

## **COMMUNICATING SCIENCE AND TECHNOLOGY IN BRAZIL: RECENT ACTIONS AND ATTEMPTS FOR ESTABLISHING A NATIONAL PROGRAM**

Ildu de Castro Moreira  
Institute of Physics, Federal University of Rio de Janeiro, Brazil  
Email: icmoreira@uol.com.br

### **Abstract**

The formulation of a national program for public communication of science is at stake now in Brazil. Federal government, scientific institutions and societies are making efforts for organizing national activities for the popularization of S&T. The main purposes are to promote scientific culture, to collaborate with the improvement of science education, to attract young peoples for S&T careers and to stimulate public engagement in science. The rich cultural diversity, the enormous social inequalities and the bad situation of science education put many challenges to these intentions. Recently large events for discussing and promoting public communication of science were organized, such as the IV World Congress of Science Museums, national and regional meetings of the Brazilian Society for the Advancement of Science and the World Year of Physics. A program for stimulating the creation of new science museums started recently. The National Week of Science and Technology was established two years ago; in 2005 about 7000 activities were organized in 350 cities, with the involvement of 850 research institutions, universities, scientific societies and high schools. We discuss here the present status of public communication of science in Brazil and the dilemmas and challenges for developing a national program for popularization of S&T.

**Keywords:** Science communication in Brazil, popularization of S&T, National Week of S&T

### **1. Introduction: Popularization of S&T as an element for social inclusion.**

Social inclusion is one of the great challenges in Brazil that, for historical reasons, accumulated an enormous set of social inequalities in distribution of wealth, land, health conditions, access to educational and cultural goods and appropriation of scientific and technological knowledge. Social inclusion can be understood as the action to provide opportunities and conditions for peoples that are social and economically excluded to be incorporated to the parcel of society that can usufruct of these goods. It involves also the establishment of determined conditions so that all the inhabitants of the country can live with adjusted quality of life and as full citizens endowed with knowledge, opportunities and mechanisms for an effective political participation.

One of the aspects of social inclusion is to make possible that each citizen has the opportunity to acquire a basic knowledge on science and its functioning that gives him conditions to understand the social, economical and cultural context and to increase his employment chances in the working market. He must to acquire a basic notion, related to S&T, of their main results, methods and applications, but also of their risks, limitations and economical and social constraints. To speak of social inclusion in the domain of the diffusion of scientific knowledge and of its applications means, therefore, not only reach the poor populations (millions of Brazilians are in this situation) but also incorporate all segments that are excluded from a basic knowledge on science and technology. The main reason for this situation in Brazil is the absence of a good science education in schools.

Science and technology are, in certain sense, well established in Brazil. For instance, research has contributed strongly for the improvement of agriculture that is Brazil's main source of commercial income. Other areas of strength include research in the physical and biomedical sciences and in engineering, particularly deep-water oil drilling and aeronautics. The country has also a long tradition of seeking alternative sources of energy, exemplified by using ethanol from sugar cane to fuel vehicles. Scientific articles published by Brazilian researchers in international journals are increasing and now account for 1.8% of total papers published worldwide. Despite these strengths, the number of Brazilian international patents is very low.

The total resources for Brazilian science and technology are approximately 1% of the gross domestic product, an amount well below the desired figure. Research is mainly conducted in universities and institutes funded by both federal and state governments. Interactions between these institutions and private companies are rare, but recently a law for innovation was promulgated with the aim of narrowing this gap. About 3000 Ph.D. students graduate in a scientific or technological subject each year in Brazil, but many cannot find jobs and the proportion scientists/population remains small. Science education is a huge strategic problem of the country. Only 25% of all Brazilians between the ages of 25 and 34 have graduated from high school, mere 11% are in universities and millions of Brazilians are illiterate. Although access to education has improved significantly in the last years, the average number of years spent in school is one of the lowest in the world.

In spite of this serious situation, Brazil still does not have a well established public policy for improving science education and the popularization of S&T. From the side of public communication of science, some specific initiatives appeared for creating new science centers and museums or for stimulating outreach activities in universities, but there is the urgent necessity of establishing and implementing a national program at this direction. A step given by the current government was the creation of a department directed toward the popularization of S&T; this department belongs to the Secretary of S&T for Social Inclusion in the Ministry of Science and Technology. Its objective is to contribute for the improvement of the public communication of science and to articulate the federal actions in this area. A national program for popularizing S&T is now under discussion involving federal agencies, research institutions and scientific societies.

