

**INTERNATIONAL RESEARCH FOUNDATION FOR  
OPEN LEARNING**

*Choosing technologies for education*

**HILARY PERRATON      NOVEMBER 1999**

## **Choosing technologies for education**

TEL-isphere 99 conference paper: Barbados November 1999

Hilary Perraton

Director, International Research Foundation for Open Learning

12 Hills Road, Cambridge CB2 1PF, England

Phone:+44 1223 364721 Fax: +44 1223 355207

Email: H.D.Perraton@open.ac.uk

The aim of this paper is to help towards the development of national policies for the use of communication technology in education. Its starting point is that the choice of technologies for education is both important and not self-evident. While it does not attempt to answer all the questions, the paper tries to identify some of the more important ones that need to be addressed.

Communication technologies have been used for three purposes: to widen access to education, to raise its quality, and to reform it. The last two tend to shade into each other as qualitative change can be seen as a way of reforming, even transforming, education. We could illustrate this from a range of technologies. Hindsight makes it easy to draw illustrations from television. It was used by universities, starting with the British Open University, to widen access to education and make it available to people outside university and college walls. By bringing resources into the classroom, it was seen as a way of raising the quality of classroom teaching. And, in a handful of projects from Samoa to Côte d'Ivoire, it was set up with the intention of transforming the educational service. Today we have a much wider range of technological options than, say, the choice between conventional teaching, radio and television. But we can probably ask the same questions about a number of them. (Similar hopes and claims are held out for computer-based technologies today as were proclaimed for television a quarter century back.)

### **IRFOL's WORK**

The suggestions in this paper grow out of the work of the International Research Foundation for Open Learning. We were set up in 1995, are based in England, and are working in cooperation with partners around the world. Our long-term aim is to raise the quality of open and distance learning through the conduct, dissemination and application of good research. We are a non-government organisation, with charitable status, operating as a project of the Institute of Community Studies. We have close informal links with others working in distance education, including - locally in Cambridge - the Open University (who have provided an office for us), the National Extension College, and the International Extension College, and - internationally - with individual institutions, with a number of the international and funding agencies and, of particular importance, with the Commonwealth of Learning. But we are independent of all of them: our interest is in research, for the benefit of the international community, and not in recruiting students or demonstrating the strength of any one institution or any one approach.

Since carrying out a feasibility study, on research needs in open and distance learning (Perraton 1997), we have worked in both industrialised and developing countries. In a concern to develop research-based guidance for policy makers we have, for example, reviewed cost-effectiveness of open and distance learning for the European Union Socrates programme, looked at world experience of teacher education for the Commonwealth of Learning, the Asian Development Bank, and the World Bank and have been running a research project on the use of distance education to support basic education. At the time of the Telisphere conference we were completing a survey of the use of

communication technologies to support basic education as an input to the world conference on 'Education for All' to be held in Dakar in 2000 (Perraton and Creed 1999a). Among other work we have undertaken assignments for the British Department for Education and Employment (Perraton and Hülsmann 1998) and the Department for International Development (Perraton and Creed 1999b) and acted as managing editor for the Commonwealth of Learning's annual *World review of distance education and open learning* (cf. Harry 1999).

## **FIVE POLICY QUESTIONS**

This work had led us to focus our own research programme on three related areas: basic education, higher education, and the use of technologies within education. Our previous work, and current research plans, have led us to propose the set of five questions which need to be answered in developing a national policy for the use of communication technologies in education. An educational policy of this kind probably needs to be framed within the context of a national policy for communications.

### **Availability and convenience**

First, we need to ask what technology is available for a particular audience and acceptable to that audience. Globalisation means that we can have Internet access, at a price, almost anywhere in the world. It does not mean that computer-based education will be suitable for any particular audience. Convenience and acceptability may be more significant than the desire to be at the cutting edge of technology. Television, for example, has proved to be a potent way of widening access to education where it is available in learners' own homes. Its record where people have to go somewhere else in order to watch it is more chequered. An early experiment in Uganda, for example, found that the only place people could watch television was in bars where the atmosphere did not lend itself to serious study. More recently, teachers offered inservice programmes of continuing education in India, who had to attend at centres away from home in order to take part in videoconferences, voted with their feet by staying away.

