSTC), Department of Science and Technology (DST), Government of India, New Delhi has been organizing the "Children's Science Congress (CSC)" as one of the mega flagship programmes at the block, district, state, and the national level throughout the country since the last 27 years. In the present paper, an attempt has been made to compile the experiences of three consecutive years (2017, 2018, and 2019) of Children's Science Congress organized by the State Council for Science and Technology. It was categorized under seven themes in 2017, while two themes were merged in 2018 and 2019. A total of 11 districts of Uttarakhand participated in the 25th Children's Science Congress during 2017, while in 2018 and 2019, all (thirteen) districts participated in the Children's Science Congress. The total number of child scientists from different districts were found to be diverse – 107, 142, and 138 during the 25th, 26th and 27th Children's Science Congress of Uttarakhand held in 2017, 2018 and 2019, respectively.

In the present paper an attempt has been made to understand the impact of Children's Science Congress (CSC) for creating scientific temper among child scientists and mentors.

KEYWORDS: Science Communication; Science Temperament; Children's Science Congress; National Council for Science and Technology Communication (NCSTC), National Children's Science Congress (NCSC)

Introduction

Science is a subject for developing the logical thought process. Sustainable development and progression of a country needs science awareness as well as popularization to create a scientific temperament (Gascoigne and Metcalfe., 2004). Science communication may pave the way forward to decision making, political and ethical thinking in the field of scientific development (Cheng *et al*., 2014). Various factors such as social context, politics, economy, culture and history may influence scientific communication (Liu and Hu., 2014). Science awareness and initiatives to promote scientific approaches in public domain might be in terms of number of school students availing science courses, science reporting in popular media, network of scientists and technologists, the number of scientists elected to Parliament, the number of high-profile board members holding degrees in science and technology, the way scientists are depicted in popular films and television shows and the number of females graduating from universities with a science degree (Gascoigne and Metcalfe, 2004). There should be science awareness programmes for rural folk, science exhibitions at lower as well as higher levels to communicate science and technology (Padmanabhan, 2004).

The intelligence of a person to take strong decisions in the field of scientific information and innovations could be defined as scientific temperament (Saxena, 2014). Scientific research leads and suggests the way of experiment and validating long-held viewpoints of society in a scientific way (Anderson., 2002). A society that supports sustainable development and scientific temperament will flourish. An ideal democracy and the edict of equality in any country is closely related to scientific temperament and an argumentative approach.

Science communication is the most advanced technological approach for modern lifestyle to develop scientific temperament with various sources (Baruah, 2019). There is a communication gap among scientists, researchers and common people which is a challenge for scientific communication (Deobhanj, 2017). Through scientific communication one can address the urgent need of improved nutrition, potable drinking water, public health issues, etc. (Srimany, 2018).

Approaches to Communicate Science among Students at State and National Level

Motivating children towards science education is the best practice among all the approaches to communicate science at school and college level (Mahanti, 2013). Minal Patel, a teacher in DPS East, Bengaluru on the occasion of the National Science Day 2020 in a report in "The Times of India" said that it is important to address the issues among students to generate scientific curiosity and awareness about the scientific activities across the globe (The Times of India, 2020). Hence, science and technology communication should be taken to generate and develop scientific temper among the school children (Bhatt, 2011). Science exhibitions, lectures, science fairs and children science congress are considered useful for the rural area to generate curiosity among the rural community (Uniyal *et al*., 2019). Science popularization is an attempt to reduce the distance standing between science specialists and the public (Positive Atheism., 2000; Sunil, 2009).

The National Council for Science and Technology Communication (NCSTC), Department of Science and Technology, Government of India, New Delhi organizes various scientific programmes across the country to disseminate science among the society. Organization of Children's Science Congress prompts children to think of some significant social problems, ponder over its causes and eventually try and solve the same using scientific approaches. This involves close and keen observation, raising pertinent questions, building models, predicting solutions on the basis of a model, trying out various possible alternatives and arriving at an optimum solution using experimentation, field work, research and innovative ideas. The Children's Science Congress encourages a sense of discovery. It

emboldens the participants to question many aspects of progress and development and express their findings in their vernacular language.

