

# *Technology, Education and Sustainable Development*

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## *Introduction*

It is a great honour to have been asked to give this lecture in memory of Dr Vikram Sarabhai, an eminent space scientist whose life and work we revere. Dr Sarabhai's contributions paved way for India to emerge as a major player in space science and applications. I shall have the pleasure of delivering this lecture; but I have prepared it with the help of two of my distinguished Indian colleagues at the Commonwealth of Learning, Dr. Krishna Alluri and Professor Mohan Menon. Beyond acknowledging their contribution to these remarks I express my admiration for the work that each of them does to further the mission of the Commonwealth of Learning in harnessing learning to sustainable development.

Before joining the Commonwealth of Learning, COL, Dr. Krishna Alluri had an eminent career as an agriculturalist, spending many years with the International Rice Research Institute in the Philippines and with the International Institute of Tropical Agriculture in Nigeria and working with the Consultative Group on International Agricultural Research. At COL he is our specialist on Food Security and Environment and leads our work in rural development. He has been working for some years with colleagues in India on an initiative that we call Lifelong Learning for Farmers. The idea is very simple. It is to work with farmers and villagers to help them create a vision of a better future and then to connect them, using ICT kiosks, to a consortium of institutions that have, between them, the information the farmers need to improve their livelihoods.

A key feature of the arrangement is a model of partnership in which financial institutions and private sector play a key role in forward-backward linkages. Commercial banks loan money to help the farmers

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become productive in a sustainable way. Private sector is involved in marketing the products produced by L3 villagers. Our aim is that this initiative be not merely sustainable, but self-replicating. I mean that its success as a model for improving village economies should be so obvious that people replicate it spontaneously from village to village rather than waiting for COL to do it.

Here in India we are pleased with the results of this initiative so far, because it seems to be benefiting all parties involved. Dr. Alluri is now extending it to other parts of Asia and Africa where the model has to be adapted to a different environment: different ecologically, different socially and different in its communications infrastructure.

Closer to home Dr. Alluri has played an important role in reviving learning materials in the area of Environmental Engineering that COL developed in collaboration with UNESCO in the 1990s. These materials are available in the form of self-learning materials and in various guises in India towards improving environmental education for continuing professional education in India.

COL, in partnership with the Centre for Environmental Education, the Indian Institute of Science and the Karnataka State Open University developed environmental educational modules for school curriculum. These modules are unique in that they focus on real-world contexts and issues, encouraging learners to forge connections and understand their immediate surroundings. The awareness, knowledge, and skills needed for these local connections provide sound base for learners to understand broader issues in larger ecosystems.

Professor Mohan Menon is COL's Education Specialist for School Development. He spent many years at IGNOU, where he was Dean of Education and also had a period on secondment as Chairman of the National Open School. His primary focus is to help Commonwealth governments use technology, particularly the technology of distance learning in all its forms, to address the colossal challenge of teacher education. In countries across the world training teachers is the critical bottleneck preventing the achievement of the fundamental development goal of Universal Primary Education. Professor Mohan helps countries improve both the initial training of teachers and also their professional development. The Green Teacher initiative is just one example of the use of distance learning to give practicing teachers the skills they need to teach a new area of the curriculum.

It is a pleasure to work with such dedicated and competent colleagues as Dr Alluri and Professor Menon.

## The challenge of sustainable development

Our title is Technology, Education and Sustainable Development. Before I joined COL I spent a few years as Assistant Director-General for Education at UNESCO. Whilst I was there UNESCO's Education Sector was charged with laying the groundwork for the United Nations Decade for Education for Sustainable Development. It is a special pleasure to be in Ahmedabad, where the first major international meeting of the decade took place in January 2005. The Ahmedabad Declaration that emerged from that meeting has been very helpful to us in preparing this lecture.

You might think that because of my role in the genesis of the UN Decade for Education for Sustainable Development that I find it easy to write and speak about education for sustainable development. Sadly that is not the case. No topic - and I regularly make speeches on quite a variety of subjects - gives me writers block in quite the same way as education for sustainable development. Why is this?

There are a number of reasons, which I shall explore because some of you may have the same affliction and we can reflect on them together.

First, the importance of the subject is so great as to be almost overwhelming. When we talk about sustainable development we are talking about nothing less than the future of humankind. The evolution of the concept of sustainable development makes me think of a train that takes on more passengers each time it stops: so far at Rio in 1992 and then at Johannesburg in 2002. You might say that in Rio sustainable development took on board the environmental agenda with its concern for ecosystems, and that in Johannesburg the human agenda joined the train with its concern for human rights. Now it reminds me of those pictures you see of trains on this sub-continent with people on the roof, hanging out of the windows and clinging to the sides.

