IOP Institute of Physics

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Physics and: development

An Institute of Physics briefing note

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Just as science and engineering enabled the evolution of the Western world into the prosperous society that it is today, so too are those disciplines vitally important for the developing world.

By building their own scientific capacity, developing countries can ensure they have the resources and skills needed to build sustainable economies, and to solve local problems such as water pollution, energy generation or agricultural productivity.

The Institute's work contributes to this by helping to improve physics teaching in rural parts of Africa, and by giving scientists and engineers in developing countries the skills they need to turn their research into commercial ventures.

There is always more that can be done, and just a few small policy changes such as those mentioned overleaf could have a big impact in helping the developing world build its scientific capacity and transform its economy just as we once did.

Prof. Sir Peter Knight
President, Institute of Physics

"We will start to get a groundswell of thinkers in young Africans that will lead to them becoming the effective scientists and engineers of the future."
Joe Brock,
IOP volunteer coordinator for Tanzania

"Entrepreneurial training fills a gap between advanced training and support in the basic sciences, and helps scientists contribute directly to the economic vitality of their countries."
Prof. Fernando Quevedo,
Director, ICTP

Science aids development

Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime.

The well-worn aphorism on the need for self-reliance is commonly used in the context of international development, and it's certainly apt in the case of physics in the developing world.

It may seem that physics shouldn't be a priority in countries with more pressing problems – the Higgs boson is of little relevance when facing a perennial threat of famine, drought or disease. But science and engineering are permanent solutions rather than short-term fixes.

Agricultural science allowed India to develop a self-sufficient food supply; medical science enabled the eradication of smallpox, with polio set to follow. Advances in physics are leading to clean, sustainable sources of energy; the internet and mobile phones are making communications between remote regions easier, and, more recently, GPS data are being used to reduce childbirth mortality in Nigeria in a project funded by the UK Department for International Development. Science is the most effective tool with which to tackle the whole range of development issues.

But it also does more than that. Innovation is a proven source of economic growth, and science and engineering create new goods and services, and the markets in which to sell them. They ensure that a workforce has the technical skills for an increasingly interconnected, technological world, and that political decisions are informed, wherever possible, by evidence.

The prosperity of western nations was built on science and engineering, and the same foundation will be just as sturdy for the developing world too.

Science is the most effective tool with which to tackle development issues, and innovation is a proven spur of economic growth

FURTHER READING

- *From Science to Business*, 2011
- *Physics for a Better World*, 2011
- *Science and International Development: a response to the Department for International Development's inquiry*, 2011
- *Science, Technology and Innovation for Poverty Reduction*, 2009

IOP publications and policy documents are available online at www.iop.org.

GIANNI PRALEA

Wider availability of clean drinking water is being made possible by desalination

IOP gives a helping hand

Many of the UK scientific learned societies carry out activity relating to scientific capacity-building in the developing work. The Institute's work on physics for development covers two main areas – entrepreneurship and secondary education.

Since 2005, IOP and the International Centre for Theoretical Physics (ICTP) have run a series of workshops on entrepreneurship, aimed at giving physicists and engineers in developing countries the skills and knowledge to turn their scientific research into a commercial venture.

Workshops have been held across the world from South America to the Philippines via Africa and the Middle East, and now take place twice a year. They give physicists the knowledge they need on, for example, intellectual property rights, sources of finance, and the development of a business plan, and they provide an opportunity for networking.

In response to requests from workshop attendees, IOP has also developed an entrepreneurship curriculum, adopted by universities from South Africa to the Philippines.

With innovation so important to any economy, establishing businesses based on physics could prove to be a vital helping hand along the path to development. "Entrepreneurial training for scientists and engineers in developing countries fills a gap between advanced training and support in the basic sciences, and helps those same scientists contribute directly to the economic vitality of their countries, creating a stronger and more sustainable scientific environment," explains ICTP's director Prof. Fernando Quevedo.

