Technologies, education, development and costs
A third look at the educational crisis

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In the far-off 1960s, decade of the Beatles, flower-power, and African independence, as well as the invention of distance education, and in contrast to the optimism of the decade, Philip Coombs published a book on the *World education crisis* (Coombs 1968). He revisited the theme in the 1980s although he did so before it was possible to see the full extent of the damage Reagan, Thatcher and their acolytes were doing to the south and its education (Coombs 1985). Twenty years on it is worth revisiting his analysis. Coombs warned that there was a crisis in which rising demands for education were coming up against fiscal barriers while expectations of what it could do were unachievable without changes in its ossified curriculum. While he was measured in his assessment of their potential he saw both nonformal education - a term he coined - and the use of the technologies as having some potential in helping to resolve the crisis. Coombs was prescient, right and wrong in his analysis: prescient in his assessment of the technologies, right in his identification of the crisis, probably wrong in his overall assessment of both formal and nonformal education where, in much of the world, formal education has done better and nonformal worse than he anticipated.

The purpose of this paper is to ask some of Coombs' questions again. In a new decade, does the record suggest that communication technologies can play a major role in the reform of education? It does so first by looking for evidence on the digital divide between the north and the south, in order to see what kind of questions the divide puts on the policy-maker's agenda. That comes first in the belief that any educational policy about the technologies is dependent on national policy about communications and technology. Then we can ask how, and how effectively educational technologies are being used in education today. And then we need to ask about their costs.

The digital divide

There is ample evidence of the existence of the digital divide, in which the north has much better access to new information technologies than the south. Nor is there just one divide as there are deep divides within countries; the fact that Bangalore can match silicon valley in software development does not mean you will find a cybercafe in every Indian village. But divisions between the information-rich and information-poor are important for the policy maker as they reflect:

> a new international division of labour. The division is based less on the location of natural resources, cheap and abundant labour or even capital stock, and more on the capacity to create new knowledge and apply it rapidly through information and telecommunications to a wide range of human activities in ever-broadening space and time.
>
> Carnoy 1995: 212

While countries in the south vary in the extent to which they are benefiting from the new technologies, with the NICs, China and India, and the larger countries of Latin American looking as if they may develop strategies to their own benefit, Carnoy goes on to argue that there are also 'clear losers ... the Fourth World, comprised of marginal rural economies on all three continents and of Africa's and Latin America's sprawling urban peripheries' (*ibid.*: 213). Except for neoliberal free-marketeers there would seem to be a moral imperative to look for policies that might seek to bridge the divides of information that threaten to reinforce existing inequalities in wealth.

The search for policy is problematic. It is easy to make the argument that the south fails to invest in the new technologies at its peril. But, on the other hand, the OECD found that, while investment in information and communication technology equipment was a driver of labour productivity growth in the United States, 'there still appears to be little empirical evidence of important economy-wide effects

developing-country experience found that while, above a threshold, the new technologies may influence growth, there is a shortage of empirical evidence on the point and 'the argument that the use of these technologies reduce transaction costs and this promotes the spread of markets is largely unverified' (Bedi 1999:49). In short, the economic literature warns us against seeing investment in the new technologies as a guaranteed route to economic growth. Furthermore, there are opportunity costs in any investment. Heeks referred to some 50 major initiatives by 1998 to improve internet access in Africa, to which should be added other ICT expenditure by donors and governments and pointed out that 'there are finite amounts of money, time and attention. Investing these in ICTs means explicitly not investing them in other development areas. Yet the "ICT fetishists" have so far been unable to demonstrate how ICT-based information represents a more important resource than water, food, land, shelter, production technology, money, skills or power in the development process' (Heeks 1999: 10).

Good policy for the new technologies needs to find a way of ensuring that their development in the south is not in fact yielding more benefits to the north, in a replay of classical colonial economics. The latest Human Development Report illustrates the point by reference to the drain of software professionals from India to the United States.

