New Technologies in Education: Not There Yet!

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Abstract

Both rich countries and poor countries hope that technology can improve and expand schooling. How are they progressing?

Drawing on his new book *Mega-Schools, Technology and Teachers: Achieving Education for All*, Sir John Daniel will address four questions. Can ICTs go beyond teaching children computer literacy to improving learning generally? Can technology-based Open Schooling give 400 million out-of-school 12-17 year olds access to secondary education? Can distance learning swing the focus of teacher education from theoretical pre-service study to in-service courses that really improve teaching skills? Are Open Educational Resources just another fad or could they revolutionize knowledge sharing globally?

Introduction

It is a pleasure to be in Shanghai again. I am pleased to say that this is my second visit to your wonderful and vibrant city this year. The reputation of the East China Normal University has spread well beyond the borders of your country and it is an enormous privilege to be asked to give the International Famous Scholar Lecture here after giving the Tin Ka Ping Distinguished Lecture in Hong Kong yesterday.

I thank the colleagues here, particularly Professor Gang Ding, who have made the arrangements for the visit and made me so welcome

I have entitled this lecture *New Technologies in Education: Not there yet!*Rich and poor countries alike hope that using technology can expand and improve education. Technology obviously holds great potential. But I shall suggest that we haven't yet learned to use it well.

Educational technology comes in many guises. In this lecture I shall address four issues that will, I hope be of interest to you in China. You still call yourself a developing country but you have a powerful technology infrastructure.

The first question is whether the use of ICTs in education can extend beyond teaching children computer literacy to improving their learning generally? Few people dispute that it is important for children to acquire competence in the use of ICTs. Even fewer think that they can acquire that competence without using ICTs. But many claim that ICTs can improve the teaching of all subjects and transform pedagogy and learning. I shall examine this claim. To make a rather silly analogy, you must use wood to teach carpentry, but few claim that working with wood transforms your learning of other subjects.

After examining the claims for the transformative role of ICTs I shall suggest criteria that we should use in assessing the role of technology in education generally.

The second question is very practical: can technology-based Open Schooling give 400 million out-of-school 12 to 17 year olds access to secondary education? I don't know how many of these children are in China. Most of your children are in secondary school but I know you have worries about the quality of some of the schooling. Anyway, I make no apology for discussing what I consider to be the world's greatest contemporary educational challenge. I shall refer not only to ICTs, but to all forms of technology. Distance learning was conducted successfully long before computers and the Internet were dreamed of – we must not forget that.

The third question brings us to another contemporary crisis. Can distance learning swing the focus of teacher education from theoretical pre-service study to in-service courses that really improve teaching skills? There is a critical shortage of teachers in many countries, developed and developing. You know the situation in China better than I do. But making teacher education maximally effective, which means examining the balance between pre-service training and in-service education must be a matter of concern to you.

The fourth question zeroes in on one contemporary feature of educational technology: Open Educational Resources. It asks whether they are just another fad or they might revolutionize knowledge sharing globally. This question is topical because some fear that wonderful period of information openness ushered in by the Internet may be coming to an end.

Earlier this month the cover story of *The Economist* newspaper was entitled "The web's new walls; How the Internet's openness is under threat". Are Open Educational Resources a major advance for humankind and are they worth fighting for if a new spirit of putting walls around knowledge is abroad? I know that Chine is making a big investment in Open Educational Resources through this CORE programme, so this must be a matter of interest to you

So that is my agenda.

Can computers improve learning generally?

I return to question one. Can the use of ICTs in education go beyond teaching children computer literacy to improving learning generally? Let me be more precise and ask whether we can point to examples, on a reasonable scale, of ICTs improving learning generally. I do not believe so. In support of that assertion I shall cite two contrary examples and one authoritative generalization.

I expand on these examples in my recent book *Achieving Education for All: Mega-Schools, Technology and Teachers*. I am pleased to say that the Chinese version of the book was launched here in Shanghai in May and copies are available at the back of the room.