Sustainable development! It is a capacious concept. The words roll off the tongue easily, but do we always take in their full implications?

There are two definitions of sustainable development in common use. One defines it as "improving the quality of human life while living within the carrying capacity of supporting ecosystems." This emphasises improving the quality of human life while protecting the Earth's capacity for regeneration.

The Brundtland Commission's definition of sustainable development, more widely used, is "to meet the needs of the present without compromising the ability of future generations to meet their own needs." Both parts of that injunction pose problems. We know that we are far from meeting the needs of the present. Yet we suspect that without even meeting the needs of the present for most of humankind we are already compromising the ability of future generations to meet their own needs.

I give you a simple Commonwealth example. Every time I see one of those TV reports of vast blocks of ice falling into the sea from the Greenland icecap I think of the islands in the Pacific, such as Kiribati, or nearer to here in the Indian Ocean, the Maldives, which risk becoming unsustainable for some of their people as sea levels rise.

My second difficulty in getting to grips with education for sustainable development comes when I ask: even if we could reverse trends such as that one by changing our behaviour, which is by no means certain, do we have the collective determination to do so? I happened to be in Washington two weeks ago when Mr. Bush made his State of the Union address and chastised the country for its addiction to oil. Even the commentators who are reliably supportive of the administration felt constrained to point out that so far the America had consistently set its face against the sure fire way of reducing the country's oil consumption, namely to tax it more aggressively.

I mention the USA because the contradiction was particularly striking that evening, but we are all guilty. Are we not all engaged in a global tragedy of the commons, where each of us grazes a bit more than our share of the land on the assumption that the tragedy will not play out on our part of the commons in our lifetimes?

Third, I ask what can education do? H. G. Wells wrote long ago that human history is a race between education and catastrophe. That raises two more questions. Can education really influence these megatrends by changing behaviour; and even if the answer is yes, can we reach enough people quickly enough to make a difference?

It is very easy to get depressed by all this, to throw up our hands, and to be paralysed into inaction. But we are human. We want to survive as individuals and as a race. Even though our minds may tell us that we may be fighting a losing war, we have to engage in local battles that we might be able to win.

In the rest of this lecture I simply want to report, in all humility, on some of the battles for sustainable development in which COL is engaged. We are a tiny agency, although thanks to colleagues like Dr. Alluri and Professor Menon we seem to have an impact far out of proportion to our size. But because we are a tiny agency we try to start with powerful ideas and principles and then build models of action that could multiply their impact by self-replication.

## Principles and Ideas

Our first principle is that we should try, in Brundtland's words, to meet the needs of the present. I refer here to the most basic needs of human beings as they are expressed in the Millennium Development Goals. These eight goals, which cover poverty and hunger, education, gender equity, health, the environment and better global partnership, were part of the Millennium Declaration with which our heads of government ushered in this new century. Already there is alarm that they will be missed by a wide margin, as has already happened with the first goal with a deadline, which was to achieve equal proportions of girls and boys in school by 2005. The proportion of girls in school is steadily going up, but the goal was missed.

One response, to avoid the ignominy of failing to meet any of the goals on a global basis, is to try to sweep the goals under the carpet and pretend that setting them was a mistake. But goals are useful. The statements of principle, like the Universal Declaration of Human Rights which calls for universal education, have been around for a long time but have lost the power to motivate. Goals with deadlines do motivate, as I saw very clearly at UNESCO as countries tried to get themselves organised, individually and collectively, to reach the goal of Universal Primary Education.

So at COL we take the Millennium Development Goals as the basic framework for our action but extend it in two ways.

First, we are motivated not only by the goal of Universal Primary Education, but by the whole set of

educational goals agreed, also in the Millennium Year, at the Dakar Forum on Education for All. Second, we subscribe to the Commonwealth's principles of Democracy and Good Governance. In our view these Commonwealth principles are particularly relevant to the sustainability part of the sustainable development equation. A shorthand expression of this is Amartya Sen's finding that there has never been a famine in a democratic country with a free press.

We are the Commonwealth of Learning. Our second principle - or perhaps I should say our second idea - is that human learning is the master key that can unlock progress to all these goals. In saying that we do not deny that better health is made easier by better health services or that better implements make farming more productive. But behind all this it is learning - sometimes very basic learning - that empowers people to raise healthier families, to feed themselves better, and to improve their livelihoods.