> The United States will issue about 200,000 H-1B visas a year over the next three years. These visas are issued to import specific skills, primarily in the computer industry. Almost half are expected to be issued to Indian software professionals. What resource loss will this represent for India?
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> Consider just the public spending on students graduating from India's elite institutes of technology. Operating costs per student run about $2000 a year, or about $8000 for a four-year programme. Adding in spending on fixed capital ... brings the total cost of training each student to $15,000 - $20,000. Multiply that by 100,000, the number of professionals expected to leave India each year for the next three years. At the high end it brings the resource loss to $2 billion a year.
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> How might India begin to recover this loss? The simplest administrative mechanism would be to impose a flat tax - an exit tax paid by employee or the firm at the time the visa was granted.
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> UNDP 2001: 92

The report goes on to warn against the danger that such a tax might encourage students to migrate at an earlier age, depriving Indian institutions of some of their best students, and goes on to examine other policy options through loan and tax policy that might have similar effects.

We do not need to take a view about the pros and cons of international labour migration to establish that a national communications policy needs to look at the costs as well as the benefits of investment in the new technologies and in education and training in relation to them. Only through deliberate policy, with national interests and the interests of the disadvantaged at their centre, is there any chance that the new technologies can avoid reinforcing old power structures and distributions of wealth. Whatever one's reservations about some of the bolder claims for the new technologies, they do put policies about their use and deployment, and policies about investment in them, on national and international agenda alike.

There is an extensive and growing literature on policy about the digital divide. Here there is room just to touch on some of the elements that might go into such a policy as it relates to education. Heeks emphasises the need to consider how the new technologies can be used in the interest of the poor and suggests that they 'need ICTs more to give them "voice" than to give them "hands", "brains" or "ears" and that they need community intermediaries to benefit from the them(Heeks 1999: 11). We come back, below, to questions about the technologies and intermediaries in looking at their potential for nonformal education. Then educational policy will need to address questions about the level of investment in education about the technologies in the interest of the economy. It is possible to identify a hierarchy of economic needs here. The wealth, level of technological development, and size of the country will determine how far up the hierarchy it wants to go; small states may reach quite different

decisions from large. The hierarchy has at least three levels.

> First, given the penetration of the new technologies within the economy, any state will need to ensure that there is a workforce of people who can use the technologies in their job. If there is a national shortage of labour with the skills to manage financial transactions or airline bookings for example, the economy will suffer.
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> Next, and even in a small state, there is a strong argument for ensuring that a country is self-sufficient in people who can maintain hardware and software.
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> Beyond that, some countries will want to develop national capacity to compete internationally either in the manufacture of computer hardware or in the development of software.

Following this type of analysis, policy makers will need to take consider the relationships between education and training and determine how far education and training about computers belongs in school, or in tertiary education, or in the private sector.

Neither a bias towards the poor, nor hard thinking about how many people need to learn what about computers, is a total educational policy in relation to the digital divide. But they illustrate the need to develop such policies which will shape the use of the technologies in education.

Technologies and the curriculum

This approach suggests that workforce demands should play the leading role in determining the level of investment in education about the technologies. Perhaps it is too narrow: three different claims suggest it may be.

First, it is argued that the new technologies are so transforming our understanding of the world that they are a necessary part of the curriculum. On this argument, everyone should learn about computers and, god help them, about navigating the internet at school, and the rest. But it is remarkably easy to get the curriculum wrong. It was a professor of computer science at the UNESCO informatics conference, here in Paris in 1989,who reminded us that similar arguments a century before would have led everyone to learn the morse code. Even within a single generation we have got it wrong: just twenty years ago computer studies for my own children meant learning to program in basic. The question of how we address information technology in the curriculum, and what we cut out if it is to have a bigger place within it, is neither simple nor obvious.