My first example is from Africa. Since Africa is the laggard in education at every level, it is a promising place to explore the potential of computers to expand schooling at low cost.

The Commonwealth of Learning surveyed the use of computers in African education in 2007. We found that African adoption of ICT was in transition from a decade of experimentation to 'a new phase of systemic integration informed by national government policies and multi-stakeholder-led implementation processes'.

The researchers concluded that the progress being made in the adoption and diffusion of ICT in education throughout Africa is remarkable. The formal schools sector has led the way in ICT in education in most African countries, often before national policies have been adopted, with much of the emphasis being on secondary school access. Encouragingly, African policies now try to integrate ICT into education, rather than treating it just as a subject to be taught.

The Commonwealth of Learning was also involved in evaluating the biggest pan-African project for ICTs in Education, the NEPAD eSchools Demonstration Project. The Project involved six diverse schools in each of 16 countries through partnerships that included private sector consortia, the country government and the eAfrica Commission. The consortia were to provide an eSchool model that included equipment, networking, connectivity, training and curriculum relevant learning materials. The aim was to identify working models for the large scale implementation of the initiative, which aimed to equip 550,000 African schools with ICT and connect them to the Internet by 2020.

Many lessons were learned. I list just three:

First, and this is my key point, there was little use of technologies to enhance pedagogy across the curriculum and create student-centred learning environments, even though the ability of pupils and teachers to use basic computer programmes improved significantly.
Second, the project had a major impact in making governments aware of the importance of adopting ICT in their strategic educational plans. Also the impact of the Demo school in each community was greater than anticipated, drawing in teachers from other schools and involving community groups.

Third, the failure even to attempt cost-benefit analyses was a weakness. And I should add that, tellingly, there has been no attempt so far to roll out the wider project for which this was a pilot.

You will certainly know about my second example, which is Nicholas Negroponte's One Laptop per Child project.

OLPC is the very personal project of Nicolas Negroponte, who believes that if children can learn the very skill of learning, education will be a force to eliminate global poverty. He wants children in the developing world to 'learn learning' through a methodology called "constructivism" in which the learners construct new knowledge from their experiences. No one can fault Negroponte for the strength of his belief that ICTs can transform learning.

The MIT Media Lab built the XO-1 laptop to enable constructivist learning in the dusty, hot, un-electrified schools of poor countries. It was intended to be cheap enough to be purchased in massive quantities for one-to-one distribution.

Launched at the 2005 World Economic Forum in Davos, the "$100 laptop" was an instant international sensation. Developing world presidents attending the Forum were 'captivated by Negroponte's dream that they could revolutionize education with an inexpensive yet rugged laptop, specifically designed for children, which negated the need to construct schools or hire teachers'.

Sadly, with the benefit of hindsight the Davos launch now seems to have been the high point of the project. It has failed to achieve Negroponte's vision in several ways.

First, take up of the XO laptop has fallen short of Negroponte's ambition to place 150 million annually by 2007. A total of around one million have been distributed to date.

Second, the discourse has shifted. Negroponte used to insist that, as a generative technology to foster constructivist learning, the OLPC initiative was about 'learning not laptops'. But today's focus is on selling the XO in a market that is replete with cheap laptops that make no claim to promote constructivism.

Third, to the chagrin of academics following the project, there is little focus on educational outcomes. There were no plans to measure usage of the laptops, or to correlate changes in test scores with their use. Instead, the idea was to create a simple and generative infrastructure, stand back, and see what happened.

We cannot know whether, with better organisation and planning, the OLPC would have confirmed Negroponte's hypothesis on a global scale. But as we stand today, the jury is still out on my first question.

The situation is well summarised by Mike Trucano, a wise observer of information technology at the World Bank, who stated recently:

"A disconnection is apparent between the rationales most often presented to advance the use of ICT in education (to introduce new teaching and learning practices and to foster "21st century thinking and learning skills"), and their actual implementation (predominantly for use in computer literacy and dissemination of learning materials)".

