Statement of the Joint Science Academies For the G8 Summit France, 2011

Education for a Science-Based Global Development
Water & Health

The Science Academies of the G8 countries, including the Science Council of Japan, announced their joint statements for the G8 Summit, France, 2011, as they have done annually since 2005. By gathering scientific opinions and insight, scientists in each country share these statements to help solve the problems that humanity faces today and recommend them to the leaders of the G8 countries.

Science Council of Japan
~Since 1949~

Joint G8+ science academies' statement on Education for a Science-Based Global Development

Education in science must be targeted not only to future scientists, engineers and other specialists but also to the general population.

Background

Economic growth, provision of food and progress in health – as measured by the spectacular increase in life expectancy during the 20th century and into this first decade of the 21st century – is attributable mostly to advances in science and technology and the expansion of systems of research and education. These advances have impacted our daily lives in many ways including travel, communication and access to new technologies. In the future, science and technology will continue to be key for global development, for example, to meet the need for new and sustainable sources of energy.

Education in science must be targeted not only to future scientists, engineers and other specialists in government and industry but also to the general public, from children in school to adults. This is the only way to make them partners of the scientists and hence to avoid misunderstandings and unfounded fears, and to better understand risks and uncertainties.

Science understanding and practice embody fundamental values such as rigorous reasoning, honesty and tolerance for the opinions of others. The practice of science must be accompanied by a sense of justice and a respect for all human beings.

Education for science-based global development involves three simultaneous challenges: science education for the general public, science education in school, and science education at university and at other national research bodies. This will require innovative approaches and institutions for teaching and research, many of them using modern information and communication tools. It requires also scientific assessment of the outcomes of the education system in order to ensure that the best state-of-the-art tools and educational methods are effectively used. Progress in cognitive sciences and brain research has shed new light on learning processes, especially in very early years of life.

Science education for the general public

Science literacy is essential for making adaptive judgments in a modern economy. These judgments involve many choices including, for example, choices about resource scarcity, climate change mitigation, food safety, health decisions, energy futures and many other individual and collective decisions. A democratic society in which only a few scientists and highly educated people understand the bases for major societal decisions is not viable. Accordingly, it is essential that greater efforts be made to disseminate scientific concepts, methods and discoveries to the public. Scientific information must be distributed widely and detailed briefing documents on topical issues must be available for decision-makers and media. Many successful interactions with society have been organised and carried by local and national governments, universities, public and private research institutes and academies. These include public lectures, 'open houses', festivals, pairing with parliamentarians and TV programmes.
We must use all appropriate education tools, including those presented by rapid developments in the electronic media and help people to identify the reliability of the information presented. Finally, the outcomes of all these education practices must constantly be assessed.

Science education in school

Science is taught at school with two goals:

The first goal is to provide the basic knowledge necessary for future citizens in a globalized world. This includes the acquisition of basic knowledge in science as well as the understanding of the very nature of science, the way to pose and then challenge hypotheses. Students must develop a taste for doing experiments, analyze results, make inferences. In short, they must be "curiosity-driven". During the last decades, inquiry-based Science Education (IBSE) has been successfully implemented in developed and less developed countries as well, supported by the Global Network of Science Academies (IAP).

A basic science education for all youngsters in the world is a matter of justice, sharing the beauty of scientific discoveries and the power of scientific methods. Last but not least, learning to reason properly may help protect young minds against intolerance.

The second goal is to recognise talented youngsters and inspire them to become science teachers, researchers, engineers and medical experts. A shor-

tage of good quality mathematics and science teachers in many countries creates a vicious circle that needs to be broken. In many countries even the most developed, there are still huge social inequalities in the opportunities for students to become scientists particularly for young women and low-income groups of society.

The decline of interest in science among youngsters is a serious issue which should be addressed.

Encouragement of young talents could be organized on the basis of different level competitions in different science domains, accompanied by contacts with leading scientists.

To achieve these goals, it is essential to share experiments and pedagogical materials in innovative science education programs and to provide teachers with a significant continued education in Science. In addition, it is advisable to cooperate with the global programs of Education for Sustainable Development (ESD) promoted by UNESCO.

Science education at university

Universities throughout the world need quality faculty, infrastructure and innovative learning programmes to train and maintain human resources. Databases, electronic libraries, scientific journals and sophisticated software should be widely accessible throughout the world. Access to distant databases creates new opportunities for researchers of all countries particularly in the experimental disciplines. Databases on gene sequences and astronomical objects, for example, can potentially be accessed freely by all researchers, including those from the less-developed countries. Similarly, essential data - such as those on biodiversity - that are acquired everywhere, can now be exploited by the global community of researchers. The effectiveness of e-learning and its highly positive prospects, however, may be limited by the high cost of implementing and using modern techniques.

