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by

Hilary Perraton and Michael Potashnik*

Summary¹

Experimental growth in teaching force. The teaching profession has expanded dramatically, with a fivefold increase in two generations. Programmes to train teachers have grown nearly as fast. With that rate of growth, teacher education has, inevitably, been criticised on grounds of quantity and quality. There are still too few teachers, especially in Africa and south Asia and for some subjects. There is only modest evidence of the effectiveness of teacher education and its curriculum and expectations are often not well matched with students' own background and the culture of the schools in which they are going to teach. Some programmes have been designed in a didactic and top-down way. And many have been relatively costly.

New model. Distance education, and the new communication technologies, have a potential role to play in teacher education. This needs to take account of these weaknesses in existing teacher training efforts and be based on an appropriate model of teacher education. That model will strike a balance between preservice and inservice education, and between general education, subject knowledge, pedagogy, and the development of classroom skills. Distance education, often linked with other forms of teacher training, has been used for most of these purposes and at most levels of education. Imaginative ways have been found of linking it with the supervision of teaching practice. Distance education is of particular significance for inservice education as it allows much of this to be done without taking teachers away from the classroom. There is evidence that distance education is effective, when examined on a number of different criteria.

Use of new technologies. Distance-education programmes have used a variety of media. Printed materials remain a staple, often in the form of correspondence courses. Radio and television broadcasts have been used, especially in large countries. Both industrialised and developing countries have begun to exploit newer technologies, including computer-based communication. Whereas some technologies are used as a means of distributing teaching to students - as with correspondence lessons or broadcasts - others allow two-way interaction and are therefore useful for linking students with tutors and with other students.

Cost-effectiveness. Media differ in their costs, and in the extent to which costs for production, distribution and reception fall on the teaching organisation or on the student. A number of studies have compared the cost-effectiveness of conventional and dis-

tance-teaching approaches to teacher education. They suggest that, under some circumstances, the cost per successful student in a distance learning format may fall to between a half and two-thirds that of a conventional programme.

1. Strengths and weaknesses of teacher education

Although some researchers, mainly in North America and Europe, have questioned whether teachers really make a difference in students' learning, the puzzle is to explain how the latter is going to be improved without them.

UNESCO 1991, p. 81.

1.1 Despite a number of difficulties, education has continued its dramatic expansion over the last quarter century. More children are at school than ever before. In many countries universal primary education has already achieved; between 1970 and 1990 gross enrolment ratios in developing countries rose from 83 percent to 98 percent. To accommodate this growth, more teachers continue to be trained. With a profession of 60 million, one in every hundred of the world's population is a teacher. Table 1 shows how the world's education service has been teaching a steadily increasing proportion of the age group, while table 2 shows in broad summary how the teaching profession has expanded. The scale of the teaching force, their importance for the world's children, and the problems they face day by day, are the starting point for our work.

1.2 This paper was prepared for the Colloquium on Teacher Education through Distance Learning, which is being held during the Global Knowledge 97 Conference in Toronto, June 23-25, 1997. Its aim is to look at the problems facing teacher education and a new model for its development, at the experience of distance education, the role of technology, and at the evidence on costs and effectiveness. It concludes by suggesting what actions might be undertaken, with the support of the World Bank and other agencies to strengthen teacher education in developing countries.

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1.3 The expansion of the teaching force has taken place against a backdrop of limited resources. While public pressure, and a commitment to expanding educational opportunities, has led to a nearly fivefold increase in the size of the developing country teaching force in less than two generations, governments have, of course, been limited in the resources they can commit to teacher training. The economic constraints are summarised in table 3 which shows how, in real terms, expenditure on education in developing coun-

tries fell in the early 1980s. Expenditure per head of the population in developing countries remains lower in real terms than it was in the mid-1970s. The rest of this section concentrates on the criticisms that have been addressed to teacher training, in order to provide a basis from which we can examine mechanisms for strengthening it. But, to put this in context, we need to recognise the scale of the achievement that has been made in expanding the teaching service during hard economic years.

