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ARTICLE

Evaluation of visitors' experiences and perceptions of a scientific lab visit: A case study

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ABSTRACT

Nowadays, the scientific community is employing a range of traditional and innovative approaches to motivate students towards science, with the ultimate objective of promoting a scientific career and instilling a scientific attitude. Organising exhibitions, quiz competitions, visits to research labs/science museums/planetariums, and taking Mobile Science Vans to schools are some ways to develop students' interest. In line with this, CSIR-National Institute of Science Communication and Policy Research (erstwhile CSIR-NISCAIR), a public-funded premier institute of India in the field of science communication (having the mission of disseminating science at scholarly and popular levels) regularly organises visits to the lab, open days, science expos for students, in particular, school students. The institute organised an exhibition-cum-open day titled "Indian Raw Materials & Products Expo" to promote interest in science and science communication, which was visited by more than 650 school students and their teachers from about 17 schools. They were asked to rate their experiences and suggestions through a feedback questionnaire. The students were intrigued by the display of live and preserved plant specimens. Teachers agreed that these visits should be regularly organised to benefit the students. Such visits expose young minds to advances in science, fostering enthusiastic dialogue among students, teachers, researchers, and scientists.

Keywords: Science motivation, Lab visit, Students, Perception

1. Introduction

Worldwide, there is deep concern about the declining number of students enrolling in science subjects at school and higher education levels (Halim et al., 2018; Lyons & Quinn, 2010; Verghese, 2006; Garg& Gupta, 2003). Maikhuri et al. (2009) analysed students' preferences across 10 science motivational training programs. They found that the majority (33.9%) were interested in studying computer science, and about 31.5% were interested in becoming engineers or computer engineers. Only about 13.6% were interested in becoming scientists. Over the last two decades, studies have examined the reasons behind students' disinterest in studying science and pursuing a science-related career (Korkmaz, 2015; Lyons & Quinn, 2010). In a large-scale survey conducted in Australia, the researchers found that about 55% of the students didn't select science subjects because they felt junior school science was not engaging or interesting, and about 50% thought they were not good at science (Lyons & Quinn, 2010).

The scientific and academic fraternity is continually developing innovative ideas to attract and engage students in different science streams. Some initiatives include offering scholarships, internships, and awards; conducting competitions; providing face-to-face interaction with scientists/researchers; providing hands-on training/experience in a research lab; forming specialised Science clubs; providing exposure to scientific events, festivals, etc.; and visiting science museums, planetariums, botanical and zoological parks, and research institutes.

Not only these, but many innovative approaches to inspire students to study and pursue careers in science have been implemented worldwide. To influence students' attitudes towards science, a "science as inquiry" learning unit was designed in the Jerusalem region. Grade 11 students were made to visit a university research lab. The researchers found that the visit significantly impacted the students by having them devote more leisure time to science-related activities and by motivating them to choose a career in Science (Tsybulsky et al., 2013). The study indicated that students became interested in watching science-related TV programs, visiting museums, and using websites.

In India, too, in a bid to develop students' interest in science, many schemes and programs have been launched. The National Council for Science and Technology Communication (NCSTC), Department of Science & Technology (DST), supports projects involving students' visits to R&D and industrial establishments. In addition, it funded numerous Science Motivational Training Programs for high school science students, inspiring them to pursue careers in S&T. In 2008, DST launched the INSPIRE (Innovation in Science Pursuit for Inspired Research) scheme with the vision of strengthening the scientific pool. One of its components, namely SEATS (Scheme for Early Attraction of Talent), gives the INSPIRE Award to school students (Class VI to X) to study science, and the INSPIRE Internship to Class XI students. The National Innovation Foundation (NIF), an autonomous body under DST, launched the annual IGNITE award in 2008 for students up to the age of 17 or Class XII to nurture innovation among children. The Government of India established the Atal Innovation Mission (AIM) in 2016 to foster innovation and entrepreneurship in the country. To inculcate innovation in school students, AIM has established over 10,000 Atal Tinkering Labs in schools, offering many practical DIY activities.

Earlier, in 1999, CSIR launched the CSIR Program on Youth for Leadership in Science (CPYLS), which offered the top 50 science students from CBSE, ICSE, and State Boards who passed the class X examination the opportunity to undertake project work at CSIR institutes. In 2017, CSIR, in collaboration with the Ministry of Education, Government of India, launched 'Jigyasa', a student-scientist connect program, to inculcate inquisitiveness and scientific temper among school students and teachers. Among other activities, Jigyasa offers students of Kendriya Vidyalaya Sangathan and other schools the opportunity to visit research laboratories in person or through virtual tours. Dimopoulos & Koulaidis (2005) noted that research centers are the only destinations for school visits where students have the opportunity to encounter genuine conditions of S&T knowledge generation. In this context, the present study aims to analyse an open-day visit by school students and teachers to a scientific institute, understand their experience, and obtain their views on how to improve future visits.