Although virtual universities may have considerable potential, research centres remain necessary both to conduct experimental works and to facilitate direct interaction between researchers and between faculty and students.

Conclusion

Data on the comparative effectiveness of educational strategies must be patiently acquired, analyzed and the results disseminated. Rigorous experimental approaches should help to identify which educational strategies are the best, at all levels of educational curricula. This "evidence-based education" could revolutionize the science and practice of education, as "evidence-based medicine" did, to the point that it has become, after just a few decades, the paradigm of modern medical practive.

Recommendations

The Academies of the G8+ countries strongly recommend the following action plan to their Governments:

- Establish the conditions for a true globalization of knowledge in science and technology. Encourage and help governments of developing countries, to give high priority to acquiring and maintaining the necessary infrastructure and human resources for science education, and to facilitate the return of those trained abroad.

- Support international collaboration to set up quality e-learning facilities, accessible to all, including students worldwide, and promote open access to scientific literature and databases.

- Share the growing knowledge derived from brain research, cognitive sciences and human behavioural research to improve learning programs for children, students and the general public.

- Create a network of virtual collaborative research centres at the front line of innovations in education, such as e-learning, inquiry-based and evidence-based education.

- Support and expand existing successful programs which facilitate the two-way interactions between scientists, on the one hand and the general public, media, and decision makers, on the other.

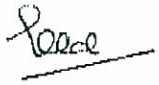
May 19, 2011

Academia Brasileira das Ciencias, Brazil

Royal Society, Canada

Académie des Sciences, France

Deutsche Akademie der Naturforscher Leopoldina, Germany



Indian National Science Academy, India

Accademia Nazionale dei Lincei, Italy

Science Council of Japan, Japan

Academia Mexicana de Ciencias, Mexicana

Russian Academy of Sciences, Russia

Académie nationale des Sciences et des Techniques, Sénégal

Academy os Sciences, South Africa

Royal Society, United Kingdom

National Academy os Sciences, United States of America

Joint G8+ science academies' statement on Water & Health

Access to clean water and sanitation was declared a human right by the United Nations on July 28th, 2010.

Background

The Millennium Development Goal (MDG) 7C states: "*Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation*". The Academies of Science of the G8+ countries stress that accessibility, quality and protection of water resources are fundamental to human health in rural and urban areas worldwide. The objectives of MDG7 are imperative in helping to achieve the MDGs on poverty, universal education, food and energy security, gender equality, child and maternal health, most critically, MDG4, reducing child mortality. Diarrhoea-related illnesses kill more children under five years old than AIDS, malaria and measles combined and are the second leading cause of child death. Over 85% of diarrhoea worldwide is due to unsafe water, inadequate sanitation or insufficient hygiene.

A focus on improving sanitation is urgently needed as there has been significantly less progress in this area than in access to safe water. Furthermore, through population growth, increasing pollution and climate change, water as a resource will become scarcer: it is estimated that around 3 billion people will be living in water-scarce countries by 2050. Today, almost 900 million people lack access to a clean water supply, with 2.6 billion people lacking proper sanitation: the direct and indirect effects of a lack of clean water and sanitation are profound.

Within the last decade, more than 1 billion people in the world have now gained access to safe drinking water; much less progress has been made on sanitation and this has a major impact on human health. It is estimated that the MDG sanitation target will not be met in Sub-Saharan Africa for more than half a century; this is clearly unacceptable. An estimated 16% of the population in Europe, and just under 40% of the world population also lack suitable sanitation.

Nearly 20% of the world population - mainly in rural areas- still practise open defecation, resulting in 300 million tons of untreated human excreta polluting fresh water resources each year. This contributes significantly to the transmission of more than 20 different infectious diseases. In addition, domestic animal populations and their excreta are increasing, as diets change to a higher meat intake. Furthermore, improper urban and industrial waste disposal threatens surface and underground water resource quality.

In the absence of improved sanitation, the efficacy of expensive vaccines and chemotherapy to control water-borne infectious diseases is seriously compromised. Policy-makers must understand that access to drinking water and sanitation facilities go hand in hand. Solving the lack of water services for tap water supply, treatment, hygiene and sanitation would mitigate many other health, economic and social problems. Providing sustainable access to safe water and sanitation is one of the most crucial development interventions in helping poor people to lift themselves out of poverty. It is also one of the most *cost-effective* public health measures.