## **2. Aspects of the history of science communication in Brazil**

Science communication, since the establishment of modern science in XVI-XVIIth centuries, presented distinct phases with purposes and characteristics that reflected the context, motivations and interests of each epoch. Different reasons for justifying this activity can be identified since the XVIIth century: Galileu, for example, made an intense work for spreading, not only physics and astronomy, but also the new experimental methods. In XVIIIth century, the wonders of science had been shown as proofs of God existence; science became first an amusing source for aristocracy and later it was raised to the category of an important political tool. In XIXth century, with the second industrial revolution, science acquired a more explicit economic character and the political role of a symbol for the progress and social liberation. On the other side, naturalists' expeditions to some parts of the world, including Brazil, conducted to incorporation of knowledge produced in other cultures to the European one.

In XXth century, the relationships between S&T and the economic and military complex narrowed and new relationships had appeared between the socio-cultural context and science. The present motivations for the popularization of S&T occupy an ample spectrum: they go from the importance for national prosperity to the recognition of the scientific knowledge as integrant part of culture. Other reasons are its meaning for the citizenship or for taking appropriate personal decisions (as those referring to the individual health). Another motivation appeared in the horizon of science communication: due to the extreme specialization in the scientific fields, it is necessary to communicate science adequately between the proper scientists and technicians.

The public communication of science in Brazil, in spite of its weakness along the time, has at least two centuries of history. The first organized initiatives for the diffusion of modern science in Brazil started soon later the transference of the Portuguese Royal family to Rio de Janeiro, in 1808. This event produced important transformations in the local political, cultural and economic life and led to the creation of the first scientific institutions, to the publication of the first books and to the appearance of the press. In the second half of XIXth century, the activities for the scientific diffusion intensified in the whole world, following the second industrial revolution and increasing the social hopes concerning the role of science and technique. A wave of optimism in respect to the benefits of technological progress covered the world and reached Brazil, even if in a small scale. At that moment, the scientific research in the country was still limited to few scientist and professionals and to some isolated areas as astronomy, natural sciences and medicine.

The decades of 1920/30 of the last century had been distinguished by the intensification of initiatives for communicating science in the country. One of the objectives of the small academic elite who promoted it was to influence governors and to stimulate the creation and maintenance of scientific institutions, besides promoting a better social valuation for research activities. However, the character of the public communication of science at that moment was still very limited, as a direct consequence of the weak situation of the scientific establishment. After the World War II, with the attempts for developing nuclear physics, several scientific institutions had been created in Brazil. Science appeared in that moment as a saving perspective and as a tool for overcoming the national underdevelopment. In 1948, the Brazilian Society for the Advancement of Science (SBPC) was created in São Paulo. Their annual meetings became in the next decades an important place for discussing the great problems of science in the country and for promoting scientists' organization. During the 1960s, under the influence of similar transformations in USA, a new educational movement was initiated in Brazil emphasizing the necessity of experimental activities for teaching sciences. This movement, among others consequences, led to the spreading of science centers around the country.

## **3. Present status of science education and public communication of science**

In reference to science education, the general situation is bad with a very low performance of Brazilian students in science and mathematics. Curiosity, experimentation and creativity are generally not valued in teaching activities. There is an enormous lack of good science teachers, and there are precarious working conditions and low wages. The serious deficiencies in laboratories, libraries, didactic material, digital inclusion etc make more difficult the picture. In the last few years an effort was made for increasing the number of students in high schools and for defining more flexible parameters for educational contents in primary and secondary schools.

One huge problem is to persuade politicians that education, in particular science education, must be a national priority. Other obstacles here are the existence of deep regional inequalities, the heavy bureaucracy, the traditional gap

between universities and schools and the lack of perception of the S&T community concerning the importance of the activities of science education and popularization of science.

However, it has been observed in the last two decades a significant expansion of actions related to the public communication of science in Brazil: creation of new science centers and museums; sprouting of magazines and websites; science news in TV, radio and newspapers especially on modern genetics and biotechnology; new books on scientific subjects; organization of popular conferences and other public events. But the picture is still fragile and limited with great part of the Brazilian population without access to good science education and to qualified information on S&T. As a consequence of the strong social inequalities, science museums are concentrated in few areas of the country. Despite the significant growth in the last years, very few Brazilians, about 1% of the population, visit some science center or science museum each year.

