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ARTICLE

# Mobile Science Exhibition: An Impact Assessment Study

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**ABSTRACT**

The Mobile Science Exhibition launched by the Pushpa Gujral Science City (PGSC), Kapurthala takes science to the doorsteps of the rural population and impresses upon them the significance of Science and Technology for betterment of the quality of their lives and exposes them to some of the issues and challenges related to sustainable development. The broad components of the exhibition are health education, genetic determination of sex of the offspring, energy education and awareness, waste management, water management and environment education.

A study was conducted to assess the impact of the Mobile Science Exhibition on the scientific awareness related to key issues like health, sanitation, environment and society among the rural children. The overall impact of MSE was also assessed and analysed before and after their visit. An important mechanism to reach out to the unreached and develop a knowledge-driven society, the exhibition enriched the knowledge and skills of the students in various areas of science and technology which is likely to have societal impact and is essential for ensuring sustainable development. Mobile Science Exhibition proved to be a vital and powerful media for popularisation of science creating a scientific temper across the state.

**KEYWORDS:** Mobile Science Exhibition, Impact, Health Awareness, Energy Education, Water and Waste Management

## Introduction

Today, most of the world's pressing issues are science-based, including climate change, disease, energy conservation, food security, water crisis, pollution, etc. and if we intend to rationally create a policy that effectively addresses these critical issues and regulates new technologies, we need global, scientifically literate citizens.

Much of the science we read in books is hard to imagine and the innumerable scientific phenomena and processes cannot be encapsulated in textbooks. It is even more difficult for children to grasp the complexities associated with such phenomena.

Science Centres and Science Museums, therefore, offer a helping hand, deconstruct complex ideas and explain them through interactive exhibits. Visits to science centres play an important role in complementing school activities, because the experiences offered at the centres are exciting and enjoyable. Science Centres also have positive impact on students' attitudes towards science. Visits to Science Centres increase students' interest, curiosity, and attentiveness towards science. Experiencing science through this stimulating medium can change visitors' behaviours associated with science and technology, helping them to feel more informed about science as they engage with the activities. While the urban and the semi-urban masses are catered through permanent science museums/centres in cities and towns, there was a need to bring the rural people under the purview of science and hence the concept of mobile science exhibition was developed.

**Mobile Science Exhibition: Reaching the Unreached**

The Pushpa Gujral Science City, a joint project of the Government of India and the Punjab Government, was opened to the public in March 2005. In over a decade of its opening it has attracted more than 4 million visitors. The number of visitors seemed quite less when compared to the total population of the state i.e. approx. 2.8 crores. Moreover, of the total population of the state, around 62.52 percent live in the villages/rural areas.

It was, therefore, felt that to extend the reach of the Science City to the section of the society that could not reach here the Mobile Science Exhibition should be launched. Accordingly, the Mobile Science Exhibition (MSE), an outreach programme of Pushpa Gujral Science City for Science Communication, was started in 2015 in collaboration with the National Council of Science & Technology Communication (NCSTC), Department of Science & Technology, Government of India and the Punjab Technical University to take science to the doorsteps of the rural population and impress upon them the significance of Science

and Technology for betterment of quality of their lives and expose them to some of the issues and challenges related to sustainable development. The MSE is an attempt to communicate science in the rural areas targeting the population unable to visit the Science City and aimed at reaching out to people from all walks of life through fun and accessible scientific content, and removing the barriers to engagement.

The exhibition comprises 34 interactive exhibits and information panels giving the students/visitors an opportunity to learn through the process of interaction and discovery. The broad components of the exhibition are Health education, Energy education and awareness, Waste management, Water management and Environment education. The bus is also equipped with a mobile planetarium and high-powered telescopes to hold night sky watching sessions where visitors under a starry night sky enjoy telescopic views of beautiful objects, including planets, nebulae, star clusters and the Moon. Demonstrations and special programs are also taken up to educate the visiting public about the renewable energy sources, water testing and clean water properties.

A brief overview of the exhibits is as under:

1 **Our Body:** An introduction to our body through the Human Torso and skeletal system.

