

identification of these stages is useful to localize the position of the analogies, which tends to happen at the cycle association searching transformation, with a tendency to accentuate in a context that encourages critical thinking.

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The trailer of science in informal education in Jalisco, México El tráiler de la ciencia en la educación no formal en Jalisco, México

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Abstract

As a strategy to strengthen the education in Jalisco, mainly with elementary school students and teachers, and social adaptation of science, technology and innovation, through itinerant trailers workshops and exhibitions of scientific experiments are developed in a fun way. This strategy of social adaptation of science has had a significant social impact, facilitating the approach of science, not only for children who are the target population, but for various social groups (like housewives and workers), several of whom are not attending or participating in typical activities of public presentations of science. Furthermore, trailers of science have served as a bridge of communication in regions that do not have options that are specific to large urban areas such as interactive science museums and the options offered by universities and research centers within their academic facilities.

Key words: trailer of science, non-formal education, science communication, social appropriation of science, science for kids.

Resumen

Como una estrategia para fortalecer la educación de Jalisco, principalmente con alumnos y maestros de educación básica y de apropiación social de la ciencia, tecnología e innovación, mediante los tráileres itinerantes de ciencia se desarrollan talleres y exposiciones de experimentos científicos de forma lúdica. Esta estrategia de apropiación social de la ciencia ha tenido un notable impacto social, al facilitar el acercamiento de la ciencia, no sólo a los niños –población meta, pero no exclusiva-, sino a grupos sociales diversos (como amas de casa y trabajadores), varios de los cuales no son asistentes ni participantes comunes en actividades típicas de divulgación de la ciencia. Asimismo, los tráileres de la ciencia han servido como un puente de comunicación en aquellas regiones que no cuentan con opciones que son propias de las grandes áreas urbanas, como los museos interactivos de ciencia y las opciones ofrecidas por universidades y centros de investigación dentro de sus instalaciones académicas.

Palabras clave: tráiler de la ciencia, educación no formal, comunicación de la ciencia, apropiación social de la ciencia, ciencia para niños.

INTRODUCTION

The goal of science museums is providing information regarding methods and discoveries of science and technology, providing in the population an orientation in these topics and raising awareness in the attending audience, so they can have the elements needed to understand, evaluate and judge the different uses and importance of science in society (Bragança, 1997; Beyer, 2000). The first museums were inaugurated in America in the 19th century, with the opening of The Franklin Institute in 1824, in Philadelphia, and the Sciences and Industry Museum of Chicago, inaugurated in 1926 (Koster, 2000).

The first museum of Science in Mexico was the “Museo Tecnológico de la Comisión Federal de Electricidad” (Technological Museum of the Federal Electricity Commission), opened in 1964, and the first interactive museum of science was the “Centro Cultural Alfa” (Alfa Cultural Centre), which was inaugurated in 1978 in Monterrey, Nuevo León.

Beginning in the 1990’s a strong boost was given to science museums in Mexico. In 1996 the “Asociación Mexicana de Museos y Centros de Ciencia y Tecnología” (Mexican Association of Museums and Science and Technology Centers) was created, AMCCYT (by its initials in Spanish), which holds meetings of professional training, publishes institutional statistics and has sponsored the publication of books regarding museography and communication of science (Padilla, 2000; Márquez, 2001).

In Mexico, there are little more than 418 museums focused on topics of science and technology, which mainly address basic and higher education students, but they also receive higher education and post graduate students and a diverse public. These museums are buildings established in the main cities within the Mexican Republic and are distributed around the 31 States and the Federal District; equipped with experiments of engineering and basic sciences, their goal is to strengthen the education and the preference for science and technology among the population, in a fun way, through demonstrations of experiments. Most of the museums and science centers are a mix of exhibition, demonstration and interactive elements (Medina, 2010; AMCCYT, 2015; CONACYT, 2015).

In the particular case of the State of Jalisco, Mexico, it has 11 science and technology museums located in strategic points within the 125 municipalities in the 12 areas into which the state is divided. However, the population dispersion in Jalisco makes it difficult to equally include all the social sectors, especially regarding encouraging and promoting a scientific and technological culture.