From the point of view of the formation of professionals in the area of science communication, the initiatives are rare. The country also lacks studies and analyses on the strategies, practices and impacts of the activities for the popularization of S&T and on the characteristics, attitudes and expectations of the audiences. The academic valuation of the outreach activities, in particular in the science communication area, is still small. Of the side of the media, the covering on S&T is in general deficient. For instance, science is usually presented in TV as a spectacular activity, in which the scientific discoveries are carried out by particularly endowed individuals. The real or imagined applications of science receive great emphasis, but the process of its production and the context, limitations and uncertainties are usually ignored; the main conceptual models simplify the relationship between science and public, as the deficit model. In function of all these considerations, some priority lines for action in the restricted domain of the public communication of science have been established by the Ministry of Science and Technology in 2004/2006:

1. Science centers and museums of science: creation of new institutions and support of the old ones, production of exhibits, Program Mobile Science. Workshops on science museums were organized in several cities where there is interest on creating this kind of institution;
2. Partnership with newspapers and TV stations for the production of special matters and programs for public communication of science; for example, the production of the series of short TV programs "Ciência Vale a Pena" with *TV Globo* and *Instituto Ciência Hoje* and special sections on Einstein in the World Year of Physics (2005) in several newspapers;
3. Contribution to the improvement of science education in secondary schools (partnership with the Ministry of Education), with support to science olympiads, science fairs, scientific competitions etc. In 2005, the new Math Olympiad for Public Schools involved about 10.5 million of students;
4. Creation and consolidation of the National Week of S&T. The accomplishment of the National Week of CT in the first two years, 2004 and 2005, had a great success (see below);
5. Support to important events for discussing and promoting public communication of science; for instance, support to the IV World Congress of Centers of Science and to the Meeting of the RedPop (2005). Other big events were the national and regional meetings of SBPC, commemoration of the World Year of the Physics and of the centenary of the flight of the 14bis (2006). Meeting on science in the radio, science and TV and scientific journalism are being organized;
6. Promotion of regional action for public communication of science in partnership with state and municipal governments, university and institutions of research and scientific societies;
7. Academic valuation of the area: it has been established a Committee for Science Communication in the *Conselho Nacional de Pesquisas* (CNPq). Special financial support has been destined to public communication of science and outreach activities;
8. Program for the establishment of Technological Vocational Centers and centers for digital inclusion in many cities of the country;
9. Promoting the interrelation between science, culture and art; for example, stimulation to the presence of scientific themes in theatre, Carnival and other popular events;
10. International cooperation with governments and organisms in the area of the popularization of S&T. Some cooperation agreements have been made with Mercosul, UNESCO, OEA, etc.

A bilateral program for public communication of science was established, in 2005, between Argentina and Brazil. Some joint activities are being programmed as the Mercosul Festival of Scientific Films and the exchange of scientific expositions. Joint research on public perception of science is being discussed too; the intention here is to construct good indicators in this domain.

#### 4. National Week of Science and Technology

In 2004, the federal government established the National Week of Science and Technology, to be realized in October of each year, under the coordination of the Ministry of Science and Technology and with the participation of scientific and technological institutions. In the 2004 National Week of Science and Technology were realized about 1840 activities, distributed in 252 cities, involving 250 institutions and entities of S&T. A nationally integrated activity, “Brazil, look at the Sky!” was organized for observing a total lunar eclipse. In 2005 the National Week occurred in October (3-9), with the integrated activity: “Brazil, look at the Water!”. In this year, the national motto will be “Creativity and Innovation” with the commemoration of the centenary of the first public flight of an airplane, the Santos-Dumont’s 14bis.

The National Week of S&T had great success with intense participation around all the country and ample covering of the media. The activities are very diversified: interactive expositions, events in public squares and streets, open days in scientific institutions and universities, popular lectures, workshops, science fairs, exhibitions of films and scientific videos, expositions on scientific subjects of general interest, videoconferences, scientific expeditions, activities joining science, culture and art (theater, cinema, circus, music) etc. Such activities had occurred in public squares, university and cultural institutions of research, schools, libraries, science centers, museums, shopping, railway stations, subway, train, boat etc.