Before moving to my second question let me pause briefly to ask a more general question about what we expect from applying technology to education.

Governments want three outcomes from their education systems:

- Access: to be as wide as possible

- Quality: to be as high as possible

- Cost: to be as low as possible

The nature of the challenge is clear when you create a triangle of vectors. With traditional methods of face-to-face teaching this is an iron triangle. You want to stretch the triangle like this to give greater access, higher quality and lower costs. But you can't!

Try extending access by packing more students into each classroom and you will be accused of damaging quality. Try improving quality with better learning resources and the cost will go up. Try cutting costs and you will endanger both access and quality.

This iron triangle has hindered the expansion of education throughout history. It has created in the public mind – and, I expect, in your own thinking – an insidious link between quality and exclusivity. This link still drives the admission policies of many universities, which define their quality by the people they exclude.

But technology can transform the iron triangle into a flexible triangle. By using technology you can achieve wider access, higher quality and lower cost *all at the same time*. This is a revolution – it has never happened before.

How does it work? The fundamental principles of technology, articulated two centuries ago by the economist Adam Smith, are division of labour, specialisation, economies of scale, and the use of machines and communications media.

Is Open Schooling an Answer?

I now look at question two through this lens. Can technology-based Open Schooling give 400 million out-of-school 12-17 year olds access to secondary education?

This is a real case. I consider that the secondary surge is today's biggest educational challenge. For 20 years absolute priority has been given to the campaign for universal primary schooling, to the neglect of other levels of education. Now, thanks to the success of that campaign, a tidal wave of youngsters is seeking secondary schooling. One estimate indicates there are some 400 million children aged between 12 and 17 worldwide who are not in secondary school. Addressing this challenge is one of the key initiatives of the Commonwealth of Learning under the leadership of my colleague Frances Ferreira.

Most of these 400 million youngsters have no chance of experiencing traditional secondary schooling because in developing countries the unit costs of secondary education are usually too high. Yet expanding secondary education is important, not least because it is the best weapon against climate change. The most powerful driver of climate change is population growth, so slowing it will help. On average, women with

secondary education have 1.5 fewer children than those without. A difference of one child per woman means 3 billion more or fewer people on the planet by 2050. Secondary education for girls must be a priority.

If conventional approaches to secondary schooling cannot deliver, what are the alternatives? COL is promoting open schooling, which is the application of open and distance learning, or ODL, at this level. This works. One example is India's National Institute of Open Schooling, which has well over one million pupils on its rolls. Alongside NIOS, India has a dozen state open schools, each of which has hundreds of thousands of pupils.

I stress that this is not a hi-tech approach. Like most distance learners the world over, these Indian children still use the well-proven media of print and audio alongside growing use of ICT. Very few of one million plus pupils enrolled in India's National Institute for Open Schooling have computers or internet connections at home although today nearly half of them register online.

One very important feature of all open schools is an extensive network of study centres, often organised, as in the case of India, by non-governmental organisations with a special interest in children's welfare. The alliances between the open school and these bodies create an excellent win-win situation. The open school gets a ready-made network of study centres while the NGOs are able to offer education to the children they seek to help.

I answer my second question positively. The challenge of the secondary surge is so great that every possible approach may be used to address it; building more schools; having existing schools work double shifts, and so on. I do not claim that open schools are the only answer, but they are an important part of the answer. That is why the open school movement is expanding quickly.

Open schooling is one of the two major topics of my book *Mega-Schools, Technology and Teachers: Achieving Education for All*. The other is the issue to which I turn with my third question, Teacher Education.

Can distance learning improve teacher education?

Can distance learning swing the focus of teacher education from theoretical pre-service study to in-service courses that really improve teaching skills?

Expanding secondary schooling is primarily a challenge for developing countries but recruiting and educating large numbers of teachers is a necessity for rich and poor countries alike. In the last decade, for example, California was employing 30,000 untrained teachers in its schools.

