Background

Economic growth, provision of food and progress in health – as measured by the spectacular increase of 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.

Science and technology having direct impacts on the present and future daily life of everyone, 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 full partners of the scientists and hence to avoid misunderstandings, 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.

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 protect young minds against intolerance.

- The second goal is to recognize talented youngsters and inspire them to become science teachers, researchers, engineers .... A shortage 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 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 medicine.

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 behavioral 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.

Endorsement