The itinerant trailers of science, technology and innovation arose as a strategy of appropriation and social communication of science, technology and innovation to include those sectors that are further away from the big urban locations. The trailers have an annual attendance of tens of thousands of people, (González, 2010; González y Rivera, 2014; COECYTJAL, 2015). This strategy for spreading science and technology on the move has been developed in Mexico in the States of Chihuahua, Distrito Federal, Durango, Michoacán de Ocampo, Jalisco, Morelos, Nayarit, Puebla, Quintana Roo and Tamaulipas. The strategy’s name changes in every State, but essentially has the same goal which is encouraging the preference for science within the population. In Jalisco, it is known as itinerant trailers of science, technology and innovation and by having 7 units it is the entity with the greatest number of trailers (CONACYT, 2015).

Itinerant science museums imply a different concept than the one traditional museums have, which are established physically in buildings in one place. The trailers of science in Jalisco are designed to be exhibited in different municipalities and have as advantages that: 1) the exposition can be seen by more people and in different places, 2) it is a way to promote the preference for science and technology at a larger scale. At the same time, they have as a disadvantage the guaranteeing, in each place where they arrive, the security of all the material goods that they contain.

It is required that the science trailer be located in a public space near basic services (i.e., electricity, toilets and safety) with easy access for visitors. The itinerant expositions are designed to receive small groups (around 30 people per group). The trailer design should require easy assembly and disassembly so that it can be carried out to any place and be returned back to its point of origin for maintenance or to be used as deemed more appropriate. Although “permanent” museums have all the services as an advantage, they are not affordable to all the entity’s population due to travel demands: distance, times and/or transportation costs. (Beyer, 1999; Fernández, 1999; García, 2002; COECYTJAL, 2015).

The goal of the trailer of science is to encourage the curiosity and interest of the student population and the general public, over the different

scientific and technologic disciplines, to stimulate the individual and collective potential, and to raise awareness in the population about the essential role that science and technology play in the intellectual and social development, having as a population target in this case the inhabitants of the State of Jalisco.

The trailer of science is also an important tool as part of the informal education, since it contributes, thanks to the use of several interactive instruments, to the learning of scientific concepts outside the classrooms, several of which are not necessarily a part of the subjects of the course that children would cover at the basic education level. This strategy is part of a communication dissemination program within the context of the so called mobile science, through itinerant spaces of practical science that have gradually consolidated at National level in Mexico and that, due its traits, have the possibility of being “self-sufficient” (understanding by it that all the material and human infrastructure that is needed to have the teaching-learning process done, is transported by the trailer) and get to different municipalities, so that children, adolescents and adults get in touch with science and technology in an informal, fun and free way (González y Rivera, 2014; COECYTJAL, 2015; CONACYT, 2015).

The officially called Itinerant Trailer of Science, Technology and Innovation, is an interactive itinerant teaching classroom that travels among the municipalities of Jalisco – several of them far from urban areas where there is little possibility of participating in “traditional” activities of communication of the science like the ones organized within the walls of museums and university and research Institutes. The itinerant trailer has the purpose of encouraging in children and youngsters the interest and comprehension of sciences in an informal and fun way, complementing what it is taught inside classrooms of schools and, beyond that, raising their curiosity about how science works, particularly experimentation as part of the scientific method (Medina, 2010; COECYTJAL, 2015).

Each trailer of science has a deployable caravan canopy that turns into a classroom, which at the same time, serves as a laboratory for communication of science and technology through the exposition of scientific experiments of basic sciences, in this case mainly from the engineering area. The trailer is regarded as a way of building communicative bridges between science and society (González, 2010; González y Rivera, 2014; CONACYT, 2015).

METHODOLOGY

Graphics of the Itinerant Science, Technology and Innovation Trailers.

The trailers of science and technology of Jalisco are labelled on their entire exterior and interior sides (Figure 1). In the external label are presented images of the economic purpose for the planned development of certain areas of the State of Jalisco.

Inside the caravan there are ten graphics, which are fixed on the walls and are related to the following topics: 1) Welcome, 2) regions of Jalisco, 3) vocation of each region, 4) recycling guide, 5) environmental education, 6) how the trailer started, 7) you can get in the World of Science, Technology and Innovation, 8) territorial map in 3D, 9) Health (medicine) and, 10) Astronomy (González y Rivera, 2014; COECYTJAL, 2015).



Figure 1. Educational Room of the Itinerant Science, Technology and Innovation Trailer (or simply, science trailer).

Content of the itinerant science, technology and innovation trailers

The itinerant trailers have four areas of knowledge: 1) interactive equipment area; 2) computer area; 3) audiovisual area; and 4) itinerant scientific expositions.

