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ICTs IN GLOBAL LEARNING/TEACHING/TRAINING

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UNDERSTANDING THE NATURE AND ROLE OF ICT

Learning, teaching and training: going global

Although great universities have always been international institutions, states have emphasized national responsibility for schooling ever since popular education began to develop in the 18th and 19th centuries. Countries consider that education is a vital element in their cultural, economic and social development.

More recently, the shared perception that education systems are increasingly important factors in economic development has stimulated interaction between countries as they try to learn from each other's policy successes and failures. The drive towards Universal Primary Education, which has gathered steadily increasing momentum since the Jomtien Forum in 1990, has been an impressive exercise in international cooperation.

The OECD's Programme of International Student Assessment (PISA) (OECD, 2012) has made the participating developed countries acutely aware of their educational performance relative to competitor states. Meanwhile, developing countries that are expanding 'open schooling' to grapple with the huge surge of pupils now seeking secondary education are helping each other within international collaborative frameworks such as the Commonwealth Open Schooling Association.

The increasing internationalization of higher education led UNESCO and the OECD to issue Guidelines for Quality Assurance in Cross-Border Higher Education (UNESCO, 2005). Today UNESCO is exploring the feasibility of a Global Convention for the Recognition of Degrees and Qualifications to complement the regional conventions already in place. The accelerating Open Educational Resources (OER) movement is producing a global pool of excellent learning materials that anyone can use and adapt (UNESCO, 2012).

The role of ICT: driver and facilitator with students leading the way

ICT is both a driver and a facilitator of this increasing globalization of education.

It is a driver because educators realize that the combination of digitally based ICTs gives more powerful possibilities for extending and improving learning, teaching and training than all previous educational technologies from the blackboard to television. Much of teaching and learning is about the manipulation of symbols, whether those symbols are words, numbers, formulae or images. ICTs are qualitatively different from previous instructional 'aids' in their power to help manipulate symbols.

It is a facilitator because the Internet is an extraordinary means for the wide, low-cost distribution of educational material. As the Internet has also become a vehicle for interaction, its potential for teaching and learning has become even more significant.

Crucially, students are driving the introduction of ICTs at all levels. School systems feel they must adapt to a digital generation and university students are opting to study online in ever larger numbers.

The nature of technology

In applying ICT to education we should start by recalling the features that they share with all technologies. Many applications of ICT in education fail or underperform because these fundamental characteristics of technology are lost behind a focus on particular machines.

All technology shares two sets of features. One is captured in the definition of technology as 'the creative application of both scientific and tacit knowledge to organized tasks involving people and machines aimed at meeting sustainable goals' (Lane, 2012). This includes three key factors. First, technology is about taking action to meet a human need – in this case education. Second, technology relies not only on scientific knowledge but also includes values and practical craft know-how. Third, technology involves organized ways of doing things. It covers the intended and unintended interactions between machines and the people and systems that use them or are impacted by them through various processes.

This last point is vital. Many attempts to introduce ICT have disappointed their promoters because they paid insufficient attention to the people and systems involved.

The second set of features of technology explains why technology has transformed everyday life since the industrial revolution by making most of the products and services that we use cheaper and better. Adam Smith captured this revolution in his classic book, 'The Wealth of Nations', where he argued that the application of technology involves division of labour, specialization and economies of scale – as well as the use of machines.

These are also key principles for the application of ICT in education, where the goal must also be to raise the quality, efficiency and accessibility of teaching and learning.

The technological revolution in education

To understand the potential of ICT and plan its use in education, start by recalling that governments share three objectives for their education systems. They seek to widen access at all levels, they want to raise the quality of the outcomes and they must keep costs low so as to maximize the value of their investment of public funds.

Representing these goals of access, quality and cost as a triangle of vectors illustrates well the potentially revolutionary contribution of ICT (Daniel, 2010). The aim is to stretch the triangle by lengthening the vectors of access and quality while shortening the vector of cost. In conventional classroom education with a teacher and a group of learners this is impossible. Attempting to increase access by packing more learners into the classroom will provoke accusations that of loss of quality. Trying to increase quality with more learning resources and better teachers will increase the cost. Cutting costs directly will impact both access and quality.

Technology has already stretched this 'iron' triangle for most of the other products and services that we rely on in everyday life. Modern cars are incomparably better and more affordable than the private transport of earlier times, while contemporary dentistry has vastly improved people's oral health. The intelligent use of ICT can bring similar revolutions to learning, teaching and training.

