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REPORT

Reaching out to the Unreached: Mobile Science Exhibition

RAJESH GROVER[1], SHEERAJ BATISH[2] AND LOVELEEN BRAR[3]

[1]Director, Pushpa Gujral Science City, Kapurthala

[2]DGM, Pushpa Gujral Science City, Kapurthala

[3]Scientist B, Pushpa Gujral Science City, Kapurthala

Corresponding Author: loveleen_brar@ymail.com

ABSTRACT

Permanent science museums and centres cater only to the urban masses in cities and towns. Most science museums/centres have limited themselves to focus on the youth and have nothing to offer or engage other sections of the society. To bring the rural people under the purview of science, an outreach programme to include the rural masses was conceived which could enable the Science City to carry its programme to the doorsteps of the target groups and spread the message of science to work towards sustainable development. Over time, PGSC has become a bridge between the scientific community and the society.

The Mobile Science Exhibition launched by the Pushpa Gujral Science City (PGSC), Kapurthala intends 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 broad components of the mobile exhibition are health education**,** genetic determination of sex of the offspring**,** energy education and awareness**,** waste management, water management and environment education. A participating approach is adopted to trigger the scientific thought process and facilitate informed decision making by the masses. The interactive exhibits and information panels give the students/visitors an opportunity to learn through an interactive process. Mobile planetarium and high powered telescopes to conduct night sky watching sessions equipped in the bus will fascinate visitors to enjoy telescopic views of celestial objects. The mobile science exhibition programme emphasizes developing an informed and knowledgeable society and pull out the masses from the clutches of the superstitions. Among other things, the project also intends to

promote a sense of both local and global responsibility, encourage future-oriented, anticipatory thinking, build recognition of global interdependence and emphasize cultural change that embrace the values of sustainable development.

KEYWORDS: Mobile Science Exhibition, Health, Energy Education, Water Management, Waste Management, Environment Education

Introduction

Science Centres/Museums, their missions, their civic responsibilities, and their modes of engagement with communities are in a constant process of transformation in response to social and economic imperatives at the local, national and global levels (Kelly, 2006). Travelling exhibitions for carrying collections of art and culture from large museums, art galleries, and cultural institutions to the provinces or to smaller institutions in districts have been in vogue for more than a century.

Travelling exhibitions originated in one of the leading museums of Great Britain namely, the Victoria and Albert Museum, London with its launch in 1850. These were adopted in Canada in the early 1920s, followed by the United States, South Africa and Australia because of their usefulness. Since the close of the war in 1945, this activity increased and was spread internationally with museums in countries like Canada, Austria, Czechoslovakia, Denmark, Norway, the Netherlands, Poland, Sweden, Switzerland, Italy, France, England, Wales, Scotland, Ireland, Israel, Lebanon, India, Pakistan, Mexico, Brazil and the Union of South Africa (Bose, 1983).

Science and technology is an integral part of the socio-economic developmental process of a country. Science Centres and their various outreach programmes provide a significant range of educational, social, cultural and economic benefits to their communities and various studies on their impact and the assessment of the extent of the influence of the scientific knowledge implicated by the society have indicated positive outcomes. The constitution of India also, vide Article 51 A, Fundamental Duties specifies that *it shall be the duty of every citizen of India (Pylee, 2003) to develop scientific temper, humanism and the spirit of inquiry and reform; to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures.*

Various S&T Policies have emphasized development of a scientifically oriented society. Extensive work started at the Birla Industrial and Technological Museum (BITM), Kolkata from the beginning of 1966 on making use of travelling exhibitions for dissemination of science and technology to the masses in the rural areas of Eastern India (Bose, 1983). The S&T Policy of the Government of India 2003 (Department of Science & Technology, 2005) and Dr. APJ Abdul Kalam, Former President of India also emphasized on the need to integrate science and technology into all spheres of national and local activity and to instill scientific temper into the population at large (Kalam, 2010). Towards this end, the National Council of Science Museums (NCSM) has started 23 Mobile Science Exhibition (MSE) buses at different centres to disseminate science in the rural areas. The exhibitions target the population that is unable to visit existing science centres (NCSM, 2015).

In 2007, another unique dimension was added to the travelling exhibition with the Department of Science & Technology, Government of India, introducing the concept of Science Express, a unique science exhibition mounted on a 16-coach AC train, thus utilizing the extensive rail infrastructure of India for science communication. It was flagged off on 30 October 2007 by the then Hon'ble Prime Minister of India. The exhibition train has since crossed 15 million visitations. Science Express has thus become the longest running and the most visited mobile science exhibition in India and has created six 'Limca Book of Records' in its journey so far. From 2007 to 2011 the train was running as 'Science Express' displaying the world of micro and macro cosmos, spreading awareness about the strengths of science in meeting global challenges, including latest discoveries and innovations in the field of modern science.