The National Children's Science Congress (NCSC) is a platform for children to bring out research activities at the local level based on themes related to the science in their surroundings. The programme was initiated in Madhya Pradesh by an NGO known as the Gwalior Science Center. It was soon after implemented by the National Council for Science and Technology Communication (NCSTC), Department of Science and Technology, Government of India for extending it to the national level. Initially, the programme was coordinated by the NCSTC-Network (a network of non-government and government organizations) working in the field of science and popularization as the national organizer. Since 2014, NCSTC, Department of Science and Technology has been organizing the Children's Science Congress with the guidance and support of the National Academic Committee, a core group of experienced academic team constituted by the NCSTC, DST, Government of India (Source: NCSTC website).

The main objectives of the Children's Science Congress is to create a forum for the young school student (10 to 17 years age group) from rural as well as urban areas, to provide them a platform for their innovative creativity, excellent ideas, innovativeness and more particularly their ability to solve any problem related to science locally using scientific techniques. The Children's Science Congress is an approach that is applicable to every student beyond the boundaries of geographical regions, languages, gender. The main perception of the CSC is based on the five pillars of education: (i) learning of education for sustainable development; (ii) learning to know; (iii) learning to do; (iv) learning to live together, and (v) learning to transform oneself as declared in the 57^{th} meeting of the United Nations General Assembly in December 2002.

The tentative activity schedule of the Children's Science Congress is described in Table 1.

Table 1. Activity Schedule of Children's Science Congress (CSC).

S. No	*Activities*	*Time Schedule*
1.	State level/district orientation of guide teachers	April-June
2.	Selection of subjects and activity for registration of teams	June-July
3.	Working on the project	Minimum 2-3 months
4.	District level Congress:	By September-October
5.	State level Congress	By November
6.	National level Congress	By December

Data Source: NCSTC guidelines

According to NCSTC, "Children's Science Congress is a forum to encourage inquiry-based learning and a platform for sharing thoughts on Science and Technology for all the children in the age group of 10 to 17 Years. It has a special emphasis on accessibility for persons with Disability (PWD) or Divyangjan also." Guidelines for participation are provided by the NCSTC, DST, Govt. of India. The Children's Science Congress is organized at the Block & District level; State level and the National level. Figure 1 describes the modalities for different levels of Children's Science Congress in India.

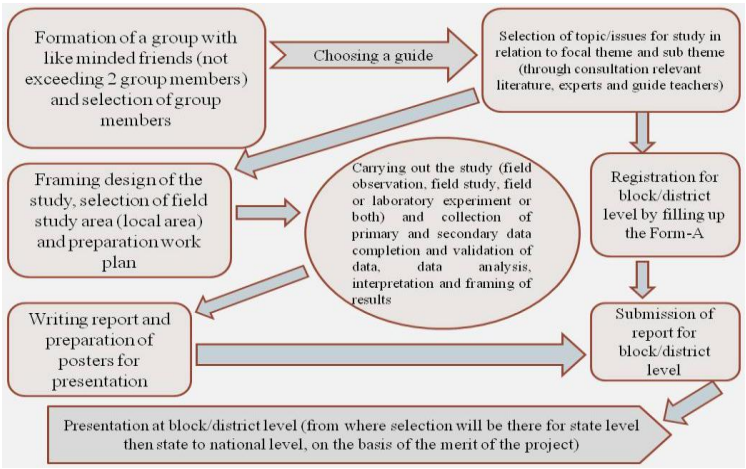

Fig. 1: Flow Chart showing modalities for different levels of Children's Science Congress in India (Source: NCSC Programme Guidelines)

The participants are motivated to come up with innovative ideas that depict scientific approaches as well as scientific methodology. The entries are evaluated on the basis of Originality of concept; Relevance of the project to the theme; Scientific understanding of the issue; Data collection; Data analysis; Experimentation/validation; Interpretation and problem solving attempt; Team work; Background correction; Report and presentation; Follow up action plan. The evaluators are also supposed to give constructive inputs, positive feedback and encouragement to the student by understanding their project with the limitations, capabilities and capacities of the students.