The need to relate technologies to our audience forces us also to ask about the pre-requisites that need to be in place for any particular technology to be useful for education. Education seems to have been most successful in its use of technology where it has followed the commercial and entertainment sector rather than attempting to lead it. If costs are brought down, and a technology made widely available, by a demand that is greater than that of education, then it may be more realistic to use that technology for educational purposes.

### **Local and national constraints**

Second, and the point is closely related, we need to look at international variations in the ways in which technologies can be used. Issues here may be geographical, regulatory, or economic. In Thailand or India, for example, it is possible to consider the use of a dedicated satellite or dedicated satellite transponders for education because of the scale of the country. In Latin America, outside Brazil, it looks as if satellite use may make sense only if there can be agreement between countries about educational programmes that go across frontiers. A World Bank attempt to get agreement on this two years back yielded little success. Small states are likely to be much more constrained in the access they have to various forms of communication. Regulatory issues will limit the access to international communication highways. If Cable and Wireless has a monopoly of external communication within your territory then this will limit the extent to which you can get cheap and easy access to things outside the territory. Economic constraints always restrict us. Schools, in many parts of the world, have started to use computers as a means of getting access to resources on the Internet, or of communicating with other schools, but in many cases are inhibited by the cost of an ISP provider and the line charges. The costs of computer communication in southern Africa, for example, are absolutely higher than they are in North America and relatively much higher.

## Curriculum

Third, once we have considered the availability of a particular technology, and related it to our national situation, it is possible to move on and consider what makes sense educationally. Our starting point here is a series of research findings, yielding consistent results, showing that there are unlikely to be significant differences in the educational effects of different media. (Chu and Schramm 1968 and Clark 1983 are among the many overviews that have demonstrated this important finding.) The fact that, by and large, you can use any medium to teach anything, is a liberating one: the educator can consider the needs of the audience and the appropriate combination of media that make most sense for a particular purpose. For there may be good practical reasons for some choices - an aural medium for teaching a language with tones for example, or a visual medium like television for demonstrating a simulation. But the important thing is to start with the curriculum rather than with preconceptions about a particular medium. We may, too, want to use a particular medium for broad social as well narrower educational reasons. Television in the past, a website today, may be a significant part of the public image of an educational institution.

In making educational choices we need to distinguish between the use of technologies to distribute learning material to students and their use to allow interaction. We can, for example, use a computer network to distribute teaching material to distance-education students or to allow schools to print materials, available through Internet, for their students. The main consequence here is likely to be a shift of costs from the centre to the periphery, or from the teaching institution to the individual student. (We do not know enough about this and it is an area of research on which we would like to move forward.) Alternatively, we can use computer links to facilitate dialogue with students, perhaps replacing the slowness of correspondence education through the post by the near-immediacy of email and computer conferencing. This second kind of use is educationally and economically quite different from the first. It is about two-way communication, not one-way, and, by easing contact between student and tutor, likely to increase the demands on tutors and therefore increase costs.

Above all, in seeking appropriate educational use of technology, we need to start with the curriculum. The use of computers in schools provides an illustration.

Computers have been used in an attempt to change, strengthen and improve education in a variety of different ways and for a variety of different purposes. It is worth distinguishing between them so that policy decisions can sensibly reflect educational purpose. An analysis by the Commonwealth Secretariat, which drew on reviews of Commonwealth-wide practice, usefully distinguished four rationales for introducing computers to education; the development of Internet communications means that we now need to add a fifth.

Rationale 1: To build a resource of people who are highly skilled in the use of information technology. Where governments see information technology as a means of strengthening the economy, and want to develop a workforce with vocational skills for computer-related activities, computer-education programmes have been set up to develop a cadre of people with specialist skills.