2 **Heart Station:** Heart station consists of a cross-section of the Heart, exercise bike with Pulse Rate Monitor, animation on mini monitor screen showing working heart and transparent model of normal and clogged artery.

3 **Powering up station:** Exhibits showing the digestive system, respiratory system, BMI calculator and touch-screen based fun game named “Make Your Plate”.

4 **Hereditary station:** Comprised of rotating 3 D double helix model of DNA, chromosome and karyotype. An interactive exhibit demonstrating the genetic basis of sex determination showing how female is not responsible for the sex of the child.

5 **Eye station:** Cross-section of eye where visitors explore the anatomy of the eye looking at the different structures of the human eye and Touch-screen with ‘Ishihara Colour

Blindness Test'. An eye testing exhibit was also placed in the exhibition.

6 **Lifestyle station:** Lifestyle diseases exhibit which emphasized the importance of knowing the ABCs of hypertension and diabetes, the seriousness, ways to control and the benefits of controlling and also the effects of alcohol & drugs on different organs. A model displaying different stages of liver damage was also exhibited.

7 **Energy and environment:** Exhibit demonstrating awareness on energy conservation, generation and distribution of electricity, journey from source to home, how electricity is produced and transmitted, transformation of various forms of energy into other forms.

8 **Safe drinking:** Exhibits demonstrating various water purification systems, various standards of water purification, sewage treatment plant,

9 **Greenhouse effect exhibit**

10 **Noise pollution exhibit**

11 **Biodiversity:** Exhibit showing national and Punjab state bird, animal, flower and tree plus critically endangered species. Exhibit demonstrating food chain and importance of each organism in the food chain.

12 **Biotoilet model** displaying the technology involved in biotoilets and the benefits of biotoilets.

Other exhibits in the bus relate to identifying disease agents in which visitors learn about how bacteria, viruses, protozoa look and prevention measures. In an exhibit, visitors can look at their hands under the magnifying glass and realize that our hands are prime targets for contamination by germs.

## Objective of the Study

To assess the impact of Mobile Science Exhibition on the scientific awareness related to key issues like health, sanitation, environment and society among the rural children.


**Figure 1: Outside and inside views of the Mobile Science Exhibition**

## Methodology

The Mobile Science Exhibition (MSE) project emphasizes on creating awareness about local issues requiring communication and outreach through developing key exhibits and designing appropriate communication strategies, empowering women as well as sensitization of the highly patriarchal society through non-formal education.

Science City in coordination with the Department of Education, Punjab drew a schedule for the visit of the Mobile Science Exhibition Bus in different districts to cover rural students to the maximum. Core areas at block level of different districts were demarcated and the Mobile Science Exhibition Bus was halted in these core areas. School students from

neighbouring rural areas in the vicinity of 5 km of the core area were mobilized to visit the bus.

The MSE covered all the 22 districts (more than 100 blocks and 1500 villages) across Punjab and received more than 2 lakh visitors over a period of two years.

The sites where exhibitions were held were challenging and required selection. These had to be easily approachable from the highway, wide enough for the movement of a heavy transport vehicle and the surface of the road strong enough to bear the weight of the vehicle. Moreover, the sites had to be in a central area so that village people and school students could easily approach the exhibition. Since the primary target group was the school students, the schools were chosen as a parking site for the exhibition bus. The schools usually have play grounds which are ideal for the exhibition. Another advantage in locating the exhibition bus inside the school campus is that the students get an opportunity to visit the exhibition usually during school hours and then on their return home they persuade their parents and relatives to visit the exhibition.

The objective was to give maximum coverage. A strict schedule was followed to cover backward villages/districts on priority. The exhibition bus remained in the school for 2-3 days.

The impact of the exhibition in inculcating scientific temper was analysed through a questionnaire distributed to a set of 350 visitors before and after their visit to the MSE. In order to prevent annoyance to visitors, the questionnaire was kept short and awareness and their views on some key issues like Health, Energy, Water conservation, Waste management, Drugs and Alcohol abuse, Genetic Basis of sex determination as well as overall impact of MSE was assessed and analysed before and after their visit.