In the year 2012 with India's presidency at the Conference of Parties to the Convention of Biological Diversity, the Science Express was redesigned on the theme 'Biodiversity'. After seven successful tours across India, the Science Express was redesigned as Climate Action Special (SECAS) and was flagged off from Delhi on October 15, 2015, with a plan to halt at 64 locations in 20 States, covering 19,800 kilometres. Its focus was on generating an interest and starting a dialogue with children

about climate change, its impact, and how they can help reduce their carbon footprint (NCSM, 2016*).* The limitation of Science Express is that it halts only at major stations where there is a provision for parking for a couple of days.

Mobile Science Exhibition (MSE), an outreach programme of the Pushpa Gujral Science City for science communication in collaboration with the Department of Science & Technology, Government of India and Punjab Technical University (PTU), is an endeavor to take science to the doorsteps of the rural population. The programmes impresses upon the significance of Science and Technology for betterment of quality of lives and to expose target audiences to some of the issues and challenges related to sustainable development. The focus of MSE is on border areas where science programmes are extremely limited, as well as, in the sub-mountainous parts of the State (the Kandi belt) with difficult terrain where rail network is absent and road network is limited.

Considering that Punjab has a high drop-out rate at the school level and drug abuse is rampant amongst the youth, the MSE project has identified several social issues that need to be scientifically addressed i.e. gender disparity, female feticide, health and hygiene, drug abuse, HIV/AIDS, etc. Similarly, environmental issues like air and water pollution, natural resources degradation, waste management and loss of nature, farm and wild diversity have been highlighted as issues of major concern.

Objectives

The MSE project, therefore, intends to attain the following objectives:

- To develop an informed and knowledgeable society,
- To create sensitivity on issues related to sustainable development,
- To enhance public awareness of the importance of science and technology in everyday life and learn through the process of interaction and discovery,
- To inculcate scientific aptitude and temperament amongst the unreached population, especially among the youth and women,

- To organize awareness activities and disseminate scientific information on various aspects to dispel illogical beliefs and superstitions and
- To promote inquiry based and hands-on learning.

Methodology

The 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. To promote scientific temper and motivate youth to take up careers in science and technology, hands-on approaches have been designed using working and interactive models, visual images, video clips and multimedia exhibits, activities such as demonstrations, quiz contest, expert lectures, guided tours of the exhibition, etc.

The project targets the rural masses, in general, and students, in particular, in all the districts of Punjab State facing air and water pollution due to industrialization and intensive agricultural practices.

Discussion

There is significant evidence that interactive science exhibitions increase visitors' knowledge and understanding of science and provide memorable learning experiences which can have a lasting impact on attitudes and behaviour. Research in learning in Science & Discovery Centres has largely focused on cognitive learning outcomes since these are often the easiest to both define and to assess. Many studies have shown that there is at the very least a short-term increase (over weeks or months) in the range and depth of visitors' conceptual understanding. For example, Anderson et al. (2000) studied the impact of various interactive exhibits on school children's understanding of the principles behind electricity and magnetism. The researchers found that what was experienced in the museum was actively interpreted by the pupils (rather than just passively accepted) and incorporated into their existing mental models. Subsequent experiences of

electricity and magnetism were likewise incorporated into the mental models developed during the museum experience.

Similarly, Beiers & Mc Robbie (1992) found evidence for the impact of a series of interactive exhibits upon children's understanding of the scientific principles of sound. A number of studies in several countries have revealed that informal exposure to science, comprising visits to science centres, has a major influence in career choice. In India several successful scientists attribute their career choice to their visit to science museums and centres in formative stages of their educational path. A glimpse into the visitors' book of any science centre will reveal that generations of scientists attributed their lifelong interest in science to their childhood visit to Science Museums (Rautela and Chowdhary, 2016)

Punjab Scenario and Need for Scientific Awareness

Punjab has witnessed remarkable growth in literacy rates during 1991 (58.51%) to 2001 (69.95%). *The Human Development Report – Punjab, 2004*, however, has expressed greatest concern about a few sections that do not have access to education. Census-2001 figures have shown rural-urban differentials along with gender differentials in the literacy attainment for the total population of the state which is not very encouraging. In addition, recent research studies (Mehta, 2007) pointed out that the state (Punjab) with 5-10 percent drop-out and 10-15 percent retention rate is placed along with some of the least developed States like Bihar and Jharkhand. Moreover, an increase in the drop-out rates from 1998-1999 to 2002-2003 has also been reported which presents a grim scenario for the level of educational attainment of the state. Further, the situation of school drop-out of girls looks more depressing with the gender-differentials in the drop-out rates indicating higher drop-out rates of girls.

Gender issues in education and women's empowerment are well known and accepted as a strategy for intervention. Punjab has a strong patriarchal society which is clearly demonstrated in the gender differences in education (Department of Planning, Economic & Statistical Organization, 2009). As per census 2011, the sex ratio of Punjab is 893 females per 1000 males, which is

below the national average of 940 females. Further, among 0-6 years age group, only 840 females against 1000 males are recorded, a trend that can have serious repercussions in the future (Census of India, 2011). Hence, there is a need to create awareness and empower women on this issue in the society. This issue has been addressed through an interactive exhibit "Who is responsible for sex of the child" in the MSE and tries to break the myth of the responsibility of women v/s men towards determining the sex of the child.