Rationale 2: To equip **all** students for a future in which technological awareness and basic computer skills will increasingly be important for greater numbers of citizens. Countries have adopted this approach as they see that, whether or not the country is likely to be a producer of computer hardware or software, their citizens need to be in a strong position to take advantage of technological developments as they arise.

Rationale 3: To use the technology to enhance the existing curriculum and to improve the way in which it is developed. Computer-assisted learning programs, in which the computer takes over some of the activity of the teacher, fall within this rationale.

Rationale 4: To promote change in education by moving towards a more relevant curriculum and a new definition of the teacher's role. Some computer projects have been designed to shift the curriculum in the direction of practical learning of information-handling and communication skills rather than over-concentration on memory.

Rationale 5: To allow learners to seek information from databases, especially through the Internet, and use computer technology to communicate with other schools, colleges and learning communities. This fifth rationale has been developed in the last five years.

(First four rationales adapted from Commonwealth Secretariat 1991: 8-12)

Of course the rationales overlap and national policies may embrace more than one but their curricular and cost implications are different. In particular, the extent and level of investment demanded will vary according to the weight given to any one rationale. Rationale one, for example, would suggest putting most investment in further education or vocational training. Rationale two suggests there should be at least a minimal investment in all schools, probably at the upper end of the compulsory cycle of education. Rationale three could lead either to significant use of, and expenditure on, imported software or major national investment in software development. The point of the illustration is to highlight the need to consider curriculum before technology.

### **Costs**

Costs come next. In order to make sound decisions about technology choice, we need to know how much they cost. Here we have two difficulties. First, the behaviour of the costs of technology differs from that of conventional education. Second, we are short of data on the costs of various technologies from developing country evidence. In the case, again, of using computers in schools, we only have two or three cost studies from the south.

In order to make sense of the cost data, we need to distinguish between the use of technology to provide an alternative type of education, thus reducing the cost of teaching staff, and its use to raise quality without affecting staff numbers. Where technologies are used to raise quality, generally within the classroom, they are likely to increase costs as no staff salaries are saved. Where they are used in distance-education programmes, to provide an alternative to conventional teaching then they may make it possible to bring costs down below those of conventional education. To illustrate: interactive radio instruction has been widely used, in a set of projects funded by USAID, to raise the quality of teaching in schools. The cost per student per annum is estimated to lie at between US \$3.26 and US \$8.12 (in 1997 US \$) but these costs are over and above those of ordinary schooling (Adkins 1999: 40-1). Similarly, the reported costs of using computers in school are add-on costs amounting to between 10 per cent and 37 per cent of existing costs per student in Chile and 13 per cent in Costa Rica (Potashnik 1996: 19-21; Wolff 1999: 29-30). (In England it looks as if we are prepared to spend 0.6 per cent of the primary school budget and 1.6 per cent of the secondary school budget on computer-based education; some agencies in the north do seem to be urging the south to spend proportionately more on technology than the north is willing to (Perraton and Creed 1999a: 74, DfEE 1999, Audit Commission 1999).) In contrast, there is solid evidence from a range of countries that distance education for teacher training, providing a substitute to in-college study, can achieve results at a cost significantly lower than that of conventional training (Perraton 1993: 385).

While we are short of cost data, work we completed at IRFOL for the European Commission enabled us to identify a range of costs for a variety of technologies for open and distance learning in higher education within Europe. The costs would obviously be different in other continents and at other levels of education. But the relationship between the costs for different technologies may well hold fairly constant.

We began by looking at the cost of developing and producing material in print, assuming that one always starts with a text and finding that distance teaching based on print was the least-cost option.

At this stage we did not examine the costs of student support, but concentrated essentially on development costs. Costs were calculated in terms of student learning hours. This then gave us the costs shown in table 1. Two conclusions follow: first, we need to find solid social and educational arguments for moving away from the simpler technologies. There will often be such arguments, but they need to be clearly worked out and openly stated. Second, the data are more limited than we would like and far more research is needed on the costs, benefits and outcomes of different technology choices in developing countries.