Uttarakhand Children's Science Congress

The Uttarakhand State Council for Science & Technology (UCOST) hosted state level Children's Science Congress on themes such as Ecosystem and Ecosystem Services; Health, Hygiene and Sanitation; Waste to Wealth; Society, Culture and Livelihoods and Traditional Knowledge Systems in 2017, 2018 and 2019. A panel of esteemed judges from various reputed institutions was formed to assess the performances of the students and to guide them. A fair representation of both girl and boy candidates was ensured from all the participating districts.

Results and Discussion

The results obtained from the data set showed that 11 districts of Uttarakhand participated in the 25th State Children Science Congress during 2017 while in 2018 and 2019, all 13 districts of the state of Uttarakhand participated (Figure 2 and Table 2). Two districts (Almora and Champawat) didn't participate in 2017 CSC. Total numbers of child scientists from different districts were found diverse (107, 142, and 138) during the 25th, 26th and 27th Children's Science Congress of Uttarakhand held in 2017, 2018 and 2019, respectively.

From the study, it is evident that the participation of girl Child Scientists was maximum (58, 93, 88) as compared to boy Child Scientists (43, 49, 50) during all the three Children's Science Congress (25th, 26th and 27th), respectively. Maximum numbers of girl child scientists (93) participated during 2018 and maximum numbers of boy Child Scientists (50) were found in

2019. Minimum numbers of girl child scientists (58) and boy Child Scientists (43) participated during 2017. It is also observed from the data presented in Table 3 and Figure 3 that maximum numbers of Child Scientists were from Pauri Garhwal (12) in 2017, from Pauri Garhwal and Dehradun (14) in 2018 and 2019, whereas minimum numbers of Child Scientists were from Pithoragarh (2) in 2017, and from Almora (8 and 6) in 2018 and 2019, respectively.

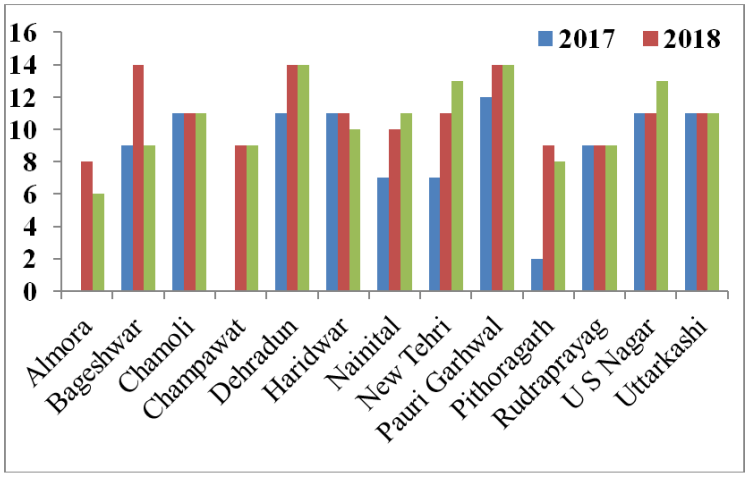

Fig. 2: Total numbers of Child Scientists from different districts of Uttarakahnd participated in Children's Science Congress during 2017, 2018 and 2019

Table 2. Total numbers of Child Scientists (Girls and Boys) from different districts of Uttarakhand that participated in Children's Science Congress during 2017, 2018 and 2019

S.No	District	2017		2018		2019	
		Girl	Boy	Girl	Boy	Girl	Boy
1.	Almora	-	-	4	4	3	3
2.	Bageshwar	5	4	5	9	7	2
3.	Chamoli	5	6	9	2	9	2
4.	Champawat	-	-	4	5	3	6
5.	Dehradun	8	3	10	4	7	7
6.	Hardiwar	5	6	6	5	3	7
7.	Nainital	4	3	7	3	9	2