Another important social and health issue impacting Punjab is drug abuse. Gupta (2014) in his article in the *Hindustan Times* on August 19, 2014 has reported that four out of ten men are addicted to drugs in Punjab. The extent to which the problem is specific to the State can be seen from the fact that roughly 60 per cent of all illicit drugs confiscated in India are seized in Punjab, as reported by Yardley in an article in the *New York Times* on April 19, 2012 (Yardley, 2012). A report published by the Punjab State AIDS Control Society (2015) mentioned that 31,961 AIDS cases in adults were reported till April 2015 and majority of the affected persons were truckers and migrant labourers. An attempt has, therefore, been made to create awareness on these issues through display of information panels and interactive exhibits in the MSE. A special section that features anatomical and physiological aspects of human body, functioning of human body and various systems, information panels on how different kinds of drugs affect various vital parts of the body, health and hygiene and lifestyle diseases, HIV/AIDS, etc. has been used to create awareness on issues of concern amongst the target population.

Further, air quality in Punjab has considerably deteriorated due to industrial, vehicular and agricultural pollution. Massive growth of vehicles (360154 in 1981 to 5711715 in 2011) compounds the air pollution from agricultural practices like burning of paddy straw in fields during the months of October and November and inappropriate air pollution control devices in industry contribute to CO_2, CO, Nitrous Oxide, and Sulphur Oxide in the air (Singh *et al.,* 2011). More than 81% of paddy straw (17 million tonnes) being burnt in the fields every year leads to air pollution in rural areas (ENVIS Centre, Punjab,

2015). Awareness programmes on the smoldering problem of wheat straw burning as well as demonstrations on importance of waste management proposed to be organized under MSE are intended to address these issues.

Increased urbanization, change in land use pattern, degradation of natural habitat & pollution, increased demand of timber, deforestation, poaching and illegal trade of wildlife products have affected forest cover and wild life in Punjab. The state is also feeling the effect of climate change as maximum and minimum temperatures in the region have increased by 0.5-1.0^{o}C with respect to the base line 1971-2000. Productivity of wheat, the prime crop in Punjab is likely to go down by over 8% by 2035 due to rising temperature. Forest plantations, of over 16,000 km of area across six districts, in the Kandi belt (lower Shivalik) of the state, are expected to be affected by rising temperatures. Extreme events (high rainfall/floods/heat wave/cold wave/hail/frost) are also reported to cause enormous loss of standing crops, livestock and fisheries (ENVIS Centre, Punjab, 2015).The MSE attempts to raise awareness on these issues as well as on biodiversity conservation through exhibits and films.

MSE will also attempt to raise critical issues like ground water exploitation and deterioration of quality of surface water. The annual ground water deficit in the State is 14.31 Billion Cubic Meter (BCM) with ground water development at 170%. The number of tube wells in the state increased from 3 lacs in 1975 to 13.8 lacs in 2011. Ground water in 80% of total geographical area of the state is now over-exploited and the water table is receding at an average annual rate of 0.7 meters across the state. Other challenges in the water sector include ever increasing demand, canal efficiency below their designated capacity, water logging and potable drinking water accessibility in South Western districts. The MSE also raises public awareness on the issue, guides people on water conservation techniques and motivates the general public to take possible actions. For this, the MSE has been equipped with water testing kits for demonstration of physio-chemical and biological parameters of potable water, etc.

The MSE is also highlighting the issue of sanitation through an exhibit on bio-toilet displaying technological information

about its benefits. To create awareness on renewable energy sources, demonstrations and special programmes have been developed to educate the visiting public. Further, solar power has been used to run the exhibits. Solar panels have been placed on the bus which will charge the battery and through inverter electricity will be supplied to exhibits thus providing live demonstration on Solar Energy.

Furthermore, the MSE has been equipped with a mobile planetarium as well as high powered telescopes to hold Night Sky watching sessions where visitors, under a starry night sky will be able to enjoy telescopic views of beautiful objects, including planets, nebulae, star clusters and, of course, the Moon which will provide the students in rural areas with an exposure to celestial bodies and events, solar system, and the different aspects of modern astronomy.

Conclusion

The mobile exhibition is an important mechanism to reach out to the unreached and develop a knowledge-driven society. It is expected that in the coming times, it will have significant impact on choosing science as a subject of higher education and careers in science. This will also enrich the knowledge and skills of the students in various areas of science and technology which are likely to have societal impact and are essential for ensuring sustainable development.

Youths, potential policy makers and major resource groups are playing an important role in taking up future responsibilities, revolutionizing the concepts and behavior of other stakeholders and acting as a powerful catalyst for bringing about change are the main stake holders. These future leaders have immense potential to mobilize the masses, be adaptable and fill the gap between education and action. Hence, the general public will benefit through this project. The project also envisages to make impact assessment studies about the scientific knowledge gained after the visit of MSE through distribution and filling of a questionnaire by the visitors. The results of the impact assessment studies after analysis are proposed to be published in our subsequent communications.

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