There are 114 educational sectors that include didactic-interactive experiments. The experiments are of: optics, laser, solar cells, mechanics, electricity, geography, thermology, plant biology, human biology, laboratory, astronomy, skills and abilities, robotics, chemistry, ecology, lab microscopes, it also includes basic science books and encyclopedias (González, 2010; Medina, 2010; COECYTJAL, 2015).

The computer area is intended to support the enlargement of knowledge through web access. There are computers, educational programs and internet, screens, videoconferencing equipment and an exhibition room where Science, Technology and Innovation are revealed. Graphics are shown with three dimensional images, vocation information of each one of the regions of the State and scientific, technological and innovation topics (COECYTJAL, 2015).

The strategy in scientific expositions

Each trailer has 30 chairs, ventilation, electricity, extinguishers and all the safety measures for people. In total, there are seven itinerant units in the state of Jalisco. These commute to different municipalities within Jalisco, especially toward marginalized areas. The project began in 2009 with four trailers of science and in 2010, three more units were acquired. In each trailer of science there is a professional working, who makes itinerant scientific expositions and is in charge of making the proper installations for the experiments, developing workshops and keeping the unit facilities in good conditions.

The project is coordinated by a professional who is monitoring and guiding the work performed in the seven trailers of science. The professionals who work in this project have scientific backgrounds focused on engineering, science, technology and innovation. They were previously trained to make installations in the trailer of science, handling of the experiments, as well as in educational strategies addressed in a fun way to the different academic levels of the students and society in general. The exposition in the trailer of science lasts one hour per each group of 30 people. (González, 2010; González y Rivera, 2014; COECYTJAL, 2015; CONACYT, 2015). A record of the schools is made that attend in each municipality, as well as the number of students, teachers and public that visit the trailers of science in Jalisco. Sometimes – besides working through a calendar with the schools- presentations for the public are done. As part of the portfolio of the project's evidence, pictures of the attending groups are taken, as well as filing letters from the schools and attendance lists. These documents support the work performed as well as being the direct monitoring of personnel from the State Council of Science and Technology of Jalisco (Coecytjal, by its initials in Spanish), (Medina, 2010; González y Rivera, 2014; COECYTJAL, 2015). Most of the experiments presented in the trailers of science are educational games (González, 2010). These educational games, according to Chimeno (2000), can be applied to science classes in every educational level to increase the quality of knowledge of the students.

In the trailers of science of Jalisco there are board games, exercise-games and contests of knowledge games. While in "permanent" museums, such as "Museo Trompo Mágico de Jalisco" there is a whole group of people in charge of designing, implementing and guiding the visitors along the activities that the place offered (Museo Trompo Mágico, 2015), due limiting economic factors in the trailer of science, the attendees have only one person as teacher or guide. This implies that the guide of the trailer of science should have a proper knowledge about several topics related to different scientific areas presented in the trailer (González y Rivera, 2014; Museo Trompo Mágico, 2015).

RESULTS AND DISCUSSION

One of the main differences between a permanent museum and a mobile one such as the trailer of science, is that the latter has made possible the popularity of science and technology to a larger public. The common visitor goes to the museum. With the trailer, the museum is taken to the visitor and, in general, this kind of visitor has bigger needs for strengthening his/her education.

In most of the cases of locations that are far from urban centers that have permanent museums such as Trompo Mágico, schools, teachers and parents don't have the financial resources to attend to them. Besides, sometimes

they have to pay an entrance fee at these museums, while in the trailers of science of Jalisco the service is totally free for the attendees.

Participating Institutions in the itinerant trailers of science and technology

The Project of the trailers in Jalisco comes under the Secretary of Innovation, Science and Technology of Jalisco and Coecytjal. The activities are carried out as a team with the Secretary of Education of Jalisco through Regional Offices of Educational Services and also with the Council. In each municipality where the trailer arrives, a visit to the Council is made in advance, where the proposal is exposed to them, and their support is requested for safety, a proper space and publicity to have students, teachers and the public attend. The Council can use the records of people who attended to the trailer of science for their official reports. This way, everybody benefits, but the main beneficiaries are the students and teachers who receive support in their education through the expositions with interactive experiments.

The Secretary of Education of Jalisco, on the other hand, participates by scheduling school groups to visit the trailer of science. The trailer is located in strategic places in the municipality and school groups go with their teachers. (Medina, 2010; González y Rivera, 2014).