Second, it may be that the new technologies can transform education. There have been some hopes of this. Costa Rica, for example, set up a programme to use computers in schools within the context of a move towards a more constructivist curriculum (Inés *et al.* 1998). More often the expectation is both vaguer and more dramatic: ICT 'can facilitate communication, increase access to information, provide greater access to students with special educational needs, model and simulate a range of scientific phenomena, and generally motivate students, develop problem solving capabilities and aid deeper understanding' (Selinger 2001). It is worth going back to Coombs at this point:

> In the euphoric education atmosphere that prevailed in the 1950s and much of the 1960s, unbounded enthusiasm and high hopes in many quarters greeted television, whose clamour and extraordinary capacity to combing sight and sound and deliver them instantaneously to classrooms over large areas overshadowed the earlier new media of films and radio. With the bush of a button or flip of a switch - so it was claimed at one extreme - the best teachers in the nation could enter every classroom bringing with them a foreign language, vivid laboratory experiments, and a host of other things of great educational value that were well beyond the reach of the ordinary classroom.
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> Coombs 1985: 126

And yet:

> By the end of the 1960s, the great boom in instructional television that had begun with such promise in the developed countries in the 1950s had lost its momentum and leveled off far short of earlier expectations ... In the developing countries as well, the high hopes held for instructional television had waned by the end of the mid-1970s, primarily because many practical difficulties had been encountered in applying it effectively and because costs proved to be higher, and results lower, than had originally been projected. ... [Evaluation showed] that few of the projects examined were living up to expectations; most were malfunctioning, some badly so - but not because television's high potentiality as an educational tool was a myth. The basic problem was the way this new technology was being used and misused. Typically, projects had been poorly planned and rushed into operation without adequate preparation. The lion's share of the budget had gone to the hardware, to the serious detriment of producing good and appropriate software.
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> *ibid.*: 127-8

If the new technologies are to transform education we need both to establish that they are the most appropriate means for this purpose and that the old difficulties - about balance of expenditure between hardware and software, about teacher training, about overcoming practicalities and logistics - have been overcome this time round.

The third educational claim for the new technologies is that they will enable the south to leapfrog over the north. The thematic study on the new technologies for the Dakar conference demolished this argument convincingly.

> It is sometimes argued that developing countries have the opportunity to leapfrog the industrialised, using technologies so that they develop a stronger system of education without going through the same, slow, stages of development that have been followed in the industrialised world. … Four conditions seem to be necessary for this to happen.
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> The first is that telecommunications should be capable of delivering the greater part of the curriculum; if they are only used for, say, a tenth of the time or the content then they do not allow for the significant reductions in expenditure on conventional education that would be necessary to make savings in unit costs. This condition may be met in higher education, where technology-based teaching has in a limited number of cases proved to be a viable and effective alternative. (The National Technological University, operating at postgraduate level in and beyond the United States, is the dominant example.) It may be met in large-scale, broadcast-based projects at junior secondary level, like Telesecundaria in Mexico, but it seems unlikely that it can be met at primary level. For both social and educational reasons, parents, teachers and politicians all expect that young children need to study, in a classroom and with a teacher, and do not believe that the technologies can provide an adequate substitute for this.
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> The second condition is that an adequate communications infrastructure is in place. Effective radio, for example, demands that schools should be able to afford radios, have access to mains electricity or to batteries and funds to pay for them, and to a service industry that will repair and replace radios when they break. A web-based computer education service demands reliable electricity and telephone lines and, again, a support service to maintain equipment.
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> The third condition is that there is the capacity to train teachers - or mentors or classroom assistants if they are to substitute for teachers. Several different elements make up this capacity: a teaching force whose background education is adequate for them to learn and apply new teaching skills; enough time for them to study on top of their day job of teaching; a national or local structure to provide inservice teaching even for the most remote teacher.
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> The fourth condition is economic. If technology-based teaching is to yield any economies, then the cost per learning hour achieved through the use of technology must fall below that of conventional education. Data from France and USA suggest that computer-based teaching there has costs of between US$1 and 2 per student hour, which would compare favourably with the cost per hour of conventional teaching which is in the range $4 to $12 (Orivel 2000). But a large

> proportion of the costs for computer-based teaching are a function of the costs of the technology. These costs are likely to be as high in developing as in industrialised countries, or even higher. In contrast conventional costs per student reflect local wage rates for teachers and may be as low as $0.10 per hour within ldcs, a fraction of the cost to be expected for technology-based teaching. Orivel has suggested that it is only when countries are achieving a GNP per capita of $7300 that they may reach a breakeven point in which computer-based costs match those of conventional education. Even here, if technology is to produce savings, it must substitute for teachers. For most ldcs technology can only increase the cost of basic schooling, not reduce it.
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> Perraton and Creed 2000: 83-4

The evidence suggests, then, that the new technologies need to justify their position in the curriculum, that they are not a magic wand to transform education, and that they will not enable poor educational systems to leapfrog over rich. With unrealistic expectations out of the way we can go on and ask the more serious questions about what role they can usefully play in education.