8.	New Tehri	3	4	7	4	7	6
9.	Pauri Garhwal	6	6	9	5	10	4
10.	Pithoragarh	1	1	8	1	7	1
11.	Rudraprayag	7	2	8	1	6	3
12.	Udham Singh Nagar	6	5	6	5	10	3
13.	Uttarkashi	8	3	10	1	7	4
	Total	**58**	**43**	**93**	**49**	**88**	**50**

(Data Source: CSC report 2017, 2018 and 2019. Uniyal et al., 2018)

The Children's Science Congress had Seven (7) themes – Natural Resource Management; Disaster Management; Food and Agriculture; Health, Hygiene and Nutrition; Energy, Lifestyle and Livelihood; and Traditional knowledge Systems during the 25th CSC in 2017, while in 2018 and 2019, there were five (5) themes viz. Ecosystem and Ecosystem Services; Health, Hygiene and Nutrition; Society, Culture and Livelihood; Traditional Knowledge System, and Waste to Wealth (Table 3 and Figure 3).

In the present study, it was observed that the maximum Child Scientists participated under health, hygiene, and sanitation (44) in 2018, while minimum Child Scientists (7) participated under disaster management in 2017. It was found that in 2017, the maximum child scientists (26) participated under the selected theme food and agriculture; in 2018, under health, hygiene, and sanitation (44), and in 2019, under waste to wealth (35), while the minimum (7) participation was found under disaster management in 2017, under society, culture, and livelihood (16) in 2018, and under ecosystem and ecosystem services (16) in 2019 (Table 3 and Figure 3).

The participation of girl Child Scientists was found maximum as compared to boys among all the selected themes except for health, hygiene and nutrition (8) in 2017. In 2017, maximum participation of girl Child Scientists was found under the theme food and agriculture (14) while minimum was found under disaster management (4). Maximum boys participated under health, hygiene and nutrition while minimum boys participated under lifestyle and livelihood (1) in 2017. In 2018, maximum girl and boy Child Scientists participated under health, hygiene and sanitation (25 and 19), respectively. Minimum girl and boy Child Scientists participated under society, culture and

livelihood (9 and 7), respectively. In 2019, minimum girl and boy (12 and 4) participated under the theme ecosystem and ecosystem services, respectively. Maximum girl (20) participation was found under traditional knowledge system while maximum boy (17) participation was observed under waste to wealth in 2019 (Table 3 and Figure 3).

Table 3. Total numbers of Child Scientists (Girls and Boys) that participated in different selected themes of Children's Science Congress during 2017, 2018 and 2019.

S.No	Theme	2017		S.No		2018		2019	
		Girl	Boy			Girl	Boy	Girl	Boy
1.	Natural Resource Management	6	5	1	Ecosystem and Ecosystem Services	18	8	12	4
2.	Disaster Management	4	3	2	Health, Hygiene and Sanitation	25	19	19	11
3.	Food and Agriculture	14	12	3	Society, Culture and Livelihood	9	7	18	9
4.	Health, Hygiene and Nutrition	8	15	4	Traditional Knowledge System	23	05	20	11
5.	Energy	6	6	5	Waste to Wealth	18	11	18	17
6.	Lifestyle and Livelihood	8	1						
7.	Traditional Knowledge System	10	3						

(Data Source: CSC report 2017, 2018 and 2019. Uniyal et al., 2018)

From the data shown in Table 4 and Figure 4 it can be seen that total 14 Child Scientists were selected for NCSC in 2017 while in 2018 and 2019, total of 16 Child Scientists were selected for NCSC 2018 and 2019, respectively. Out of 14, 7 girl Child Scientists and 7 boy Child Scientists in 2017, 10 girl Child Scientists and 6 boy Child Scientists in 2018, and 8 girl Child Scientists and 8 boy Child Scientists in 2019 were selected for NCSC. Out of all five selected themes, maximum