Table 1 : Gross enrolment ratios

	1970	1980	1990
PRIMARY			
World	88.5	96.1	98.7
Developing Countries	83.5	94.9	98.1
Developed Countries	103.9	101.4	101.6
SECONDARY			
World	36.2	44.6	52.1
Developing Countries	23.9	35.3	44.1
Developed Countries	76.8	84.4	93.6
TERTIARY			
World	8.5	11.5	13.5
Developing Countries	3.0	5.7	8.3
Developed Countries	23.4	30.3	36.8

Source: UNESCO 1991, tables 2.4, 2.6, 2.7

Table 2: Number of teachers by level of education (millions)

		Primary	Secondary	Tertiary	Total
World	1960	8.10	3.79	0.89	12.78
	70	14.33	9.07	2.14	25.54
	80	19.93	14.15	3.63	37.71
Developing countries	1960	3.22	1.16	0.15	4.52
	70	8.71	4.00	0.60	13.30
	80	14.06	8.10	1.29	23.44
	90	17.30	11.12	2.08	30.49
Developing countries	1960	3.22	1.16	0.15	4.52
	70	8.71	4.00	0.60	13.30
	80	14.06	8.10	1.29	23.44
	90	17.30	11.12	2.08	30.49

Source: UNESCO Statistical Yearbook 1975, 1985, 1994

Table 3: World total public expenditure on education 1965 - 1994

	1965	1975	1985	1994
<i>Total public expenditure in constant 1987 US\$ billion</i>				
World	328.7	663.0	597.3	982.8
Developed countries	298.5	591.0	491.4	834.9
Developing countries	26.8	72.1	105.9	147.8
<i>Public expenditure per inhabitant in constant 1987\$</i>				
World	129.2	218.0	133.1	188.0
Developed countries	295.8	540.1	563.2	908.3
Developing countries	17.0	40.0	29.6	34.7
<i>Public expenditure on education as percentage of GNP</i>				
World	4.9	5.7	4.9	5.2
Developed countries	5.1	6.0	5.1	5.4
Developing countries	3.0	3.9	4.0	4.2

Source: UNESCO Statistical Yearbook

Criticisms of teacher education

1.4 Most teachers have received some training, although the length, quality and duration varies widely.² But the effectiveness of teacher education has been criticised around the world, by researchers and practical educators alike. There are six main criticisms.

1.5 First, teacher education has not delivered the numbers we need. Some middle and low-income countries, especially in Africa and Asia, still do not have enough trained teachers at primary and secondary levels.

1.6 The most severe teacher shortages at primary level are in south Asia, and in Africa. The African problem is severe and, in contrast with Latin America and Asia, worsened as structural adjustments were enacted. The result was that in 14 countries, a smaller proportion of primary age children were going to school in 1992 than in 1980 (UNESCO 1995, pp 130-1). The task is daunting: UNESCO forecasted in 1991 that, in Sub-Saharan Africa, the primary level teaching force needed to grow at 5.6 percent per annum throughout the 1990s and the secondary force at 9 percent, even with stable staffing ratios (UNESCO 1991, p. 78). Where the teaching force is adequate in size, there remain many untrained teachers within the system. In India, for example it was estimated in 1996 that there are about 0.24 million teachers who are not fully qualified. It is important to mention that the gross number of unqualified and untrained teachers is increasing, since many states continue to recruit untrained teachers' (National Steering Committee,

1996, p. 2). In Botswana, for example, there are still a significant number of untrained teachers in the system, 25 years after the conclusion of a distance-education programme intended to train them all.

1.7 Even in countries that have successfully expanded their teaching force so that all or most children get to school and are taught by a trained teacher, there are still some particular, sometimes crippling shortages. For example, as junior secondary education has expanded, many countries have insufficient numbers of specialist junior secondary teachers to work in those classrooms. Shortages tend to be particularly acute in science and mathematics. Girls' education is hindered in some countries by a shortage of women teachers, and a scarcity of male teachers in other areas. (There are, for example, few male teachers at the primary level in some western European and Caribbean countries.)

1.8 The first criticism of teacher education is, then, the simple one of quantity: it has not produced the numbers of teachers needed for the rapidly expanding school-age population

1.9 Second, there are doubts about the effectiveness of teacher education. The research evidence is mixed but we have all too little evidence to show that pre-service teacher education provides skills and develops attitudes that carry through into a better education for pupils in school. Three overviews of the research data (Husen, Saha and Noonan 1978, Avalos and Haddad 1980,

Schiefelbein and Simmons 1981) found only modest evidence of the effectiveness of teacher education. In a later study Avalos noted that, 'there is little evidence about which approaches work best in training teachers to undertake the variety of roles required of them' (1991 p. 30-31) while work by UNICEF suggests that, 'in different parts of the world, primary education programmes that operate with underqualified and para-professional staff are often showing equal or even better student results than those operating with professional, certified teachers' (Torres, 1996, p. 449). There have been two kinds of response to these findings. One response, mainly from practitioners, has been to develop proposals for raising the quality of teacher training (e.g. Dove, 1986 and Hawes and Stephens, 1990). Another response has been to argue for reducing the length of teacher training and put training which amounts to the equivalent of secondary level education back where it belongs in the secondary schools (Lockheed and Verspoor, 1991, p. 96). There is room for more research here, especially on the effectiveness of new approaches to teacher education and inservice education.