Technologies for education

How far do technologies have a role in helping provide education as contrasted with their, more problematic, role within the curriculum as an element in its content or a driver of reform. A range of technologies have been used at all levels of education. They have been used within school, to raise quality or broaden the curriculum, to create an alternative kind of school, and outside school.

At primary and secondary level broadcasts have been used within school, using various different approaches from providing enrichment to direct teaching including interactive radio instruction. Computers have been used for two decades and much attention has recently been given to their use for school linking and for access to the internet. Computer-based teaching may be blurring the distinction between work on and off-campus when the same program is available to both groups of students.

In a handful of cases technology has been used to create an alternative system of schooling. There is little documented success in reaching out-of-school primary children or adults following a similar curriculum. The great success story here was Acción Cultural Popular in Colombia, with between 100,000 and 200,000 students annually in the 1970s. But its work fell away, hampered by the severity of the depression in Latin America in the 1980s and eventually falling foul of both church and state (Fraser and Restrepo-Estrada 1998). In Mexico, Telesecundaria offers television-based secondary education to rural students, originally using monitors to support the work taught by broadcast. Open schools in Asia are attempting to reach similar audiences, as are new programmes in Africa of agencies like the Botswana College of Distance and Open Distance Learning, the sonorous BOCODOL. At tertiary level, open and dual-mode universities have used communication technologies, from print to broadcasts to computer-linked technologies, in order to teach off-campus audiences and may-perhaps, be regarded as a kind of alternative college.

Technologies have also been used for off-campus teaching, often to individual students as contrasted with the classes gathered together for Telesecundaria. Here the success stories belong to the open universities, which have attained a measure of credibility, and in teacher education where distance-teaching programmes have a reasonable record of success.

This experience is summarised in table 1 but reviewed more extensively in Perraton (2000). Much of the record is dominated by quite simple technologies; open universities, for example, still use print to teach their students more than they use computers. The record also suggests that the successful development of technology-based teaching demands, for most audiences, a concern for the social support to students. The lower the educational level, the more important this support becomes. Primary education at a distance does not seem to work as primary-age children need the support of a school to help them learn and the social experience of attending one. At secondary level, Telesecundaria works because it provides a structure within which children can learn from television. For teacher training, the more successful programmes have been those that integrated student support and classroom practice while others disappointed because logistical problems cut this back. At tertiary

level, we remain short of outcome data, and of information about the factors that influence this - the theme of a research study currently in progress at IRFOL.

Table 1: *Types of educational activity using technology*

Educational level	*In-school*	*Alternative school*	*Out-of-school*
Primary	Broadcasting (e.g. school broadcasting, Interactive radio instruction) Some use of computers in rich countries	Few successful examples since the collapse of ACPO	
Secondary	Broadcasting Increasing use of computers	Open schools (Asia) Telesecundaria (Mexico) Study centres (central Africa)	Enrolment of secondary-level students on distance-courses
Tertiary	Growing use of web-based material	Print, broadcast and web-based teaching for off-campus work by open and dual mode universities	Increasing public access to web-based material
Teacher education	Some use of computers e.g. for college linking		Extensive experience of using distance education for inservice teacher education
Nonformal education			Some exemplary projects, many of them based on low levels of technology Modest use of technologies to support extension agents