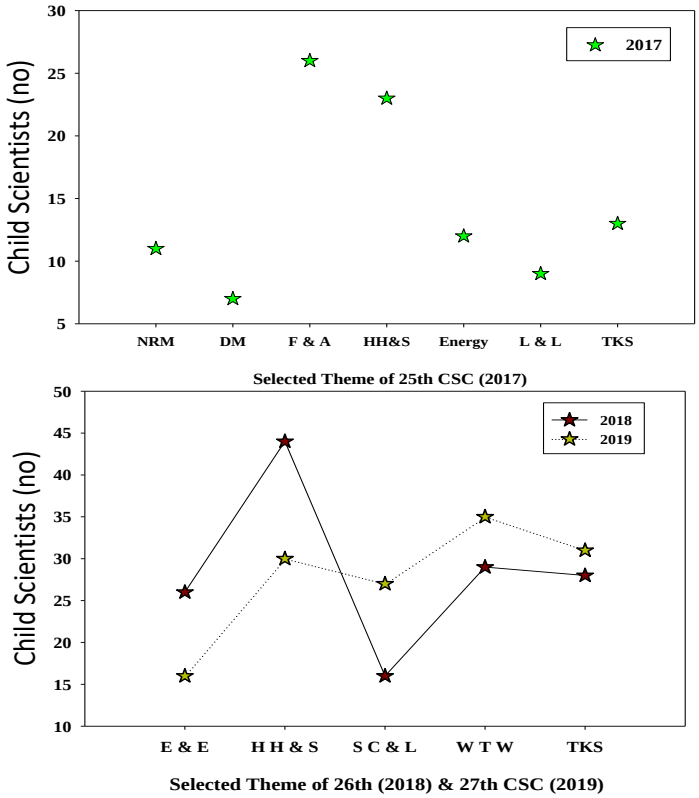

Fig. 3: Total numbers of Child Scientists that participated in different selected themes during CSC 2017, 2018 and 2019 (NRM: Natural Resource Management; DM: Disaster Management, F & A: Food and Agriculture; HH&S: Health, Hygiene and Nutrition; L&L: Lifestyle and Livelihood; TKS: Traditional knowledge System; E & E: Ecosystem and Ecosystem Services; SC&L: Society, culture and Livelihood; WTW: Waste to wealth)

Child Scientists (4) were selected from Health, Hygiene, and Sanitation in 2018, out of which 2 were boys and 2 girls. In 2019, maximum Child Scientists (4) were selected from Ecosystem and Ecosystem Services, out of which 2 were girls and 2 boys. In 2018 and 2019, maximum Child Scientists (4) selected for NCSC were from Udham Singh Nagar district, out of which 3 were girls and 1 was a boy Child Scientist in 2018

and 2 girls and 2 boys Child Scientists in 2019 (Table 4 and Figure 4).

Table 4. Numbers of selected Child Scientists of different districts for NCSC

S.No	District	2017		2018		2019	
		Girl	Boy	Girl	Boy	Girl	Boy
1.	Almora	0	0	0	1	0	0
2.	Bageshwar	1	1	0	0	0	0
3.	Chamoli	0	1	2	0	1	0
4.	Champawat	0	0	0	1	1	0
5.	Dehradun	0	0	0	1	0	1
6.	Hardiwar	1	0	0	1	0	1
7.	Nainital	0	0	0	0	0	1
8.	New Tehri	2	1	1	0	2	1
9.	Pauri Garhwal	0	0	0	1	0	1
10.	Pithoragarh	0	0	2	0	1	0
11.	Rudraprayag	0	0	1	0	0	0
12.	Udham Singh Nagar	1	3	3	1	2	2
13.	Uttarkashi	2	1	1	0	1	1

(Data Source: CSC report 2017, 2018 and 2019. Uniyal et al., 2018)

Overall comparative study of the three consecutive years of CSC concludes that total 11 and 13 districts participated in 2017 and 2018, 2019, respectively (Table 5). Total numbers of Child Scientists was found 101, 142, and 137 in 2017, 2018, and 2019, respectively. Total numbers of boy Child Scientists participated 42, 49, and 57 in 2017, 2018, and 2019, respectively. Total numbers of girls Child Scientists participated 58, 93, and 89 in 2017, 2018, and 2019, respectively. Total Child Scientists selected for NCSC was 14, 16, and 16 in 2017, 2018, and 2019, respectively (Table 5).