##### National Week of Science and Technology - 2004

Region	Number of cities and small towns	Number of activities
North	17	124
North-East	46	356
Center-West	20	182
South-East	112	910
South	57	276
TOTAL	252	1842

##### National Week of Science and Technology - 2005

Region	Number of cities and small towns	Number of activities
North	43	855
North-East	107	1.759
Center-West	18	570
South-East	109	2.770
South	55	747
TOTAL	332	6.701

For the National Week thousands of posters, folders, a national supplement (for newspapers) and other materials were distributed around the country. Several books and videos on different scientific subjects has been produced for distribution in each state too. The structure of the National Week is not centralized: there is a national organizing committee but there are local coordinators in each state and, in some cases, in cities and small towns.

It is interesting to note the participation, in the National Week, of the National Congress where some activities had been carried in 2004 and 2005, such as a special session of the Parliament, an exposition on scientific and technological research of institutes of the Ministry of Science and Technology and an exposition on technologies for helping blind people. A point of great importance was the creation of the *Frente Plurissetorial em Defesa da Ciência, Tecnologia e Inovação* (Front in Defense of the S&T&I), installed in the House of representatives and formed by parliamentarians (129 members up to now) and representatives of the scientific community, national and regional governments and private entities.

## 5. Proposal of a national program for the popularization of Science and Technology

Several countries have established, in the last decades, national programs directed toward the popularization of S&T. In the establishment and execution of programs of this kind many social actors as universities, research institutions, science museums, governmental agencies, media associations, private and public companies, NGOs etc, must be involved with the purpose of promoting a set of well articulated activities of public communication of science.

A preliminary proposal for the establishment of a national program for popularization of S&T was presented and discussed recently in the III National Conference on Science, Technology and Innovation. This conference was organized by the federal government but with the involvement of many scientific and technological institutions and entities. Some of main points proposed are summarized below.

(i) The national program must contribute for: increasing the collective appreciation about the value and the importance of S&T in the modern world; promoting a general diffusion of information on general aspects of S&T, including the functioning of the scientific and technological apparatus; promoting the improvement and modernization of science education with valuation of creativity and innovation; stimulating the use and the diffusion of S&T in activities of social inclusion and reduction of inequalities; promoting actions that stimulate the increase of the participation in the S&T of young people and of other social segments (women, black people, etc); stimulating the interaction between science, culture and art; promoting the respect to the environment and to the regional and cultural diversity; valuating the recognition of popular and traditional knowledge; stimulating a bigger popular participation in the general questions of S&T; stimulating that the activities of public communication of science be not limited to mathematical and natural sciences but incorporating also social sciences.

(ii) It was suggested the creation of a National Committee for the Popularization of Science and Technology with the participation of the scientific and technological community, federal and local governments, public and private enterprises etc. Its objective will be to articulate all these sectors to formulating and executing national plans and actions directed toward science education and popularization of S&T in Brazil.

It was recognized that the public universities and research institutions have made many contributions for research, science education and outreach activities, despite the many bureaucratic and financial difficulties that create strong obstacle for the scientific and technological development. But these institutions have a bigger potential than the one effectively realized and it must be used.

(iii) Many specific lines of action and suggestions for improving the science education and the public communication of science in the country were discussed: (a) To stimulate universities and governmental agencies for a best valuation of the work in public communication of science; (b) To create a national agency of news in S&T, involving universities, research institutions, governmental offices etc; (c) To stimulate the participation of all the students of public universities and technological institutions in outreach activities, in particular in science education and in public communication of science; (d) To establish courses for science communicators, including long-distance courses; (e) To promote periodic research on the public perception of the S&T and the construction of indicators for public understanding of science in partnership with other international initiatives; (f) to collaborate with TV and radio stations, universities, research institutions and centers and museums of science, for the production of good programs for the popularization of S&T; (g) to extend the use of scientific magazines in schools such as the case of the magazine *Ciência Hoje das Crianças* (Science Today for Children); (h) To promote the training of journalists in research laboratories and of interested scientists in newspapers offices.

(ii) Some suggestions in the area of science education: (a) To support initiatives for the introduction of science education in elementary schools; (b) To support programs for the improvement of the qualification and the working conditions of science teachers; (c) To stimulate the accomplishment of science fairs, olimpyads and competitions, with emphasis in developing creativity, capacity of working in a team and interdisciplinary activities; (e) To establish a program so that all the schools of average education can have science laboratories; (f) To make possible the access to the internet in all Brazilian schools.