The evolution of hardware and software

The rapid evolution of hardware and software for education shows no sign of slowing down. Furthermore, the trajectories of the application of ICT in education are diverging across the world. When desktop or laptop computers were the commonest interface between learners and ICT there was much soul searching about the 'digital divide'. It expressed the concern that both within and among countries individual access to digital equipment varied widely. Today the digital divide is more revealing of the growing wealth gap within countries than of an absolute lack of access to digital communication. Developing countries have taken massively to mobile technology and networks are growing to meet their rising demand for connectivity.

Open educational resources: coming of age

Much of the tremendous potential of ICT for global learning, teaching and training comes together in open educational resources (OER). A decade after the term OER was first coined at a forum on open courseware for developing countries, the OER 'movement' gained a new maturity at UNESCO's World OER Congress in 2012 with the adoption of the Paris Declaration on OER (UNESCO, 2012b). As well as encouraging governments to promote and support OER for reasons that combine equity and sound economics, it asks them to ensure 'that educational materials developed with public funds be made available under open licenses'. As countries adopt such policies they will create a world in which, as never before, knowledge is the common wealth of humankind.

The growing availability of OER will dramatically increase the potential of ICT in education. Teachers will quickly change their attitude to ICT as good quality and relevant OER become plentiful, simple to locate and easy to adapt and modify. That will transform the effectiveness of ICT in the classroom.

Key questions and policy issues for the use of ICT

This summary of the essence of technology and ICTs can be distilled into five questions to guide in the introduction of ICTs into learning, teaching and training.

Why introduce ICT?

There must be clarity about what aims are being pursued through the introduction of ICT into education systems. For example, ensuring that all citizens are computer literate is a common aim. But there are better ways of achieving this objective than flooding school systems with computers. Similarly, even if playing with computers does enhance children's creativity, simply filling schools with ICT equipment may be an expensive distraction from other important goals.

Into what system is ICT being introduced?

To be effective technology must be part of a system. Key elements of education and training systems already in place are the curricula, the teachers, the organization of the system and its supporting infrastructure. The insertion of ICT into these established systems requires careful and sensitive planning.

Is ICT meant to improve learning outcomes?

Those introducing ICT expect that it will change things for the better, either by improving the quality of learning outcomes or by making the system more cost-effective, or both. The first question is whether ICT will be used to carry the existing curriculum or whether its introduction will be accompanied by curriculum reform that takes advantage of the benefits of ICT? If so, such reform, which may be timely anyway, is a major task in itself.

Is ICT intended to improve cost-effectiveness?

The second question is whether ICT is intended to make the education system more cost-effective. Such an aim will require careful planning to ensure that there is some substitution of capital for labour. Without such substitution overall system costs will increase because the investment in ICT will simply be an add-on cost.

Is there an exit strategy?

Education systems will last longer than any particular type of network or computing device. Earlier we noted that technology should be used to aim for sustainable goals. Vendors will naturally try to lock institutions into their particular proprietary ICT systems and make it difficult for them to change to another approach or supplier. Policy-makers must be aware of this. While lock-in may be less of a problem as systems become increasingly interoperable, good plans should include exit strategies.

ICT IN SCHOOLS: DISAPPOINTMENT

We shall now examine the introduction of ICT at three levels of education in the light of these five principles. The higher the level of education and training, the more ICT is seen as a useful component of the system.

Primary education: do children learn best in groups?

For most educators the socialization of children, through contact with their teachers and other pupils, is a fundamental purpose of primary education. This may be particularly true in richer countries where children are often left to their own devices with both parents working and spend many solitary hours watching television.

Educators also agree, however, that primary school is an important locus for 'learning how to learn', which has been the focus for several major ICT projects. Two high-profile projects have addressed this challenge directly.

One Laptop Per Child: failed implementation?

Best known is the One Laptop Per Child (OLPC) programme launched by Nicholas Negroponte in 2005. He started from the premise that children could teach each other through experiential trial-and-error learning on a rugged yet cheap educational tool. Believing that knowledge is constructed by the learner through activities and not supplied by the teacher, he wanted children in the developing world to 'learn learning' through a methodology call constructivism.

Nearly a decade later it seems that despite its high profile the project has been a failure. Whereas Negroponte aspired to place 150 million of his specially designed XO laptop by 2007 the number in use today is not more than a few million. The reason for the failure is that the rollout of the XO laptops was done without addressing any of the key questions that we enumerated earlier.