The changing record on nonformal education needs a further look. At the time of Coombs' first book, it was possible to look at a range of projects that used educational technology to offer out-of-school education in areas like health, agriculture, family planning and rural development as well as for formal qualifications (cf. Coombs with Prosser and Ahmed 1973, Coombs with Ahmed 1974, Ahmed and Coombs 1975, Young *et al.* 1980). Typically they combined broadcast or print support with group study; the experience included radio schools in Latin America, mass-media educational campaigns in Botswana, Tanzania and Zambia, farm forums in India and Africa, and attempts to link group learning with support for rural farmers by the multi-country African Institute for Economic and Social Development, INADES-formation, in fourteen African countries. This approach rested on well-tried theories of communication and, in particular, on the two-step or multi-step theory of communication, arguing that we learn from the mass media most effectively if we have an opportunity to discuss mediated analysis and suggestions with peers within our own community (cf. Rogers with Shoemaker 1971). Much of this work has fallen away; radio farm forums generally stopped meeting; radio campaigns seem no longer to exist; INADES-formation did not find a general formula for agricultural group study. Thus, while models have been developed and tested on a trial basis, 'with only rare exceptions, structures that link the use of mass media with face-to-face learning have not proved sustainable' (Perraton 2000: 30).

But there are attempts, with quite different starting points to use some of the newer technologies for development and for making information available to support development. They include, for example, the experimental development of cybercafes, the use of community radio, and the promotion of cell phones by the Grameen bank in Bangladesh: using computer technologies, radio, and telephones to support rural development. The experience is reviewed in, for example, O'Farrell 1999 and Rose

1999. It may be that the future of nonformal education belongs in the cybercafe rather than the university class.

We are short of evaluative data on these newer developments: one conclusion from them is the need for continuing experiment and good evaluation. But it is possible to reach some preliminary conclusions. The reported experience is mainly from communication-led, rather than education-led activity. Much of it is about one-way transmission of information, or two-way point-to-point communication and not about the two-step flow of the earlier work. Then, old problems of communication-based education have been resurfacing. Early evaluation data of the Canadian-backed Acacia project, experimenting with multipurpose community telecentres, suggested that solving the technical problems of the last mile of interconnection, of mobilising public support, and of generating an adequate revenue were all important (Rose 1999). Cost remains a constraint; the Grameen bank's supply of cellular phones has been widely acclaimed, but its extension to the whole of Bangladesh would require some $80 billion investment (Hans d'Orville quoted in O'Farrell 1999: 13). Improved external communication can, of course, benefit the rural and remote; providing better market information may be a potent force for change. But internationally available information will not meet every need; a project in Uganda, for example, documented the demand for local-language material (O'Farrell 1999: 8). There is a tension here between locality and economy, to which we return in looking at the costs of the technologies.

This experience is mainly about the use of the technologies for individual citizens and learners. It is, too, essentially about distributing information from the centre to the periphery not about, for example, using the capacity of the technologies to store and use indigenous knowledge in agriculture or health. A different approach has been to use the new technologies to strengthen the work of intermediaries - health and agricultural extension workers for example. Here there are a few beginnings with attempts to make information services like AGRICOLA available more widely and the pilot use of telecentres to overcome the isolation of extension agents (cf. Perraton and Creed 2000: 63-5). But the thin evidence available suggests that there are only scattered developments of this kind. World Bank websites, for example, say much more about the technologies for education than about technologies for extension.

These scattered experiments are important. There are large cadres of extension workers and teachers at work, often isolated, and the new technologies have a potential for increasing their effectiveness. In exploring that potential it makes sense to use the route maps drawn during the last phase of technological euphoria

The costs

In examining the comparative costs of technology-based and conventional education we can look both at the determinants of the costs and the actual costs achieved. And the costs will tell us only part of the story: of the six possible outcomes from their expanded use, economics will give us a guide to policy in only four cases; we have poorer outcomes for less expenditure or better outcomes for more expenditure (3 and 6) then economics will not tell us what to do

1. Costs the same but improvement in quality or equity or more students reached	4. Costs the same but results worse
2. Cost reduced but results as good or better	5. Costs increased but results the same or worse
3. Costs reduced but results worse	6. Costs increased but results better

Teacher salaries dominate educational budgets. Where nonconventional approaches to education, such as open and distance learning, show unit costs lower than for conventional, they have usually done so by substituting capital for labour, or by employing cheaper labour with tutorial assistants replacing teachers. Capital investment in the production of teaching materials has made it possible for a smaller number of teachers to teach a larger number of students. Off-campus, distance-education, programmes can, under some circumstances, have significantly lower costs per student than conventional programmes. Less

often and with more difficulty they may achieve lower costs per successful student.