1.10 Third, we do not know enough about matching the curriculum of teacher education to the background of its students. It is probably the case that, where trainee teachers have little more than primary or junior secondary education, the best thing to be done is to raise their general educational background. At the other extreme, where they are already graduates in a particular discipline, teacher education probably needs to concentrate more on classroom processes and practice. Beeby (1966) spelt this out 30 years ago in identifying what he saw as stages of development in the building up of teaching forces and arguing that plans to raise the quality of the teaching force needed to be realistic about what teachers could be expected to do in the light of their own educational background. But we are short of any systematic guidance to help us in judging the weight to be given to different components of the curriculum for particular groups of students.

1.11 Fourth, the curriculum of teacher education has been criticised for its narrowness. Many programmes have used a top-down approach, based on external definitions of the teacher's role rather than being grounded in the teacher's own experience and encouraging reflective practice. Centrally designed programmes have been conceived as a way of inculcating prescribed skills and attitudes. (This may be especially true of distance-education programmes.) Trainees are expected to master a curriculum which is 'limited in scope (e.g., to a body of professional content knowledge and teaching skills) and is fully determined in advance by others often on the basis of research on teacher effectiveness. The prospective teacher is viewed primarily as a passive recipient of this professional knowledge and plays little part in determining the substance and direction of his or her preparation program (Zeichner, 1983, p. 4). In contrast some teacher educators have been stressing the need to develop trainees' capacity not only in the technical skills of teaching but also in reflecting on their own work and in gaining 'the inclination and skills to analyse what they are doing in terms

of its effects upon children, schools and society' (ibid., p. 6). Any move towards an inquiry-oriented curriculum of this kind has major implications for the organisation and curriculum of teacher education and poses critical questions about the appropriate use of technology.

1.12 Fifth, within teacher education there is often a psychological distance, sometimes open hostility, between the colleges that teach teachers and the schools where they go to work. Theory and practice can be far apart. Teacher training institutions are often isolated from the education systems where their graduates will have to teach. In many countries, the plans and programmes of teacher preparation do not match what teachers are expected to teach in elementary and secondary education (Villegas-Reimers and Reimers, 1996, p. 480). Several factors contribute to the problem. Often those working in teachers' colleges have, themselves, limited experience of primary education even when training teachers to work at that level. Newly trained teachers need to feel comfortable in the schools where they are working and to work within its dominant culture. Where teachers' colleges have developed ideas and approaches that are unfamiliar to schools, perhaps as part of a programme of educational innovation, newly trained teachers are likely to find there is a conflict between the culture of the colleges from which they have come and the school to which they are going. If the culture of education is to change, it needs to change at all levels of the system and it is unreasonable to expect the most recently trained teachers to be isolated but harbingers of change.

1.13 Sixth, teacher education is criticised as being costly. *Teacher-training costs as much as 35 times the annual cost per student of a general secondary education. Although the difference in expenditures might be justifiable if the curricula were substantially different (teaching pedagogy, for example) or if particularly high levels of material inputs were required, but cannot be justified where the curriculum content is similar* (Lockheed and Verspoor 1991, pp. 95-96). There are such wide differences in the relative cost of teacher education and secondary education that generalisations are tricky. (In Bangladesh teacher education costs 1.64 times as much as secondary education while the figure for Pakistan is 25.33 (ibid., p. 97). As the teaching service is often the largest national profession, presenting the largest single wage bill to governments, so the costs of training the service are significant for educational budgets. The economic challenge is to find a way to expand the number of teachers trained and to improve the quality of that training, while at the same time doing so within tight budgetary constraints.

2. Towards a new model of teacher education

A teacher who stands on a level with the modern course of education has the sense of being a living, active member of a great organism which is grappling with the ignorance and vices of mankind, a mediator between all that was noble and sublime in the past history of people and the new generation, the preserver of sacred precepts of people who fought for truth and good.