**Table 1: Comparative costs of some technologies**

Medium	Cost per student learning	Cost in 1998US\$\$	Ratio to print cost
Print	500	825	1
Radio	15,000 <sup>a</sup> to 27,000	24,750 to 44,550	x 50
Television	90,000 <sup>a</sup> to 125,000	148,500 to 206,250	x 180 to 150
Audio	17,000	280,050	x 36
Video	18,000 to 84,000	29,700 to 138,600	x 36 to x 170
CD-rom	20,000	33,000	x 40

Source: IRFOL research, reported in Perraton 2000: 149, except where shown

Note. a. Figures shown are taken from Bates 1995

To make sense of the costs, within a communication policy, we need therefore to ask whether we are trying to strengthen education, which is likely to increase costs, or to extend to new audiences using new approaches, which may - only may - be possible at lower unit costs; then we need to seek out hard evidence on what the costs really are.

### **Small States**

Finally, and appropriately for the location of this conference, we need to think about the issues identified so far in the context of a small state. Here new communication technologies are a double-edged sword. On the one hand, they may allow a small island developing state, for example, to have wider access to sources of information than was ever previously possible. On the other hand, there is an ever greater danger of cultural hegemony by the large countries and large international companies who control the production of hardware and software. Resolving the dilemma is not easy. It presents a challenge to educators in small states, to the research community, and to this conference. Small states have very different success stories: Iceland, Mauritius and Singapore form an intriguingly varied trio. Alongside them, Barbados' achievement of near self-sufficiency in food during the second world war, and world pre-eminence in cricket in many decades, demonstrate in just two ways its strength and resilience; small states can perhaps be expected to resolve their own communication problems provided that the rich large and powerful do not actively prevent them.

### **CONCLUSIONS**

There are three conclusions. First, if these five questions are asked and answered, they should lead to a hard-headed choice between technologies: tough thinking is better than following fashion in choosing technologies.

Second, we are under-informed. We need to know much more about the actual benefits of technology use in developing country situations and the actual costs achieved.

Third, I would put the educational questions first. Industrialised countries have wasted huge amounts of public funding on ill-thought introductions of computer activities into schools. A good slogan would be: 'consider the curriculum and count the costs'.

## REFERENCES

- Adkins, D. 1999 'Cost and finance' in A. Dock. and J. Helwig (ed.) *Interactive radio instruction: impact, sustainability and future directions*, Washington D.C.: Education and Technology Team, World Bank
- Audit Commission 1999 *Local performance indicators: education services*, London
- Bates, A.W. 1995 *Technology, open learning and distance education*, London: Routledge
- Chu, G. C. and Schramm, W. 1968 *Learning from television: what the research says*, Stanford: ERIC
- Clark, R.E. 1983 'Reconsidering research on learning from media', *Review of educational research* 53, 4: 445-59
- Commonwealth Secretariat 1991 *Microcomputers in schools: policy and implementation guidelines*, London
- Department for Education and Employment 1999 *Survey of ICS in schools, 1998*, London
- Harry, K. (ed.) 1999 *Higher education through open and distance learning*, London: Routledge
- Perraton, H. 1993 (ed.) *Distance education for teacher training*, London: Routledge
- 1997 *International research in open and distance learning: report of a feasibility study*, Cambridge: IRFOL
- 2000 *Open and distance learning in the developing world*, London: Routledge
- Perraton, H. and Creed, C. 1999a *Applying new technologies and cost-effective delivery systems in basic education* (mimeo) (Thematic review commissioned by DFID for 2000 EFA meeting)
- 1999b *Distance education practice: training and rewarding authors*, London: Department for International Development
- Perraton, H. and Hülsmann, T. 1998 *Planning and evaluating systems of open and distance learning*, Sheffield: Department for Education and Employment
- Potashnik, M. 1996 'Chile's learning network' *Education and technology technical notes series* 1,2
- Wolff 1999 'Costa Rica: are computers in school cost-effective?' *TechKnowlogia* Nov/Dec (www,TechKnowLogia.org)

© Hilary Perraton 1999