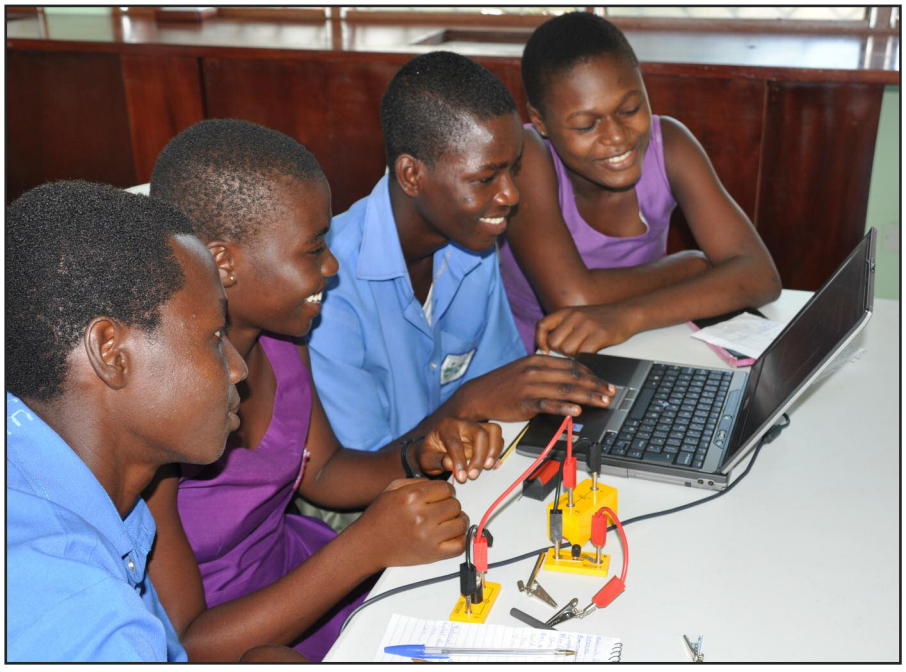
But in building a more technological society and innovative economy, developing countries will also need a trained workforce that is well versed in the practicalities of physics, rather than just the theory – which all too often is not the case. In much of sub-Saharan Africa, for example, physics is often taught by rote, as a lack of resources makes conducting experiments difficult. That approach may be fine for getting through exams, but it does little to encourage a deep understanding of the subject or the benefits of its practical application.

The Institute's IOP for Africa programme helps to train local teachers in practical physics teaching. Resource centres have been established in nine countries across the continent, providing equipment and training to schools and teachers in their nearby area.

The programme, delivered largely by volunteers, has helped to train hundreds of teachers and benefitted tens of thousands of students since it began in 2005.

"If we can get enough teachers to teach in this way we will start to get a groundswell of thinkers in young Africans that will lead to them becoming the effective scientists and engineers of the future," says physics teacher Joe Brock, IOP's volunteer-coordinator for Tanzania. "Apart from that, of course, it is great fun, and will lead to students turning to physics rather than, as I have heard on many an occasion, running away from it."

The Institute's teacher-training programme has reached hundreds of teachers and tens of thousands of students



A practical physics lesson at the IOP resource centre in Ghana in September 2010

Seeing the difference

● Information gleaned from the entrepreneurship workshops proved useful to South Africa's QZN Technology, a spin-off from research in quantum technology at the University of KwaZulu-Natal. One of its founders, Abdul Mirza, attended one of the workshops in 2009 to help get an idea of how to put together a business plan. The company was launched in 2010. "The workshop offered me an ideal arena in which to analyse case studies of scientists who have successfully marketed their research, as well as the opportunity to network with them," Mirza told IOP at the time. "Learning through best practice was both inspirational and effective. The fundamentals of writing a business plan were something that I immediately applied to our funding applications."

● One of the schools that has benefitted from the IOP for Africa programme, Mvomero Secondary School in Morogoro, Tanzania, won a national science competition in 2010. This rural school beating relatively well-heeled rivals helped to spread interest in taking a more practical approach to science to other schools. A school in Uganda that acts as a host to an IOP resource centre achieved the best exam results in its district in 2012.

Making changes

While the work of organisations such as the Institute is making real changes to scientific capacity in the developing world, it's still possible to do even more.

One obstacle in particular is a lack of flexibility in government funding – large-scale projects are preferred and smaller programmes often miss out. Not only are small-scale but high value-for-money projects denied funding, but the opportunity to test out new ideas before applying them more widely is also lost.

In its response to an inquiry by the House of Commons International Development Committee's inquiry on science and international development in 2011, IOP made several other recommendations, including:

● Support for scientific capacity-building should be more explicitly stated as a development objective by the Department for International Development.

● Support from government for learned societies to mentor their equivalents in developing countries should be introduced.

● The learned societies should be engaged in the international development agenda, and in particular with DfID's Chief Scientific Advisor.

The Institute believes that such changes could add up to a considerable impact in building scientific capacity in the developing world.