First, the project had no clear aims that could be evaluated. Second the computers were launched with very little educational software. Third, there was no attempt to fit them into the existing educational systems by providing training for teachers. Fourth, the distribution and maintenance of the machines was left largely to chance.

The largest experiment with the XO laptop is in Peru, which spent $225m to supply 850,000 laptops to schools throughout the country. However, according to an assessment in The Economist (2012) 'giving a child a computer does not accomplish anything in particular… Peruvian test scores remain dismal. Only 13% of 7-year-olds were at the required level in maths and only 30% in reading'. An evaluation by the Inter-American Development Bank did not find evidence that access to a laptop increased motivation, or time devoted to homework and reading. It concluded that the government needed to improve teacher training and the curriculum and that the classroom environment needed to change.

The Hole in the Wall: could it work in schools?

It is interesting to compare the OLPC programme, which aimed to roll out custom-designed laptops to many developing countries, with the Hole in the Wall (HITW) project in India. Its designer, Sugata Mitra, began with similar assumptions to Negroponte about computers facilitating constructivist learning but then went in a different direction. Instead of trying to put computers in schools Mitra put them in local playgrounds, beginning with a computer embedded in the brick wall of an informal playground next to residential slum in Delhi. The results surprised everyone. Slum children were able to use the computer to browse, play games, create documents and paint pictures within a few days. Researchers called it 'Minimally Invasive Education', meaning that children could learn to use computers on their own without adult intervention.

Since the success of that early experiment Mitra has conducted extensive research and the phenomenon has been reproduced in other countries (e.g. Cambodia, South Africa). Perhaps the most fundamental conclusion of this research is that learning happens in groups. The OLPC programme, as its name implies, stressed that each child should have a laptop, whereas Mitra found that having numbers of children working on the same computer is the key to success. Typically, 300 children can achieve computer literacy in India in three months with only one machine. Groups are normally heterogeneous with three to six children actively engaged, although a wider group of ten or more may gather behind them and offer advice (often wrong). In rural areas there is no differentiation by gender. Children aged 8-14 work together. The lower end of the age range, around eight, is the age at which children have the readiness and preparedness to learn. The upper end, around 14, is when adolescents feel that they are too old to visit a public space with younger children, although some then say they miss the HITW experience. The visits that children make to the HITW last between 5 and 30 minutes. Most of the children are enrolled in local elementary schools, usually government schools.

Although this project took place outside the school system researchers measured the impact of participation in the HITW on pupils' achievement in English, Science and Mathematics. Frequent visitors to HITW significantly increased their achievement in Mathematics but no effect was found for English and Science.

Conclusions

What conclusions can we draw from these two projects? The OLPC project took place in the schools but gave little role to the teachers. The HITW was done outside the schools. In both cases children enjoyed working on the computers but the activity had little impact on their school performance. Evaluation of the OLPC concluded that the training of teachers, the curriculum and the classroom environment would all need to change in order to for computers to have a more positive impact. Since the HITW took place in playgrounds it would need to be embedded in a wider educational ecosystem in order to have a wider impact. In neither case was a serious attempt made to address the key questions for the use of ICT that we listed earlier.

Although the OLPC and the HITW both had the advantage of particularly strong intellectual input from their creators (and generous funding for OLPC), they share the disappointing results of most other initiatives for introducing computers into schools. After reviewing many such projects Toyama (2011) concludes that the history of electronic technologies in schools is fraught with failures. He adds: 'there are no technology shortcuts to good education. For primary and secondary schools that are underperforming or limited in resources, efforts to improve education should focus almost exclusively on better teachers and stronger administrations. Technology has a huge opportunity cost (compared to) more effective non-technology interventions.'

Secondary education: learning computing or learning with computers?

Much of the record of failure in introducing computers to primary schools is equally true of secondary schools. However, there are greater incentives – three in particular – for developing approaches to try and ensure that computing does make a positive contribution to secondary education.

Computer literacy

Most education systems aim to ensure that children leave secondary school computer literate. Because secondary schools are equipped with computers for this purpose it is worth exploring whether, as well as using them for teaching computing, they can be used to improve and enrich the teaching of other subjects.

The political imperative

Whatever the evidence to the contrary, many politicians continue to see ICT as a shortcut to the improvement of education. They hope that using technology will yield quicker results than the hard slog of improving teaching and management. Since these pressures will bring computers into schools anyway, policy-makers should ensure that it is done in a systematic and successful manner.