Our belief in the importance of learning is not merely, or even mainly, pragmatic. We subscribe to Amartya Sen's view that development is freedom and that education is the royal road to freedom. Development is the process of increasing the freedoms that people enjoy.

First there are the basic freedoms of existence, what we call the 'freedoms from': freedom from hunger, freedom from disease, freedom from living with sewage or garbage, freedom from discrimination. Then there are the freedoms of the human spirit, the 'freedoms to': freedom to listen, freedom to express oneself, freedom to practice religion, freedom to choose how one is governed and so on.

Amartya Sen emphasises that freedom is not only the measure of development but also the means to achieve it. People, acting as free agents, are most reliable motors of development, whether at the level of the family, the community, the nation, or the world. Going back to the second half of the Brundtland statement, the evidence clearly indicates that free people acting as free agents are less likely to compromise the abilities of future generations to meet their own needs than people who cannot make choices.

That does not mean to say that we can stop worrying about the tragedy of the commons, but the answer, in our view, lies in more education not less and education of communities as well as individuals. Or, to put it better, education of individuals as members of communities. I have visited over a hundred countries and I find there is a reasonable correlation, once abject poverty has been eliminated, between the freedom of a people, their sense of community, and the quality of the environment that they sustain.

All this, of course, was well said by a famous former resident of this city of Ahmedabad, Mahatma Gandhi, when he called for "education for life, education through life and education throughout life". That phrase appears in last year's Ahmedabad Declaration on Education for a Sustainable Future.

COL's third basic principle is that traditional and conventional methods of education and training simply cannot address the scale and scope of the learning challenge. We are not hostile to these methods. I am sure that we have all enjoyed special moments of being taught or tutored face-to-face when we felt that learning was particularly exciting. Traditional methods have their place - a large place - in addressing the challenge of learning for sustainable development.

But these methods alone are not enough. In all other aspects of life technology has changed our lives by making many of the products and services that we use more available, cheaper, and better. Of course, some of those applications of technology have contributed to the environmental degradation and lack of sustainability that we lament today. That, however, is not a reason for turning our back on technology; it should rather motivate us to ensure that we use technology for learning a sustainable and environmentally responsible way.

The fundamental challenge of teaching and learning - of education and training - is simply expressed. First, it is to make it widely available, which, second, means keeping its cost low. Third, it is to ensure that it is of good quality, otherwise what is the point?

You can construct a triangle from these three vectors of access, cost and quality. I call it the Iron Triangle because until our own times it has created a prison for education. By that I mean simply that with traditional methods of face-to-face teaching you cannot change any one side of this triangle for the better without changing at least one of the others for the worse.

For example, if you try to raise access by packing more people into the classroom you will indeed make education more available. You will also cut costs. But people will accuse you of lowering quality. If you try to raise quality with smaller classes or more study materials costs will go up, which usually means that access will go down. You can see the problem.

COL tries to discover and replicate learning technologies that let us break out of the prison of the iron triangle by achieving more access, lower cost and higher quality. People take it for granted that industrial processes can achieve this with the production of goods. But in education we tend to assume that such processes do not exist. Indeed, it is worse than that. We assume, if we are honest, that in education quality is defined by exclusivity. In other words we cannot have quality education without excluding most people from it because quality is costly.

Education for sustainable development means eradicating this insidious assumption from our thinking.

What do we mean by quality? I define it as fitness for purpose at minimum cost to society. The last part of this definition is important for sustainable development. We should not equate educational quality with higher cost because the correlation is actually rather poor. The OECD's Programme of International Student Assessment, PISA, shows that very clearly.

Finland's education system is about the world's best overall performer, as measured by the competence of its 15-year olds. But it does not have very high spending on education, compared to countries that perform much worse, and it achieves an impressive equity of outcomes across all social groups. Here we are talking largely about the conventional face-to-face teaching system.

Using technology in education can corrode the link between quality and exclusivity much more radically. The clearest example is the open university movement. A new model of higher education was created

nearly forty years ago in the UK. It combined modern information and communications technology with the old industrial principles of division of labour and specialisation. The process of higher learning was split up into its component parts, dedicated people concentrated on making each component as good as possible, and the components were then reassembled into an open and distance learning system.

Today that original model, the UK Open University has 200,000 students; which are small numbers in Indian terms but large in UK terms. It provides higher education at a significantly lower cost than the campus universities and, most importantly, on the latest national assessments of teaching quality it ranks fifth out of the hundred UK universities, just above Oxford, my own alma mater.