2. Methodology

2.1 About the Visit

CSIR-National Institute of Science Communication and Policy Research (CSIR-NIScPR, erstwhile CSIR-NISCAIR), a public-funded premier institute of India in the field of science communication (with the mission of disseminating science at scholarly and popular levels), regularly organises lab visits, open days, and science expos for all, in particular, school students. The Delhi-based institute organised an exhibition-cum-open day titled "Indian Raw Materials & Products Expo" on 25 September 2017, under the aegis of CSIR Foundation Day 2017. The visit was divided into five sections:

i) Institute's Raw Material Herbarium and Museum exhibits (having over 8000 herbarium sheets, 190 zoological specimens, and over 200 mineral samples of economic importance). The display also included dried crude drug samples used in traditional Medicines,

ii) Climatoons (Cartoons on Climate Change and Environmental Protection)

iii) Institute's Science Communication through Multimedia Studio,

iv) The institute's printing facility, with a live demonstration of ongoing printing jobs, and

v) Hands-on experience with medicinal, aromatic, and economic plant specimens on the campus, as well as a separate arrangement of potted plants displayed in an open area

2.2 Questionnaire Survey and Data Analysis

Questionnaires are structured tool that provides both quantitative and qualitative information (Carr, 1999). A questionnaire-based survey was conducted, and feedback was solicited from both students and teachers to obtain their views on the scientific institutional visit. All visitors were given feedback forms to rate their experiences and provide suggestions. The data was entered and analysed in MS Excel.

2.3 Study Participants

About 650 school students (Class IX and above) from 17 Delhi-based schools visited the half-day expo. Of all the people

who visited the expo, 184 filled out a feedback questionnaire. Of these, 13 questionnaires were excluded from the study because it could not be determined whether they were students or teachers. So, a total of 171 questionnaires were used for analysis, of which 161 were from students and 10 from teachers.

2.4 Ethical Compliance

The visitors were informed verbally that the inputs may be used for research purposes and to improve future visits, maintaining anonymity. Feedback submission was voluntary, and signed feedback forms were collected immediately after the visit.

2.5 Study Limitation

The study is limited to the data collected for a single event.

3. Results

3.1 How useful was knowledge sharing in our programme?

The visitors were asked to rate overall knowledge sharing on a five-point scale (Table 1). Of the 171 responses, the majority of students (43.48%) and teachers (50.00%) rated knowledge sharing as very good. This was followed by 36.65% of students and 40.00% of teachers rating knowledge sharing as excellent. This may be because, for each section of the visit, researchers and scientists working in that area/division interacted with the visitors.

Table 1: Response of students and teachers to the knowledge shared during the visit

	Students		**Teachers**	
	No.	**Percent**	**No.**	**Percent**
Excellent	59	36.65	4	40.00
Very Good	70	43.48	5	50.00
Good	27	16.77	1	10.00
Average	5	3.11	-	-
Poor	-	-	-	-
Total	**161**		**10**	

3.2 How useful is this programme in your profession / studies?

The visitors were asked to rate the visit's relevance to their profession or studies (Table 2). Among teachers, 60.00% thought it was of little value, while the remaining 40.00% thought it was extremely valuable. This extreme variation may be relevant to their subject domain. In contrast, the majority (84.47%) of the students found this visit extremely or quite valuable. One student thought that it was of little value, whereas 22 thought it was of some value. It will be interesting to explore the reasons behind students' thoughts. To understand what kinds of visits or experiences would inspire them towards science.

Table 2: Response of students and teachers to the relevance of the visit

	Students		**Teachers**	
	No.	**Percent**	**No.**	**Percent**
Extremely Valuable	64	39.75	4	40.00
Quite Valuable	72	44.72	-	-
Some value	22	13.66	-	-
Little value	1	0.62	6	60.00
Did not answer	2	1.24	-	-
Total	**161**		**10**	

3.3 Time given for demonstration

The majority of students (69.57%) felt the visit duration was sufficient (Table 3). The majority of the teachers (40.00%) thought the duration was more than enough, whereas only 7.45% of the students shared the same opinion. About 15.00% of the students and 20.00% of the teachers didn't answer the question.