Often, however, it is not appropriate or acceptable to use technology as a substitute for a teacher. Computers cannot look after a class of primary-school children. Where technologies are used within schools or colleges we may therefore expect them to increase unit costs. As already noted, from Orivel's analysis, even if technology is used to replace teachers, there may be no economies because of the relative cost of the new technologies and of teachers.

In looking at the comparative costs of different educational methods we can look at the costs of individual technologies and at the comparative costs of whole programmes that use them.

Computer-based technologies may be used for new styles of teaching, to distribute teaching material to students, or to allow interaction between tutors and students. Where they are simply used as a means of distribution they may, in principle, do nothing to the total costs, although they are likely to redistribute costs from the institution to the learner. But where teaching materials are produced for computer-based learning, or they are used for interaction between tutor and student, then they have profound effects on the costs of teaching. For not only does it cost more to produce material in computer-based formats than in print but the accessibility made possible through computer links mean that the cost of tutorial support to students is also likely to rise.

In a study of the cost effectiveness of a range of technologies in education within the European Union, my own organisation looked at the comparative costs of different technologies. Arguing that teaching usually starts with a text, Hülsmann took as his starting point the cost of preparing teaching material in print and then looked at the effect on the cost of moving to a different medium. From eleven case studies in Europe, and in line with earlier researchers, he found that the costs of producing teaching material, in various formats, varied as in table 2.

The table shows relatively high costs for broadcasting, with television far exceeding the costs of radio. But, typically, broadcasting has been used in education for large audiences where the costs are spread over such a large number of learners that the unit cost is modest. Television is, for example, appropriately used for teacher education in China. The figure for developing material on cd-rom is more disturbing if we are considering its widespread use as, so far, computer-based projects have not been addressed to audiences on this kind of scale. (In a recent study Rumble has found costs escalating in the same way as more and more sophisticated uses were made of computer technologies. Arizona Learning Systems showed a cost for a text-based course rising from $12,000 for text to $120,000 with audio and video and $1,000,000 for virtual reality (Rumble forthcoming: 6).) The consequence of these costs is that developers will seek to maximise

Table 2: *Cost of preparing unit of teaching material*

Currency: 1998£ sterling

Medium	Cost per student learning hour	Ratio to print costs
Print	500	1
Radio	15,000 to 27,000	x 30 to x 50
Television	90,000 to 125,000	x 180 to x 250
Videoconferencing	18,000 to 84,000	x 36 to x 170
cd-rom	20,000	x 40

Source: Perraton and Hülsmann 1998, Hülsmann 2000

their audience, with interesting consequences for academic institutions seeking to develop their own materials in competition. While this may be possible for accountancy - and even there American, Canadian
and European practice varies - it is more difficult in basic or nonformal education. The Ugandan search for materials in the local language does not fit with the need to maximise audiences in the interest of sophisticated production.

The evidence from an examination of individual technologies suggests the need to make a strong educational case as you move up the level of sophistication and costs increase. It is much easier to justify the costs of the more advanced technologies when there is a potential multiplier effect. While, in many jurisdictions, it is difficult to find an educational justification for heavy expenditure on the technologies in school, it is much easier to see a role for them in the education and continuing professional development of teachers or of extension agents.

Turning to broad comparisons between distance-education and conventional systems, where we have a fair amount of evidence, conclusions from it are mixed.