Furthermore, in a very recent survey of student satisfaction amongst 170,000 students across all British universities, the Open University came top. Students at the Open University are happier with the education they receive than those of any other university. These are remarkable results for a very large university teaching at a distance. I am not saying, of course, that open universities are automatically of higher quality than conventional campuses. Quality is never automatic. You can have a low quality open university just as you can have a low quality campus university.

But my conclusion, which represents a revolution in education, is that by using technology intelligently you can achieve wider access, higher quality and lower costs, all at the same time. You can reconfigure the iron triangle. This is not the place to describe in detail how this is done, but I can enumerate briefly some of the principles, which apply very widely to the use of technology in education.

First, you disassemble the teaching and learning process into its component parts. In classroom teaching one teacher takes charge of the whole process: planning the lesson, preparing supporting materials; instructing the class, answering questions; assessing student performance, and evaluating the effectiveness of the whole cycle.

When using technology you adopt the old industrial principle of division of labour. You separate out each of these and other component parts and you specialise in doing each of them well. Then you re-assemble the whole system so that the new whole is even greater than the sum of its improved parts.

Second, you take advantage of economies of scale. This is easy to do with learning materials. When you are making ten thousand copies of a book it costs little to print an additional copy. Furthermore, this is even truer of the newer media like CDs. Indeed, distributing extra copies of material via the internet or via television costs almost nothing.

But you can also get economies of scale with the more personal aspects of learning. By having well-trained part-time tutors available all over the country an open university can give better academic support to students than they get on campus where hundreds of students may have to fight for the attention of one professor. This is what I call the quality of scale, and it applies also to learning materials. If you are going to print many thousands of copies of a book, or burn a million DVDs, or broadcast a TV programme to 100 million people, it makes economic sense to ensure that it is of good quality.

Third, you pay close attention to the logistics of the operation. Brilliant learning materials are no good unless they reach the student. A stimulating tutorial session is unhelpful unless the student knows about it. This really takes us back to the disassembling and reassembling of the total student experience. You focus on making each operation as effective, efficient and economic as you can.

Fourth, and finally, you remember that educational institutions are communities. Making people who study at a distance part of community is a special challenge, but again, if you focus hard on that challenge you can overcome it. The survey of UK Open University students showed that they felt just as much part of an academic community as those in the campus universities.

Mention of community brings us back directly to sustainable development. I suggested earlier that education for sustainable development requires both the education of individuals as members of communities and also the education of whole communities. There is a strong correlation between successful development and the creation of communities. We are back to Amartya Sen's point that people, acting as free agents are the best drivers of development, both as individuals and as communities.

Another way of putting this is to say that whereas education focuses on human capital, the development of the skills and knowledge of the individual, education for sustainable development must also focus on the creation of social capital. Social capital is the networks of contact and trust that exist between people and create communities.

That gives me a nice lead in to conclude by describing some of COL's work in using technology to enhance learning for sustainable development. We like to think that all our work is really education for sustainable development, but let me concentrate today on the work of my colleagues Dr. Alluri and Professor Menon.

This list, with our COL acronyms, names projects in three general areas.

First, in the area of Environmental Education we are pleased to be assisting countries to improve their teaching about the environment at a number of levels. I am pleased to say that this work began in India and is now being taken to other countries. We are delighted with our association with the Centre for Environmental Education, here in Ahmedabad for a key part of this work, the Green Teacher course.

This is a one year distance learning diploma course in Environmental Education which is now at the pilot stage. Thanks to the Government of India's policies to introduce education about the environment at all levels we expect a large take-up for this programme. Already institutions in South Asia and Africa are looking to adapt it for their use, while here in India some open universities and teacher education colleges have decided to form a consortium and work together on applying open and distance learning to education and training for sustainable development.

As you can see, we are also helping tertiary institutions extend their teaching in environmental areas, taking advantage of a large corpus of scientifically excellent materials that we developed with UNESCO in the last decade. This has also allowed us to partner with the Indian Institute of Science, which has



piloted a continuing professional education programme in environmental engineering that addresses the issues targeted by the Millennium Development Goal on the environment such as air pollution, municipal water and waste water management, environmental management, ground water and soil pollution and solid waste management.

Then, in a nice example of the onward adaptation that we encourage at COL, these courses have been recast by the Karnataka State Open University to be offered at certificate, diploma and degree levels in English and Kannada. We intend to take these programmes to other developing countries.