Table 3: Response of students and teachers to the duration of the visit

	Students		Teachers	
	No.	**Percent**	**No.**	**Percent**
More than Enough	12	7.45	4	40.00
Enough	112	69.57	3	30.00
Not Enough	14	8.70	1	10.00
Not answered (-)	23	14.29	2	20.00
Total	**161**		**10**	

3.4 If we organise programme of this type again in future, would you recommend it to your colleagues?

Although 60.00% of the teachers found the visit to be of little use to their profession, 90.00% agreed that, if the visit were organised again, they would recommend their colleagues to visit the Institute (Table 4). Among students, 77.02% agreed they would recommend the visit to their peers. About 20.5% of the students were undecided about this.

Table 4: Response of students and teachers to recommending a visit organised in future to colleagues

	Students		Teachers	
	No	**Percent**	**No**	**Percent**
Yes	124	77.02	9	90.00
No	4	2.48	1	10.00
Not answered (-)	33	20.50	-	-
Total	**161**		**10**	

3.5 Your suggestion for identifying topics for future programmes. An additional area of interest that the open day should have covered, but has not been covered.

Visitors were asked to suggest topics that they thought should be included in the visits. The students suggested that topics like the Indian army, space technology, movie-making on science,

physics, chemistry, plant breeding, tissue culture, human body functions, outer space, aliens, wormholes, white dwarfs, climate change all over India, food science and technology, animal sciences, medieval plants, biotechnology, inventions and theories, should be included. The students offered a variety of suggestions, indicating their engagement during the visit. Some of the suggestions include

- Use of animated video/film shows
- Models for virtual understanding
- Experiment/Practical for students
- Talks/presentations so students can get attracted towards pure sciences
- Priority for the Hindi language to be used
- Group activities with scientists with hands-on experience
- Information on the medicinal uses of the common plant
- Sale of medicinal plants
- Smaller groups for focused understanding
- Frequent/regular visits to be organised
- More time for demo/students to converse/ to inspect the exhibition
- Longer visits (2-3 days) to be organised
- Display of more preserved animal specimens and microscopic specimens
- Highlighting the scope for students in such fields
- Explanation of identification aspects
- Organise competitions like a quiz on Botany

4. Discussion

According to Krepel and Duvall, a field trip is a school or class trip with educational intent, in which students interact with the setting, displays, and exhibits to gain an experiential connection to the ideas, concepts, and subject matter (Nawi & Azmi, 2016). In a large-scale study in which students visited an interactive space center, Jarvis and Pell (2005) observed that 20-25% of children developed a new interest in science and in pursuing a science career. Five months post-visit, this interest

was retained in the majority of the students. It has been noted that social interaction during a museum visit is a crucial and significant part of the field trip (Falk &Dierking, 2000;Dierking, 2002). Also, a study found that a teacher's comprehensive preparation before a visit to the science center led to a greater appreciation of the learning opportunity (DeWitt and Storksdieck,2008). In the present study, one of the schools took this opportunity and assigned a task to its students to be completed during the lab visit. The students were asked to record the names and uses of 10 medicinal plants on display, thereby turning the visit into a practical learning experience.It highlights that small, thoughtful initiatives by teachers and schools can significantly enhance students' field visit experience. DeWitt and Storksdieck(2008) noted that communication with colleagues and teachers during visits is also vital for the exchange of information among students.

Further, it was observed that both students and teachers shared different perspectives on what activities could be included in the visits. The teachers commented that talks/presentations could be arranged to attract students to the pure sciences. For future visits, different opinions emerged from the students. Arranging more open-day visits, longer durations, smaller groups for focused learning and attention, and prioritising communication in Hindi were among them. Both the teachers and the students were interested in hands-on experiments. In addition to raising curiosity about science, research clearly shows that access to hands-on science activities improves student achievement in science. All students merit an appealing experience with science so they become life-long learners and critical thinkers (Jonas & Stapleton, 2017). Also, students must be encouraged to understand scientific phenomena, recognise advances in S&T, and adopt a scientific attitude for continued science education at school (Arslan et al., 2017).

5. Conclusion

Not all students have the opportunity to gain hands-on experience in a research lab. Planned laboratory visits/open days should be used to expose them to the real lab environment and to develop a keen sense of pursuing and developing excellence in

science subjects. Institutional visits can serve as a motivating factor, but to make a long-lasting impact on students and capture their attention to pursue science-based careers, labs also need to organise interesting, engaging visits, as students are inquisitive by nature. If their curiosity is further piqued, students will turn to science in search of answers. The current study indicates that students and teachers are interested in lab visits but want more interactive activities on diverse topics. The study had a limitation in that it was based on a single visit of CSIR-NIScPR by Delhi-based schools. More definitive perceptions may emerge if a pan-India longitudinal assessment of a greater number of visits is undertaken.

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