The secondary surge

Providing access to secondary schooling is now the world's biggest educational challenge. Because of the success of the drive to Universal Primary Education hundreds of millions of children between the ages of 12 and 17 are now not getting secondary education. Many countries do not have the resources to address the challenge by expanding the number of conventional public secondary schools so all feasible alternatives must be exploited. Open schooling is one such approach and ICT can play an important role in expanding it. Daniel (2010, p. 102) has argued that open schools can be an invaluable resource for entire educational systems by linking schools, teacher-training institutions, curriculum developers, ministries of education and the community.

Taking a systematic approach

The only way to break out of the cycle of disappointment that has characterized the introduction of computers into schools so far is to take a systematic approach that addresses the questions listed earlier. This means giving focused attention to four elements of the system: training teachers; creating curriculum materials; making organizational arrangements; and creating a computer network.

Training teachers

Providing training for teachers before the roll-out of the computer systems in the schools is the most important element in the whole approach. Teachers who are not confident that they can use computers effectively with their children will simply avoid using them. There are many stories of laptops gathering dust in school cupboards because teachers did not feel equipped to use them in the classroom. The task is not to force a change in teachers' mentality but simply to empower them to use modern tools with confidence.

Fortunately schools and education systems can benefit from the careful work that has been done by UNESCO and an international team to create a complete ICT Competency Framework for Teachers (CFT) (UNESCO, 2012). This starts with computer literacy but goes far beyond it, including all elements that teachers need to master in order to use computers confidently in the classroom to teach subjects other than computing.

The CFT is a curriculum framework but organizations like the Commonwealth of Learning (COL) have created courses for teachers based on this CFT curriculum such as the Commonwealth Certificate for Teacher ICT Integration, which is freely available on COL's website (Commonwealth of Learning, 2012).

Another interesting example is the ICT integration programme for teachers developed, also using the UNESCO CFT, by the Cyril Potter College of Education (CPCE) in Guyana (Commonwealth of Learning, 2012b). The notable feature of this approach was that the faculty of the CPCE, using the CFT curriculum, were able to assemble quality courses to teach that curriculum very quickly using open educational resources (OER) from the Internet.

The existence of these key elements, the UNESCO CFT and the courses for teachers derived from it, greatly facilitate the task of educational authorities in giving their teachers the necessary training. Doing this well is the best assurance that the roll-out of computers in schools will be a positive experience.

Creating curriculum materials

Countries introducing computers into the schools will want the learning materials used to reflect their national curriculum. Converting classroom curriculum materials and textbooks for computer-based learning is not a trivial task if the potentialities of the computer are to be fully exploited. Effecting this conversion may be a good pretext for revising some the content of the old curriculum.

Moving learning materials to computers also gives the opportunity to combine the best of the global with the best of the local by drawing on OER. Similarly smaller countries can reduce the cost of curriculum development by working together. This was done by Botswana, Lesotho, Namibia, Seychelles, Trinidad and Tobago and Zambia, which jointly developed materials for the complete senior secondary curriculum with the assistance of the Commonwealth of Learning (Commonwealth of Learning, 2012c). These can be freely used – and more importantly adapted to local needs – by any teacher in the world.

Thanks to OER the previously lengthy and costly process of developing good learning materials for use in the classroom and on computers can now be done quickly and cheaply.

Organization

Technology involves organized ways of doing things. Introducing computers into schools requires organizing physical and administrative networks across school systems if not nationally. Few schools are big enough to go it alone and in any case the sharing of experience between teachers and schools can make the introduction of computers a richer experience. School systems are wise not to skimp on staffing the central network

organization because as staff increasingly turn to computers to carry out more educational and administrative tasks network organization becomes a mission-critical function.

Those jurisdictions that have created open schools in response to the secondary surge should see them as a key resource for the entire school system (Daniel, 2010, p.79). This is because open schools must acquire strong expertise in ICT to run their large administrative systems, as well as being major developers of curriculum materials that can be used in all schools.

Computer network

We have left the issue of choosing a computer network and suppliers until last because it probably does less to determine the success of the introduction of computers into schools than the areas of teacher training, learning materials and organization already addressed. However, school systems should take independent professional advice in choosing and installing computer systems in order to ensure that the systems chosen are appropriate, sustainable and cost-effective.