This is a nice example of the way that open and distance learning contributes to sustainable development. When we talk about recycling we don't usually think of recycling educational courses like this, but it is a very good practice. You make a significant investment in learning materials of high quality and then you use them as extensively as possible. With conventional teaching methods you tend, on the other hand, to make a low investment in materials of modest quality and repeat it over and over again.

I turn now to a COL activity that addresses the MDG of Poverty and Hunger. It starts from the principle that the route to world development has to go through the rural areas and involve the millions of farmers and smallholders who are the rural economy.

We call it Lifelong Learning for Farmers. This is another of our initiatives that began here in India, in Tamil Nadu and Maharashtra, and is now being taken to Africa by Dr. Alluri.

The idea is simple. Step one is to mobilise the farmers, by village, to develop their vision of a better future and create questions about how they might achieve it. The novelty here is that too many previous projects of this kind operated from the top down and communicated with the farmers in a uni-directional way. The COL initiative works from the bottom up and, going back to a point we made earlier, treats the farmers both as individuals and as a community.

Step two is to get those institutions that have the answers to the farmers' questions to work together to provide them. In Tamil Nadu this meant a consortium of the Tamil Nadu universities of agriculture and veterinary science, the Tamil Nadu Open University, Anna University and the University of Madras. These institutions now coordinate their extension operations and address the questions, often simple questions, that the farmers ask, like 'how do I tell whether a cow is a good cow or not?'

Step three is to provide this information in a timely and interactive manner, often using the ICT kiosks that are present in more and more villages. We prefer commercially operated kiosks because they are more sustainable. Those who operate them must respond to local needs, otherwise they would go out of business.

Step four is to get the commercial banks involved. They want to do more rural lending but have been put off by a poor record of loan repayment. Encouraged by the prospect of making village agriculture more productive in a sustainable way they are ready to help, not only with small loans to the farmers but also by working with other businesses to improve the whole process of getting the village produce to market.

This model, Lifelong Learning for Farmers, is one very simple answer to the huge worldwide challenge of the rural economy, but we think it has merit. The test will be whether those involved see it as so obviously helpful that they replicate it spontaneously. We think this may be happening. COL is a tiny agency, so we must operate by finding models that work so well that they reproduce themselves without our help or involvement.

I hope I have given you an idea of how COL applies technology to education in order to achieve sustainable development. Let me just mention, as I conclude, a series of programmes that Professor Mohan Menon is managing for teacher education.

Teacher education, both initial training and in-service training, is the key bottleneck in progress towards Education for All. Africa alone will need five million more teachers to achieve the goals of education for all. There is no way that either the initial training or the professional development can be provided for such numbers by traditional means. Hence these four programmes.

I-CONSENT stands for the Indian Consortium for Educational Transformation. It has been created by Professor Ram Takwale and others with COL's encouragement. The aim is to apply Technology-Mediated Open and Distance Education (Tech-MODE) to teacher education in a way that integrates formal, non-formal and informal education.

MATE-I stands for the Masters of Arts in Teacher Education - International, developed by the Open University of Sri Lanka for use throughout the region. The fundamental principle is that in these challenging times the teacher educators themselves need professional development and that some of this can benefit from being done in an international programme to facilitate the sharing of ideas.

NCCE-NTI are the National Commission of Colleges of Education and the National Teachers Institute in Nigeria. The idea is to network all teacher education institutions in the country so as to facilitate the adoption of open and distance learning in teacher education.

Finally, one of our roles as an international agency is to look for areas where the creation of consortia can lead to the cross fertilisation of ideas and the encouragement of innovation and transfer of good practice. A local example is a South Asia Consortium for Teacher Education that Professor Menon has helped to create for this region.

## Conclusion

In conclusion, may I say again that it has been a singular honour to give the Dr Vikram Sarabhai Memorial Lecture? My subject has been the great challenge of sustainable development and I have argued that it is not enough to argue that education is the key to sustainable development because traditional methods of education cannot match the scope and scale of the challenge. However, with the intelligent use of technology we can create a revolution in education by expanding access to it whilst cutting its cost and improving its quality.

This revolution will not guarantee that humankind gradually adopts the principle of sustainable development. However, it gives us a fighting chance of getting the mass of people to engage with the problem, provided we remember that education is for communities as well as individuals; that we create social capital as well as human capital.

I end by saying what a pleasure it has been to give this lecture in India, which certainly faces a massive challenge of sustainable development but is also full of intelligent and committed people who are creating answers to that challenge and implementing them at scale. At the Commonwealth of Learning we are proud to be connected to a wonderful network of such Indians, and I hope that one of the effects of my visit here will be to expand that network further.