## Key Findings

***Awareness on Health Issues:*** Healthy eating can be defined as a balanced intake of food to meet the physiological needs of the body. The aim of this survey was to establish the level of awareness of the students about the basic principles of healthy eating and how much they know about ‘useful’ and ‘harmful’

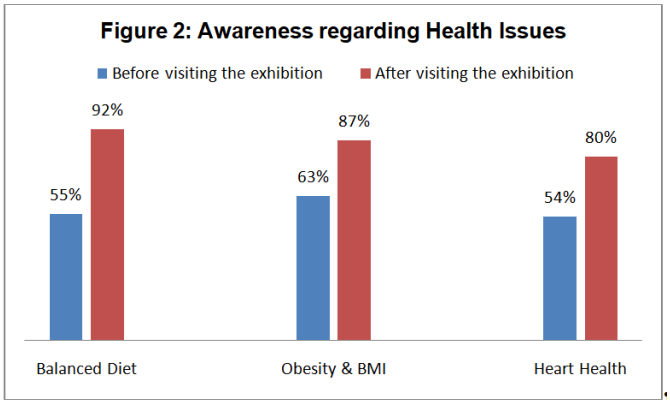
foods. The exhibit named Heart station, Calculate your BMI and Balanced Diet-Make your plate were installed in the exhibition. The Heart Station displayed cross-section of heart, working of heart, clogged and unclogged arteries. In the Balanced diet exhibit, visitors played a fun game where lots of different foods appeared on the screen. They would select the various foods and drag them to their plate. The plate had various colours, each colour depicting specific food groups. The visitors dragged the foods to the right coloured part of the plate and kept going until they put all the food in the right place.

The respondents were questioned about balanced diet, BMI and Heart Health. Before visiting the exhibition, 55% visitors gave correct answers about Balanced Diet and after visiting the exhibition 92% responded correctly about Balanced Diet.

Before visiting the exhibition, 63% knew about obesity and BMI and after the exhibition 87% were aware about Obesity and BMI.

Regarding Heart health, 54% were aware about which fats causes clogged arteries and heart attacks before visiting the exhibition and after visiting the exhibition 80% got awareness regarding saturated and unsaturated fats and what causes heart attacks (Figure 2).

The study found that the after visiting the exhibition the visitors attained relatively high level of awareness of the useful and harmful food products and formed correct understanding about healthy eating, good and bad food early in their education.



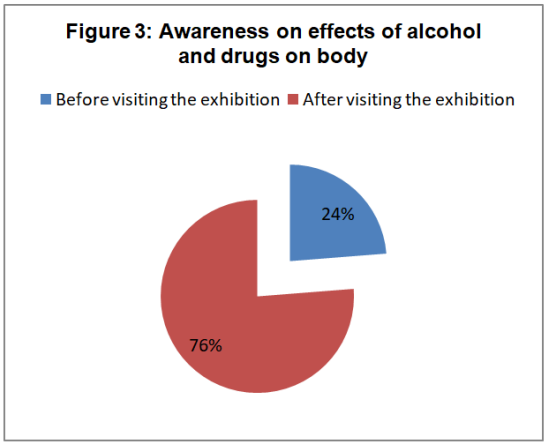
***Alcohol and drugs awareness*:** An important social and health issue impacting Punjab is drug abuse. Over the last couple of decades, drug consumption has been steadily rising in Punjab to the point that some experts have even used the term 'epidemic' to describe it. In recent years, there have been many anecdotal reports suggesting a significant problem of drug dependence in Punjab (DNA, 2014). A study was commissioned by the Ministry of Social Justice and Empowerment (MoSJE), Government of India to estimate the numbers of opioid dependent individuals in Punjab. It was estimated that a huge population is affected by opioid drugs: about 2.3 lakh dependent individuals and probable 8.6 lakh opioid users (SPYM and NDDTC, 2015).

Knowledge is power, and with accurate information about the topic, a person is more likely to make a fact-based and informed decision. When educating people, all drugs should be covered, regardless of the strength or perceived risk of harm. While opioids, cocaine, and methamphetamine are viewed as "hard drugs" and therefore have serious consequences, "minor drugs" such as alcohol can still be addictive and are frequently abused. People of all ages should be aware of the damage that all drugs and alcohol have the potential to inflict on the body, mind, and relationships.