The worldwide shortage of teachers has several causes. First, completing the drive to Universal Primary Education and beginning to expand secondary education will require large numbers of new teachers. Second, some developed countries will see a significant proportion of their teaching force retire in this decade. Finally, the ravages of AIDS have been particularly severe for teachers in Africa.

Putting all this together UNESCO estimates that 10 million additional teachers will be needed worldwide by 2015 if Universal Primary Education is to be achieved and a serious start made on expanding secondary education. Fortunately progress is being made because the number of teachers worldwide has increased by some 1.5 million annually since 2000. However, many of these teachers have little or no training before they join their schools.

In the book I focus on two related aspects of teacher education. First, how can we recruit and train more teachers more rapidly? Second, what kind of training is best suited to the needs of the second decade of the 21st century?

Teacher recruitment

First, I make a few comments on teacher recruitment. There is a three-way correlation between the status of the teaching profession in a country, the performance of its schools and children, and the ease of recruiting able people as teachers. In countries like Austria, Canada, Finland, France and Germany teacher recruitment and retention is not a major issue. Teaching is a high status profession and most of these countries score highly on international surveys of pupil performance such as PISA.

Sadly, however, the status of teaching is declining in most countries and the blame for this lies with both teachers and governments. Where teacher absenteeism is a constant problem the public cannot be expected to admire teachers. Where governments have eroded teachers' salaries and the deployment of teachers is infested with corruption good people will not be attracted to the profession.

A century ago the Irish playwright George Bernard Shaw made the oft-repeated remark that 'those who can do; those who can't teach'. But today's knowledge economy has stood this sarcastic comment on its head. The training and skills that teachers acquire are highly valued in the contemporary labour market. Indeed, the UK's Secret Intelligence Service, MI5, advertised for teachers last year, seeking their 'relationship-building skills'.

The combination of the low status of the profession and the attractiveness of teachers' skills in the wider labour market no doubt explains why 50% of teachers in the US leave the profession within five years of completing their training.

Faced with the problem of teacher shortage and the necessity of putting an adult in front of each class of children, at least in primary school, many governments have had to resort to employing untrained teachers, as in the example of the 30,000 untrained teachers in California that we noted earlier. But sending people into the classroom with minimal initial training can be a good strategy for our times if they are then provided with appropriate on-the-job training.
Two interesting examples of this from developed countries are the Teach for America programme in the US and the Teach First programme in the UK.

These programmes recruit the best graduates they can find, ask them to make a two-year commitment to teaching, and send them into the classroom, often in the toughest schools, with just a minimal orientation beforehand. In fact almost three-fifths of the Teach First graduates elect to stay in teaching once their two year commitment is over.

What is also revealing is that these highly qualified graduates are positively attracted by the description of teaching, in the Teach First advertisements, as 'tough and demanding'. The obverse of the coin is that they are put off by the standard one-year postgraduate route into teaching as 'too slow', 'too theoretical' and 'too boring'. Importantly, however, they did value this training once they had experience of the classroom.

Teacher education

Combining these examples of putting unqualified teachers straight into the classroom in developing countries and doing the same with good graduates in developed countries, I follow others, such as Professor Bob Moon, in arguing that the concept of teacher education needs radical revision.

Although 'more policy attention was given to teacher education in the 1990s than in all the hundreds of years of history that preceded it', much of this 1990s policy-making has little relevance to today's world. 1990s policy focused on long programmes of pre-service training whereas today's emphasis must be on shorter and recurring programmes of continuous professional learning.

Professor Keith Lewin has argued that because the continuing professional development or upgrading of primary teachers is carried out without reference to school needs – often without the knowledge of the school head – it encourages them to move to other jobs rather than improving their effectiveness in their schools.