ICT IN HIGHER EDUCATION: DISRUPTION

The centrality of ICT in higher education is in stark contrast to the somewhat hesitant role that it has played so far in schools. ICT is so pervasive in the administrative and research activities of universities that they have come to take it for granted and are now surprised to see ICT beginning to disrupt the teaching function. When UNESCO's 2009 World Conference examined the 'new dynamics' of higher education and research it found that many of them were related to the increasing role of ICT and the related activity of open and distance learning.

Learning: students leading the way

Students are opting for online learning in large numbers. Bates (2011) identified four key trends in US higher education. The first is the rapid growth of online learning. Enrolment in fully online (distance) courses in the USA expanded by 21% between 2009 and 2010 compared to a 2% expansion in campus-based enrolments. Second this growth is accelerating. He projected that over 80% of US students are likely to be taking courses online in 2014, up from 44% in 2009.

His third finding is that the US for-profit sector has a much higher proportion of the total online market (32%) than its share of the overall higher education market (7%). Seven of the ten US institutions with the highest online enrolments are for-profits. Being already well established in this delivery mode the for-profit providers are likely to reap the advantage of student preference for online. Furthermore the for-profits are better placed to expand online because they face less resistance from academic staff and need not worry about exploiting an earlier investment in campus facilities.

Fourth, Bates found that public sector higher education did not have ambitious goals for online learning. As this Policy Brief has argued, the intelligent use of technology could help higher education to accommodate more students, improve learning outcomes, provide more flexible access and do all this at less cost. Instead, he found that costs are rising because investment in technology and staff is increasing without replacing other activities. There is little evidence of improved learning outcomes and often a failure to meet best quality standards for online learning.

Teaching: corporate structures challenged

One of the reasons for the success of the for-profits in online learning is that they operate their organizations as systems and use a team approach to course development and student support. In contrast, most public institutions usually simply rely on individual academics to create and support online versions of their classroom course. Bates calls this the 'Lone Ranger' model and argues that it is less likely to produce sustainable online learning of quality than the team approach.

If these trends continue and public institutions do not adapt their corporate structures and processes to the demands of online teaching we could see an important reconfiguring of higher education systems as they split in a public sector focused mainly on research and a private sector doing most of the teaching online.

This would create an important issue of public policy. Some governments have tried to strengthen the distinction between research-active universities and others. However, the idea that this might also become a distinction between public universities (research) and for-profit universities (teaching) is new. Public higher education's leaders have some important policy choices to make!

Training: from informal to formal learning

The exception to the generally hesitant approach that public higher education has taken to online learning are the open universities: large distance teaching institutions that enroll over a hundred thousand students (e.g. the UK Open University) or even over a million (e.g. India's Indira Gandhi National Open University). These institutions have deployed ICT at scale for many years in both teaching and administration. More recently some of them have made a strong commitment to the promotion of informal learning by making their learning materials available as OER. In 2012 some US universities went a step further and started offering Mass Open Online Courses (MOOCs) free worldwide. Only a tiny proportion of learners complete these non-credit courses but it is a development to watch (Daniel, 2012).

Meanwhile, the UK Open University has tens of millions of visitors to its OpenLearn website and tens of thousands of downloads from iTunesU, where it is the biggest player. Open University Vice-Chancellor Martin Bean considers that one of the functions of a modern university is to provide paths from this informal cloud of learning towards formal learning for those who wish to take them. This could create new patterns of ICT-based training and higher education as individuals draw on the global pool of OER to find materials for their studies and then present themselves for assessment and certification to a member institution of the OER consortium that is under development.

This will provide an interesting convergence between higher education and the lifelong learning agenda that UNESCO has pursued through its series of CONFINTEA conferences (UNESCO, 2009).

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Despite their clear potential, the expectation that ICTs will advance learning, teaching and training is often frustrated. Computers are powerful tools for the manipulation of symbols (words, numbers, images), which is a core educational activity. Combined with communications technology they have created the Internet: an extraordinary global learning environment. Yet, despite these assets, the dream of transforming teaching and learning with ICTs remains unfulfilled. Computers in schools have usually been an expensive disappointment, while most higher education institutions seem reluctant to embrace online learning as eagerly as their students.

The Policy Brief outlines the systematic approach that must be taken for ICTs to fulfill their promise. Schools must focus on training teachers; creating curriculum materials; making organizational arrangements; and creating networks. Higher education must rethink its role for a world where open educational resources make high quality content abundant and students want to combine work and study seamlessly.

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