An exhibit demonstrating impact of drugs and alcohol on different body parts was installed in the bus. A human model displaying harmful effects of alcohol and drugs on different organs was exhibited. Awareness regarding drug and alcohol abuse was assessed in the present study. 4% respondents admitted to consuming alcohol and drugs at some point of time but were not regular users (Fig. 3); 24% respondents were aware of the ill effects of alcohol and drugs on the body before visiting the exhibition whereas 76% got aware of the impact of alcohol and drugs on body parts after visiting the exhibition.

***Awareness on safe drinking*:** Clean drinking water is a basic human need. Unfortunately, people still lack reliable access to this precious resource. The problem is particularly acute in Punjab. The hydrochemical analysis of the study area in parts of Malwa region of Punjab revealed that the groundwater is

highly contaminated except for a few locations. The majority of water samples were found to be beyond desirable limits as prescribed by WHO standards and Indian standards for drinking water. Samples from almost all the locations were classified as hard and contained high TDS which indicates its unsuitability for drinking (Kaur, Bhardwaj & Arora, 2017).



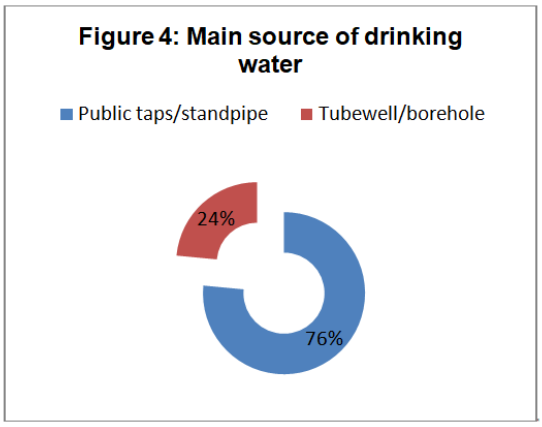

In the present survey, 76% of the respondents informed that they used water from tubewell whereas 24% used water from public taps (Fig. 4).

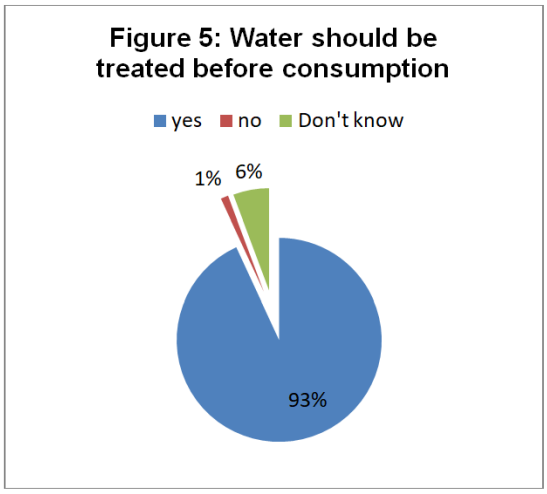
Awareness is a determinant of the demand for safe drinking water. To estimate and analyze the magnitude of awareness for safe drinking water practices, the need for potable water was questioned. It was found that majority of the respondents were not aware of the importance of safe drinking water.

An interactive exhibit demonstrating different water treatment methods was designed and exhibited. The first part of the exhibit was an interactive diorama showing drinking water treatment process. The diorama depicted a river/stream in the background and various steps of water treatment process like chemical addition, coagulation, sedimentation, filtration, disinfection and distribution with the help of illumination and different colours of water discharge.

The second part of the exhibit depicted six water filtration techniques on top. The exhibit had eight push buttons depicting various impurities they remove. Visitors pressed the button and the corresponding light illuminated showing to what extent the given system eliminates impurities.

After getting demonstration on safe drinking and different treatment methods, 93% respondents felt that water should be treated before drinking and were now aware of the different treatment methods (Fig. 5).