Third, policy usually ignored the gathering momentum of distance learning and its enhancement by ICT and open educational resources. Today distance learning cannot be ignored because it provides the only way of addressing the two central requirements of teacher education just identified: the emphasis on continuing professional development and the focus on the teacher in the classroom.

The locus of continuous professional learning must be the school and its focus must be the classroom. This has always been the strength of distance learning systems for teacher education.

Distance learning in teacher education

Information and communications technologies – and the possibility of open educational resources that they have created – have significantly increased the power of distance learning in teacher education. However it is not new. In my book I give profiles of eight successful applications, going back to PERMAMA, an in-service programme for Quebec Mathematics Teachers that I worked on in the early 1970s. The impact of this programme is still being felt in the high performance of Quebec pupils in the PISA mathematical literacy surveys.

But this programme, just like its much more recent California equivalent, CalStateTEACH – and to some extent the teacher education programmes of the UK Open University, had to face the hostility of teacher educator colleagues who were so heavily invested in long, theoretical pre-service programmes that they felt threatened by programmes that reached teachers on the job and taught them on the job. Yet these programmes are rated as positively by employers as other university programmes and more positively than most. External independent evaluation is giving the programmes very high ratings.

One of the great contributions of information and communications technologies to in-service programmes has been to make it possible to gather the teacher learners into a community of practice through computer conferencing. This virtual environment provides a secure setting in which novices can gain experience through contact with veteran practitioners.

Open educational resources are already making a powerful contribution to teacher education in Africa. My book includes a profile of a programme of Teacher Education in Sub-Saharan Africa abbreviated as TESSA.

TESSA is a consortium of 13 African universities, the UK Open University and five international organisations including COL. It works across nine African countries – with more participating informally – by creating teacher education materials in Arabic, English, French and Kiswahili. In 2008 nearly half a million African teachers worked with materials and resources produced through the TESSA community. Since these are classroom-based in-service materials they have a direct impact on millions of children through their use in the classroom.

Because they are open educational resources, institutions and schools can adapt them to their needs. For example, Nigeria's National Teachers' Institute, one of the world's largest programmes of teacher education at a distance, uses the materials differently from the University of Fort Hare in South Africa, which has developed a distance learning programme for teacher education alongside its campus offerings because it could see that the campus programmes were not reaching most of the teachers who needed continuous professional development.

This programme has evoked a very enthusiastic response from female teachers in a poor rural region of South Africa.

It seems that teacher education needs radical rethinking to meet these challenges – and not just in developing countries. Henceforward it may be good policy to put teachers into schools with the minimum training necessary for them to function, and then to concentrate the major resources of teacher education on recurrent in-service programmes of professional learning that are resolutely based on school practice and the classroom experience.

Once that paradigm shift is made, all teacher education institutions will have to give themselves the capability to offer distance learning programmes in order to reach teachers in their schools. Today information and communications technology can make distance learning a richer experience than learning in a university classroom. Furthermore, drawing on the growing body of open educational resources allows institutions to take materials of world-class quality and adapt them to local conditions in a thoroughly authentic manner.

Open Educational Resources: fad or revolution?

Which brings me neatly to my final question: are Open Educational Resources – OERs – just another fad or could they revolutionize knowledge sharing globally?

I suggest that OERs are entirely consistent with the best of our academic traditions. Reflect for a minute on the contrast between the way that academics conduct research and how they prepare for teaching. When we engage in research we assume that we will build on the research of others. We cite previous work as background to our own, or to apply it to a new situation, or sometimes to challenge it. We publish our research results so that others can scrutinise our work and build on it in their turn.

Compare this to the way we prepare for teaching. We usually scan current scholarship to ensure that our teaching is up to date. However, apart from recommending textbooks, we rarely make much use of others' teaching materials, even if we could access them.

Furthermore, whereas we treat research as a public activity, until quite recently most academics considered teaching to be a private activity – except, of course, for the students present. Department heads were shy of attending their colleagues' lectures and academics were slow to accept student evaluations of their teaching.