> Basic education for adults, on a large scale and in a poor country, may be possible only by using mass media linked with some kind of student support, perhaps provided by unpaid volunteers. Even so its costs tend to be higher than those of primary schools and it is difficult to see how governments could afford to expand it to reach large, national audiences. Distance education has particular strengths where it is used to support extension agents so that a multiplier effect comes into play. Education out of school, whether for adults or through alternative secondary schools, has lower costs than conventional education and would probably not exist unless it did so. In many cases its modest costs are matched by modest success; poor completion and pass rates mean that its costs per successful student tend to compare much less favourably with conventional alternatives. Teacher education, again, has a potential multiplier effect and high motivation levels, for teachers expecting promotion, has brought high success rates with competitive costs per graduate. In higher education, so far as we can tell, there are many examples of costs per student being kept quite modest while costs per graduate may rise to equal or exceed those of the conventional sector.
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> Perraton 2000: 138

To reiterate, the cost data support a bias towards technological simplicity, a search for multiplier effects by using the technologies to help teachers and extension agents, and an exploration of their role in tertiary education where problems are stark and comparative costs already high.

Conclusions

Progress in addressing the world educational crisis has, despite all the setbacks, often been faster than could have been foreseen some thirty years ago; education has expanded dramatically; the gender gap is narrowing; even the 2015 targets look as if they might very widely be attained. Much of this, perhaps surprisingly, and against the forecasts, has been achieved mainly because of the work of ministries of education and teachers, pursuing a conventional agenda. Nonformal education, seen as a poor relation in the 1960s, remains the poor relation today. 'Furthermore the meager resources actually allocated to nonformal education are too often wasted for lack of a clear strategy, good planning, firm priorities, and workable administrative arrangements' (Coombs 1968: 144). Then and now. But this is not to dismiss the role of nonformal and out of school education and of the information and communication technologies in education. The evidence suggests that five conclusions can be drawn about their significance for the crisis today.

First, the case for investment in the technologies within the economy is not clearcut and, by extension, determining the appropriate level and location of investment in education about and through them is neither clearcut nor simple. The development of national policies for information and communication technology, and for educational policies within them, is both necessary and difficult.

Second, poor countries are not going to leapfrog the educational development of the rich.

Third, as we are still struggling to find appropriate ways of using the technologies, and especially computer-based technologies, it is right to experiment with their use. But these experiments will have a chance of success only if they take account of the old lessons - about learning and logistics, pedagogy and practicality - demonstrated long ago but still applicable in cyberspace. The tough questions here are still about linking what can be mechanised, even made universally available, and what needs to be done locally and face-to-face. If we have a bias towards the interests of the poor, in a new round of

exploration we will look at attempts to build on indigenous knowledge, or empower and strengthen remote teachers and extension agents, ahead of proposals that enrich already privileged schools. Basic computers in teachers' colleges or extension offices, and their proper use, look more important than cyber links between capital-city schools.

Fourth, those experiments will be worthwhile if there is honest evaluation. In reviewing the evidence on the technologies for DFID and UNESCO we found a sad dearth of good research that would tell us about outcomes and costs as well as hopes and methods. Nor is this just a problem of the developing world; in their review of research on computers in schools Kulik and Kulik (1991), for example, commented on the near-total lack of studies of cost effectiveness.

Fifth, we need to be attentive to the costs. Out-of-school education, that does not demand school buildings or classroom teachers on fixed staffing ratios, sometimes shows economies as compared with conventional education, but does not always do so. Advanced information and communication technologies can eat up budgets. The educational case for their use needs to be tested and demonstrated ahead of investment.

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Background

The International Research Foundation for Open Learning is a specialised research agency, concerned with research to guide the development of policy for open and distance learning. It has charitable status as part of the Institute of Community Studies, and is housed in the East Anglia regional office of the Open University. IRFOL was set up in 1995 and has carried out research on open and distance learning within both industrialised and developing countries on behalf of the Department for International Development, the (then) Department for Education and Employment, the European Commission, the World Bank, and the Commonwealth of Learning among others. Its work concentrates on basic education, teacher education and higher education and it has a particular concern for education in developing countries. IRFOL's policy is guided by an international steering group. Its director is Hilary Perraton. He was previously educational planner for distance education at the University of the West Indies and is a former member of the Commonwealth Secretariat.

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