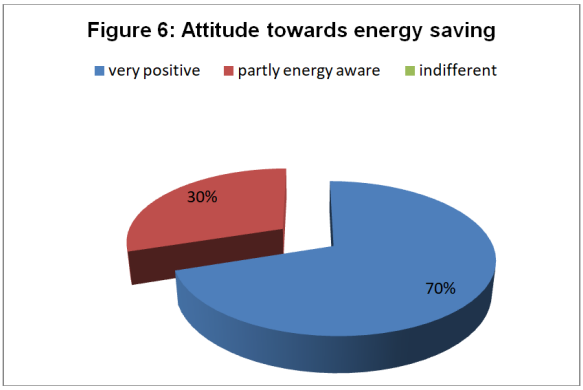



***Attitude towards energy saving*:** An increasing hazard in our society is the overuse of energy. Over the past decades we have seen an increase in the amount of energy consumed in households on account of lack of awareness about its harmful impact on the environment. There is a limited amount of non renewable energy sources and it is important to budget these sources or use renewable energy.

To create awareness on renewable energy sources, demonstrations and special programmes were developed to educate the visiting public. Further, solar power was used to run the exhibits. Solar panels were placed on the bus to charge the battery and through an inverter electricity was supplied to exhibits thus providing live demonstration uses of Solar Energy sources.

The exhibit Bulb vs CFL vs LED demonstrated the comparison between Incandescent lamp, CFL and LED indicating the wattage consumed and light intensity (luminescence) on the respective meters (Watt & Lux meter). CFLs and tubelights were the most common source of illumination in households.

Before visiting the exhibition, 92% respondents were aware of the use of CFLs and tubelights in homes whereas 6% used LEDs and only 2% used Incandescent bulbs. After visiting this exhibit 70% respondents were very positive in saving energy and believed in making a difference (Fig. 6). 76% voted for LEDs as their future preference for their house.

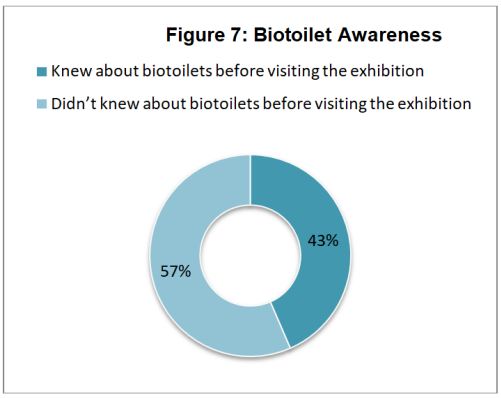


Other exhibits imparting awareness about energy conservation and sources were Generation and Distribution of Electricity and Conversion of Solar Energy to Electrical Energy and Conversion of Electrical Energy to Light.

***Awareness about Biotoilets*:** According to UNICEF and WHO estimates, one-seventh of the world population still openly defecates due to lack of proper toilet facilities. Of these, 60 per cent live in India. On a global scale, it is estimated that yearly 10 million children die under the age of five due to improper sanitation. Of these, 2.4 million children belong to India. The provision of proper toilets could save the lives of more than two lakh children in the world, according to the UN. The countries where open defecation is most widely practised are the same with the highest numbers of under-five child deaths, poverty, and large wealth disparities (Mayarani, 2014).

The MSE also highlighted the issue of sanitation through an exhibit on biotoilet displaying technological information about its benefits. 57% were not aware about biotoilets before visiting the exhibition (Fig. 7).When asked if they would recommend biotoilets now after knowing the benefits of the biotoilets, 92% gave a positive response.

Another interactive exhibit highlighting the problem of waste management was Sewage Treatment Plant displaying the various stages of sewage treatment. A critical component in any waste management program is public awareness and participation, besides appropriate legislation, strong technical support, and adequate funding. Waste is the result of human activities and everyone needs to have a proper understanding of waste management issues, without which the success of even the best conceived waste management plan becomes questionable (Hasan, 2004). Unfortunately, budgetary allocation for health sector in India is only 2.5 per cent of GDP, a fraction of the allocation in the Western countries (Manjunath, 2013). The need of the hour is to address basic issues such as safe drinking water, proper sanitation, checking of environmental pollution, better connectivity and awareness about various health schemes.