These attitudes began to change 20 years ago, thanks in part to the great American educationist, Ernie Boyer, and his book *Scholarship Reconsidered*. Starting from Aristotle's dictum that teaching is the highest form of understanding, Boyer insisted that knowing and learning are communal acts.

He distinguished four types of scholarship: the scholarship of discovery, which we usually call research; the scholarship of integration, that throws bridges between disciplines; the scholarship of application, that uses knowledge to solve real problems; and the scholarship of teaching – whose role, like research, is to transform and extend knowledge. As a result of Boyer's work, the way that academics are evaluated for promotion and tenure has evolved from an almost exclusive focus on published research towards a more holistic conception of their work.

How do OERs fit into this evolutionary process? I return to the statements that teaching is the highest form of understanding and that knowing and learning are communal acts. Open Educational Resources place teaching in the public domain. OERs can be developed by individuals – what my Vancouver colleague Professor Tony Bates calls the 'Lone Ranger' approach – but more often they are developed by teachers working as a community.

I think of the OERs on the UK Open University's *OpenLearn* website, which derive from courses developed by teams. The Virtual University of Small States of the Commonwealth is an extreme international example. It is a collaborative mechanism through which academics from up to twenty countries work together online to develop teaching and learning materials as OERs, which are then adapted and used by all to support both classroom teaching and distance learning.

Here in China have your own CORE programme for developing Open Educational Resources.

OERs offer special advantages for distance learning – and today there are few universities that are not engaged in distance learning in some way. The possibility of sharing teaching and learning materials has long been hailed as an advantage of distance education. Until recently, however, such sharing has encountered three obstacles which OERs now surmount.

First, institutions and their academic staff are prone to the 'not invented here' and the 'not invented by me' syndromes. The rich resources of the Internet, Google and social software are steadily curing that syndrome.

Second, until academic world went digital sharing materials was tiresome. They always needed adaptation, and this meant re-keying large amounts of text and changing illustrations.

Third, intellectual property rights were a nightmare. Copyrighted material was often buried in learning materials that claimed to be free of restrictions, and a conscientious institution had to proceed very circumspectly.

OERs are now removing the last two of these obstacles. First, they are almost invariably developed in digital format even if, in Africa for instance, they often reach students in the form of print. That makes them easy to change and adapt. Second, the various licences under which OERs are shared mean that you can proceed with confidence both to develop and use OERs.

My final comment is that OERs can facilitate intellectual exchanges that are genuinely multi-directional and multi-national. There are of course concerns about OERs. One is that OERs promote a form of intellectual neo-colonialism whereby the rich north rams its OERs down the throats of the poorer south. But that does not have to happen. In the TESSA programme that I just mentioned thirteen African universities are working together to produce and use OERs for in-service teacher education. Last year half a million African teachers in ten countries adapted and used these OERs, which are available in Arabic, English, French and Kiswahili.

That seems to me to show that OERs are not a fad but a revolution in knowledge sharing. And, furthermore, that they are a nice example of an educational technology that advances the revolution I noted earlier, of increasing access, improving quality and cutting costs – *all at the same time*. That is why COL has a joint project with UNESCO to take the awareness of the potential of OERs beyond the community directly involved in developing them.

Conclusion

It is time to conclude. The title of this lecture is *New Technologies in Education: Not there yet!* I have addressed that statement through four subsidiary questions. I found that the jury is still out on whether computers can do more for children's learning than help them master IT. However, technology can help education address the major challenges of the secondary surge and the expansion and improvement of teacher education. Open Educational Resources are an important tool in both cases.

I conclude from all this that we must take a broad view of technology if we are to reap its benefits in education. Technology is more than networked laptop computers; it is the judicious use of the principles of technology listed by two centuries ago by Adam Smith: division of labour, specialisation, economies of scale, and the use of machines. Those principles caused an industrial revolution then. They can create an educational revolution now. In China you are excellently placed to take that revolution forward.