(iv) From the debates of III National Conference in S&T&I it is clear the necessity for the country of a deep educational reform in all the levels, in particular in respect to science education. Not a movement organized only by the scientific and educational community or governmental agencies, but with the involvement of many other social sectors. The education must be seen not as a governmental problem but as a problem of State and society. Brazil must improve the quality of teaching, particularly of scientific subjects. In particular, this could boost the development of science and technology by motivating young people to choose scientific careers.

(v) One important aspect in the process of formulating a national program is the analysis of the possible financing resources for public communication of science activities. Some traditional sources are: (1) the Federal Government, through the Ministry of Science and Technology, Ministry of Education, other ministries and state-owned agencies;

(2) local governments (from states and cities); (3) private sector: direct support or use of the Law of Innovation and the Law Rouanet; (4) International organizations.

New mechanisms for financing activities of science education and public communication of science were proposed as the use of resources proceeding from the so-called *Fundos Setoriais* (Sectorial Funds). This is an ingenious funding initiative, created few years ago, whereby taxes from certain industries, such as oil, are diverted directly into R&D spending. Some funds from this mechanism are being now used, in a small scale, for activities of popularization of S&T. Another possibility is the creation of specific sectorial fund (or similar structure) for the renewal of the science education with tax on profits of the banks. On the other hand, it was suggested the utilization of a mechanism adopted in certain European countries (and in some programs of the FAPESP, agency to support to the research in state of São Paulo) that establish a small percentage of the research resources for the public communication of the results of that research.

## 6. Conclusion

The deep inequalities in the distribution of the educational opportunities are still great challenges for social inclusion in Brazil, particularly in respect to the access to a basic science education. The possibility of success in facing this problem will depend certainly on the establishment of a collaborative process, involving governmental agencies, research institutions, universities, scientific and technological entities, scientists, communicators, researchers, professors and students. However, we must not forget that science, for itself, does not solve the huge problems of social inequalities and unemployment, not to mention ethical problems. More science and technology do not mean necessarily more justice, greater equality and better conditions of life, particularly in the Third World. They are necessary conditions but they are not sufficient.

The lack of consistent policies and stable funding is a serious problem for implementing lasting policies for improving science education and public communication of science in Brazil. It will be necessary the active participation of the scientific and technological communities in the formulation and implementation of bold new policies to overcome the huge social, economic, and environmental problems that Brazil faces, including the challenge of promoting an efficient public communication of science.

## 7. References

- [1] CIENCIA HOY, Qué piensan de la ciencia los argentinos?, vol. 8, no 48, p. 54-61, setembro/outubro, 1998.
- [2] CINI, Marcello. O paraíso perdido. *Ciência Hoje*, vol. 23, n. 138, p. 8-11, maio 1998.
- [3] COLLINS, Harry, PINCH, Trevor. *The Golem - what everyone should know about science*. Cambridge: Cambridge University Press, 1996.
- [4] FAYARD, Pierre. *La Communication scientifique publique - De la vulgarization à la médiatisation*. Lyon: Chronique Sociale, 1988. 148 p.
- [5] IRWIN A., WYNNE, B. (eds.) *Misunderstanding Science? The public reconstruction of Science and Technology*. Cambridge: Cambridge University Press, 1996.
- [6] JACOBI, Daniel, SCHIELE, Bernard (orgs.). *Vulgariser la science - Le procès de l'ignorance*. Seyssel: Editions Champ Vallon, 1988.
- [7] MOREIRA, Ildeu de Castro e MASSARANI Luisa. (2002) Aspectos históricos da divulgação científica no Brasil In: L. Massarani, I. C. Moreira, y F. Brito (Eds.). *In Ciência e Público: caminhos da divulgação científica no Brasil*. Rio de Janeiro: Casa da Ciência/Editora da UFRJ.
- [8] MOREIRA, Ildeu de Castro, Editorial: Brazilian Science at a Crossroads, *Science*, vol. 301. n. 5630, p. 141, 2003.
- [9] NELKIN, Dorothy. *Selling Science - How the press covers science and technology*, Nova York: W.H. Freeman and Company, 1995.
- [10] RAICHVARG, Daniel, JACQUES, Jean. *Savants et ignorants - une histoire de la vulgarization des sciences*. Paris: Éditions du Seuil, 1991.
- [11] THUILLIER, Pierre. O contexto cultural da ciência. *Ciência Hoje*, vol. 9, n. 50, p.18-23, janeiro/fevereiro 1989.