Since its inception, the Project has been supported by the National Council of Science and Technology (Conacyt, by its initials in Spanish). Some of the trailers were acquired through mixed funds with funding of Conacyt. During the last four years (2011-2014) Conacyt has financially supported the maintenance of the units, mechanically as well as regarding the experiments and has paid the transportation costs (driver and fuel) through an agreement executed within the framework of the National Strategy of Conacyt for the Social Appropriation of Science, Technology and Innovation (COECYTJAL, 2015).

Other events in which the trailer of science participates

The trailers of science and Technology of Jalisco participate practically in every scientific event held in a public and institutional way in Jalisco, such as: the National Week of Science and Technology, the event "Ciencia Joven" (Young Science), research congresses, cultural Weeks, and scientific events of the Government of the State of Jalisco. The Agreement with Conacyt has a period of one year; at the end of which reports are delivered describing the work done, the impact, the achievements and portfolios of evidence such as pictures and certificates that support the work (González, 2010; Medina, 2010).

The National Week of Science and Technology is one of the strategies of wide scope in the public communication of science, technology and innovation in Mexico. In the case of the State of Jalisco there are several institutions that promote the activities performed during this week. The University of Guadalajara has 15 university centers distributed within 12 regions of the state. Furthermore, within the state of Jalisco there are three Federal Technological Institutes, Tlajomulco, Ciudad Guzmán and Ocotlán, 13 Superior Technological Institutes, 3 Technological Universities and several research centers and private universities (COECYTJAL, 2015).

In most of these institutions during the National Week of Science and Technology there are conferences, workshops, projects' expositions, interactive games and other activities focused on encouraging an interest in science and technology, mainly among children and youngsters. Generally during these activities the itinerant trailers of science, technology and innovation are presented, especially since the goal of the trailer of science is consistent with those of the National Week of Science and Technology. Besides, it is also an advantage that the organizing institutions many times help by facilitating transportation for students and teachers to attend those activities (González y Rivera, 2014).

In 2014, the Secretary of Innovation, Science and Technology of Jalisco along with the Secretary of Economic Development, the "Instituto Jalisciense de la Juventud", and the State Institute for Youngsters and Adults, held a series of events called "Camino al Bienestar" (Path to well-being). These events are celebrated in different municipalities of Jalisco. The goal of the program includes sharing information with the population regarding supporting funds provided by the Secretary of Innovation, Science and Technology, the Secretary of Economic Development and the "Instituto Jalisciense de la Juventud". Besides adding itself to the educational offering at the higher level, the itinerant trailer of science has the goal of supplementing education at the basic level.

Since April, 2014 and up to 2015, every week a “Camino al Bienestar” has been held. Authorities receive directly the population with work tables, accompanied by their consultants and managerial staff, while the trailers of science receive students, teachers, and parents in the sessions of interactive scientific experiments. During these sessions government officials visit, witness the work done and interact with the instructors of the trailers of science and with the public (COECYTJAL, 2015).



Figure 2. High school students interacting with human resources and educational equipment in the trailer of science.

Impact on population

Since 2009 and up to May, 2015, more than one million people have participated in the trailers of science. Of this amount of people that have been received, 80% are students, 12% are teachers and the rest, general public. Science communication through itinerant trailers of science, technology and innovation in Jalisco is made with the commitment of letting the general public know about improvements in science research, mainly regarding engineering, through demonstrations of experiments in a fun way. The whole experiment and how it works is explained including its purpose and what the results are (Figure 3). This science communication also enriches the knowledge of a population regarding other topics that have a direct impact on their daily life: health, environment, education and engineering topics (Medina, 2010; González y Rivera, 2014; COECYTJAL, 2015).

CONCLUSIONS

The attendance to the expositions of the scientific experiments by students, teachers and parents in the trailers of science is raising the interest for science in Jalisco. The trailers of science strengthen education of the school students in those regions that don't have the equipment and enough material for practical demonstrations of the topics that teachers are teaching in their lessons. So the trailer of science provides support for lab practices and workshops corresponding to natural science subjects.

Beyond the cultural and academic achievements, the trailer of science is a social space that benefits conviviality between children and their parents by having them integrated and participating in the visits and family programs of each trailer. The trailer promotes equity and the quality requested by a high educational level at the national level, by making possible that this learning takes place even in rural and marginalized areas. Jalisco is a state recognized by its financial and social importance at a national level. The trailer of science, which has been successfully replicated in several parts

of the Country since several years ago, is also in Jalisco a transcendent project of social appropriateness (Medina, 2010).

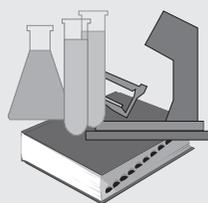
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