Water and health impacts

Major health issues are associated with unsafe water. They include:

- Water-borne infectious diseases - some of animal origin - including cholera, and other diarrhoeal diseases, hepatitis, amoebiasis.
- Water-related vector-borne diseases such as malaria, filariasis, schistosomiasis and dengue, affecting more than 500 million people worldwide.
- Diarrhoeal diseases represent one of the major sources of morbidity/mortality in developing countries, accounting for the death of between 1.5 and 2 million children under the age of 5, annually (UNICEF_WHO, 2010). Alarmingly, 50% of hospital beds in the developing world are occupied by patients with water-borne diseases.
- Increasing concentrations of organic pollutants through anthropogenic activity (whether industry, agriculture or groundwater management related) and of naturally occurring arsenic, fluoride and nitrates in water all constitute human health hazards. They require either the development of alternative water resources or appropriate cost¬-effective treatment technologies. Regulations on chemicals need to be improved through better understanding of eco-toxicity and the toxicology of chronic exposure to micro-pollutant mixtures. Traditionally prevalent in industrial countries, chemical pollution is now emerging as a public health concern in developing countries. These countries are now also confronted with massive urbanization. Areas of greatest population density present different challenges to rural populations. The re-emergence of cholera is largely due to the spontaneous and burgeoning growth of mega-cities, townships, shanty towns and favelas with no sewage systems or infrastructure. Major improvements have to be made in sewage treatment.

- Water and sanitation issues can be intrinsically linked to land settlement and whilst access to water and sanitation is now recognised as a basic human right, this is often overlooked for displaced people; a problem that will become all the more important with increasing mass migration.

Socio-economic impacts of sanitation and safer water

The improvement of sanitation and use of safe water would strongly impact:

- Economical development and lost productivity
  Diarrhoeal diseases account for an estimated 4% of the total DALY (Disability Adjusted Life Year) global burden of diseases, nearly 90% attributable to unsafe water supply, lack of sanitation and hygiene.

- Education
  Approximately half a billion school days are lost each year due to water¬-borne diseases. The lack of adequate facilities in schools is one of the factors that prevent girls from attending school, particularly when menstruating. Gender-sensitive sanitation, together with education and hygiene, especially handwashing, has significantly reduced the incidence of water-borne and diarrhoeal diseases, *e.g.*, in Bangladesh and Morocco.

- Public health
  Promoting sanitation must be a priority for the development of public health if we are to attain the MDGs. Achieving the MDGs will depend on the promotion of international coordination, community-based cost-effective technologies - such as membrane filtration units - that have dramatically improved access to microbiologically clean water from individual to community scales.

- Integrated Water Management
  An integrated approach to managing at watershed level should address the biogeophysical, climatic, social and economic issues related to water management particularly within river basins.

Recommendations

The Academies of the G8+ countries strongly recommend the following action plan to their Governments:

- Develop basic infrastructure for sanitation and maintenance, to achieve acceptable quality water as key priorities and reduce rural/urban disparities. Sanitary facilities in schools, adapted to local, environmental, technological and cultural constraints, are a priority.

- Promote education, including training of professionals and technicians to improve management of water quality, and public information to change the behaviour of populations regarding water supply.

- Fund research and development for the identification of pathogens of human and animal origin and the development of simple, low-cost and efficient markers. Further epidemiological studies are needed to develop vaccines against water-borne pathogens.

- Promote capacity-building to improve water management and hygiene standards; support watershed level community-based actions favouring the key role of women both in rural and peri-urban areas to echo "unheard voices of women".

- Establish networks of competence at national, regional and global levels to improve the efficiency of water use in domestic context, as well as in agriculture and industry, through research and innovative practices that are ecologically oriented.

The benefits of fulfilling these recommendations are so rewarding, both socially and economically, that the Academies urge the leaders to address this concern and identify methods to meet the financial challenge.

May 19, 2011

Academia Brasileira das Ciencias, Brazil

Royal Society, Canada

Académie des Sciences, France

Deutsche Akademie der Naturforscher Leopoldina, Germany

Indian National Science Academy, India

Accademia Nazionale dei Lincei, Italy

Science Council of Japan, Japan

Academia Mexicana de Ciencias, Mexicana

Russian Academy of Sciences, Russia

Académie nationale des Sciences et des Techniques, Sénégal

Academy os Sciences, South Africa

Royal Society, United Kingdom

National Academy os Sciences, United States of America