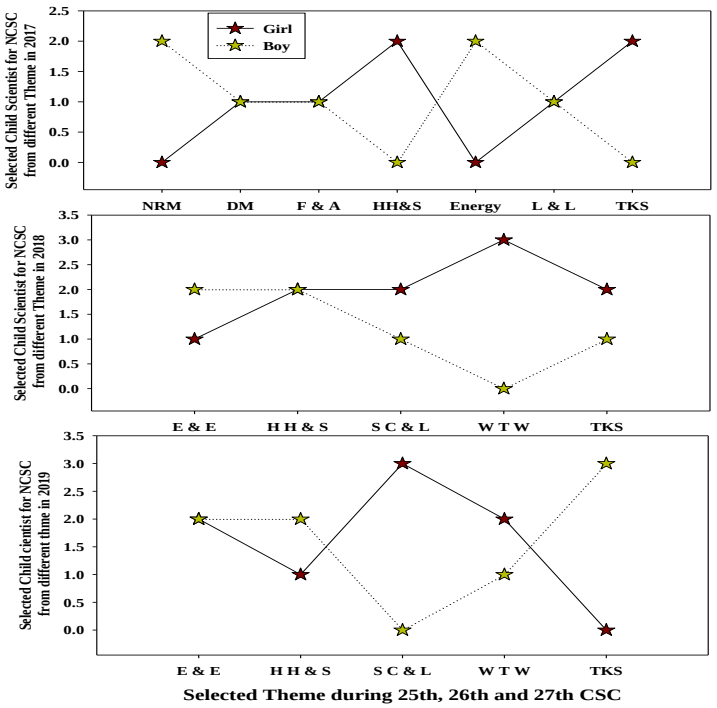

Fig. 4: Total numbers of Selected Child Scientists (Girl and Boy) from different selected themes during CSC 2017, 2018 and 2019 (NRM: Natural Resource Management; DM: Disaster Management, F & A: Food and Agriculture; HH&S: Health, Hygiene and Nutrition; L&L: Lifestyle and Livelihood; TKS: Traditional knowledge System; E & E: Ecosystem and Ecosystem Services; SC&L: Society, culture and Livelihood; WTW: Waste to wealth)

Table 5. Comparative Study of CSC 2017, 2018 and 2019

S. No	Participation	2017	2018	2019
1.	Total Districts Participated	11	13	13
2.	Total Students Participated	101	142	137
3.	Total Boys Participated	42	49	57

4.	Total Girls Participated	58	93	89
5.	Selected Theme	7	5	5
6.	Total Child Scientists Selected for NCSC	14	16	16

(Data Source: CSC report 2017, 2018 and 2019. Uniyal et al., 2018)

Conclusion

The above study concludes that science communication to develop scientific temperament is the basic need of the society. Uttarakhand is a hilly state that covers 13 districts. While some are urban, the majority are rural. Students from rural areas face challenges in their school activities as well as in their daily life. They face a lack of communication, infrastructure, connectivity, etc.

The National Children's Science Congress is a platform for children to carry out research activities at the local level. Children's Science Congress organized at the state levels provide a platform especially for students from rural areas to carry out research on their local problems and suggest solutions. CSC also provides them a platform to understand the latest issues of science and technology.

Acknowledgements

The authors are thankful to the National Council for Science and Technology Communication, Department of Science and Technology, Government of India, New Delhi, for their financial support and SPECS Society Dehradun and all the coordinators, mentors and Child Scientists from the state of Uttarakhand for their active participation.

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