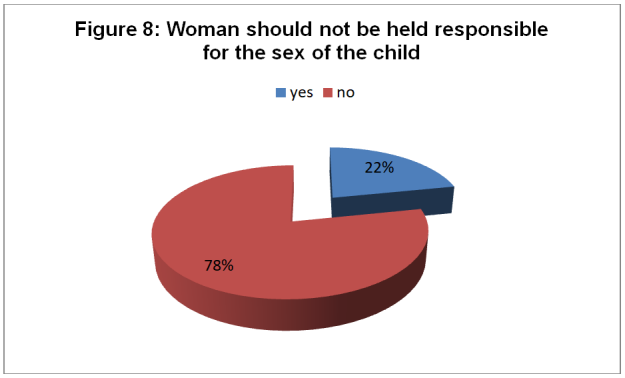


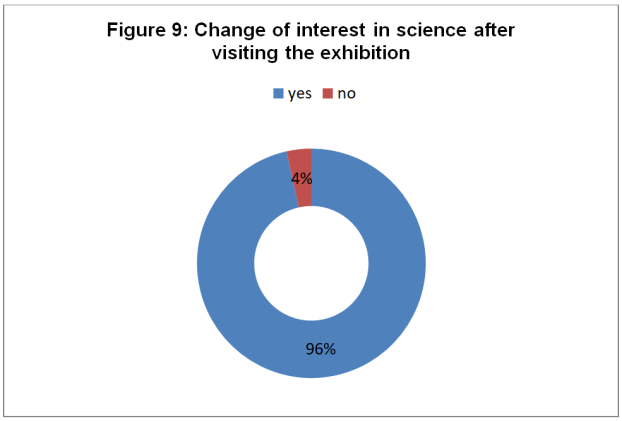

***Awareness on genetic basis of sex determination*:** Punjab has a strong patriarchal society which is clearly demonstrated in the gender differences in education, health and socialization. Even today where ignorance of medical knowledge still prevails, it is the woman who is still incriminated and blamed for repeatedly giving birth to a female child. There is a need to create awareness and empower women on this issue in the society. This issue was addressed through an interactive exhibit "Who is responsible for sex of the child" in the MSE which tries to break the myth of the responsibility of women alone in determining the sex of the child. The exhibit demonstrated that sex is determined by two chromosomes, X and Y. A female is XX, a male is XY. Since women completely lack the Y chromosome, they always contribute an X chromosome to the baby. The sex is determined by whether the sperm that fertilizes the egg is carrying another X or a Y.

According to the survey, 78.2% of the respondents felt that a woman should not be held responsible for the sex of the child (Fig. 8). Of these, 84.5% said that they were not aware earlier about this fact and it was only through this exhibit they got sensitized.

***Change in interest in science after visiting the exhibition*:** Science improves the quality of daily life, underpins prosperity and increases our readiness to face the challenges of the future. Our future economic prosperity and our ability to become an

Innovative Nation depends on the successful exploitation of science and technology. Having more people with high level of science skills benefits the economy by meeting potential skills shortages and increasing the productivity and capacity of businesses to innovate, and the prosperity of the country as a whole. The decreasing interest in science among youth in both primary and secondary educational systems has been widely reported and documented. Many students think science is too hard, uninteresting, and irrelevant (Aschbacher, Ing & Tsai, 2013). Studies indicate that students are weaning away from science considering it as 'drab' and 'difficult'.




Science can be made 'fun' and 'easy' through such programmes as the MSE as 96% of the students felt that they had

become more interested in science after visiting the exhibition (Fig. 9). 85.7% children said that after visiting the exhibition they have made up their minds to opt for major in science in college.

## Most liked exhibit

The most liked exhibit in the bus was the heart station followed by drug abuse and genetic basis of sex determination.

## Conclusion

In our rapidly changing world, there is a great need for public understanding of science and technology to create a more science literate society at all age levels. Mobile Science Exhibitions have great potential to promote science and knowledge as important instruments to overcome underdevelopment and social issues and can impact public understanding, attitudes and behaviours toward science and technology. Such programmes are the need of the hour when 68% of the total population is rural. Aimed at reaching out to people from all walks of life through fun and accessible scientific content, and removing the barriers to engagement, the Mobile Science Exhibition, an outreach programme of Pushpa Gujral Science City, proved to be a vital and powerful media for popularisation of science creating scientific temper across the state.

## Acknowledgements

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