Ushinsky 1975, p. 62

Traditionally, teachers would learn the contents they were going to teach. With the development of new technology and a switch in the emphasis from giving information to students to helping them 'learn to learn', the role of the teacher needs to be modified as well. The question, however, is whether it is possible (and efficient) to prepare teachers to be creative and develop new information when they enter the profession with such poor and weak backgrounds or whether the teacher-preparation programmes should strengthen the knowledge base of new teachers so that they can be effective promoters of learning in the classroom . . . Recent trends emphasize the preparation of teachers who are creative researchers in their own classrooms, so that they can model for their students the processes of seeking information, of questioning, learning on their own, checking data, etc. The question is whether it is realistic and efficient to try and develop these skills in teachers who do not have a minimum knowledge base. Another way to pose the question is whether it is possible to move from a content pedagogy to an emphasis in processes without a solid content base. (Villegas-Reimers and Reimers, 1996, p. 485-486).

2.1 A new model of education will build on the achievements of the old but also respond to the criticisms we have outlined. It is likely to include a role for information and communication technology. But the new model will have little impact if it simply uses technology to replicate in a new form a model of teacher education which is demonstrably flawed. In designing the new model we need, therefore, to begin with questions of curriculum and not of technology.

The content of teacher education

2.2 A recent review suggested that the content of teacher education should comprise

. . . a broad grounding in the liberal arts and sciences; knowledge of the subjects to be taught, of the skills to be developed, and of the curricular arrangements and materials that organise and embody that content; knowledge of general and subject-specific methods for teaching and for evaluating student learning; and knowledge of students and human development. There is a measure of consensus about the content of teacher education.

quoted in Lockheed and Verspoor, 1991, p. 90

2.3 The British Open University's plans for a postgraduate certificate of education, where students were assumed to have an adequate educational grounding and knowledge of the subjects to be taught, defined the curriculum in terms of five competencies: 'curriculum/subject planning and evaluation; classroom/subject methods; classroom management; assessment, recording and reporting; and the wider role of the teacher' (Moon and Mayes, 1995, p. 99). While these two quotations are from rich countries, the identification of the elements of teacher education fits well enough within all countries.

2.4 At the same time, the criticisms of the curriculum of teacher education warn us against seeing this categorisation too narrowly.

2.5 In constructing the new model of teacher education, and asking about the role of information technology within it, we need therefore to consider the role that the teacher will play in the classroom so that the style, content and approach of the programme is appropriate. (There can be contradictions between precept and example in which, for example, trainees sit in rows and listen to lectures about the importance of small-group teaching.) Our educational philosophy, and view of the teacher's functions and responsibilities, will shape the curriculum of teacher training. It will, too, guide us through a set of strategic planning decisions.

2.6 These strategic planning decisions are summarised in Table 4. As a broad generalisation we can distinguish between programmes primarily concerned with expanding the teaching force from those aimed at raising quality. Many of the latter have been designed as a preservice activity but distance education has also been used to provide training to unqualified but experienced teachers already in the teaching force. Programmes have been run for teachers with a variety of educational backgrounds and have been aimed at teachers at all levels of education. Any programme will reflect the organisers' view of its purpose and the educational background and other characteristics of the audience, and will seek to achieve the right balance between a number of competing demands for emphasis.

Balances to be sought

2.7 Once broad questions about purpose and audience have been resolved, teacher educators need to strike balances between preservice and inservice work, between the different components of teacher education, between methodologies, and to develop a process for programme development.

Preservice and inservice education

2.8 The first balance is between preservice and inservice education. While much teacher education has been run as a preservice activity, once-and-for-all training is seldom seen as adequate; in any programme, planning decisions are needed about the appropriate allocation of resources between these two modes. At the same time the two modes can be seen as converging: *for many unqualified teachers in-service training may be the only training they receive. For others, pre-service education may well have been of a general kind, an extension of their secondary education with some study of education thrown in for good measure. In-service education (if they are fortunate to receive any) may constitute their only source of professional training . . . the current divisions between 'pre-service' and 'in-service' training may prove increasingly unprofitable to maintain and that we may do well to evolve a more unified and more flexible concept of 'Teacher Education and Training'* (Hawes and Stephens, 1990, p. 93).

2.9 To illustrate, Ghana is working on plans for teacher education in which student teachers, at the outset of their career, will spend some time in-college and some studying at a distance. The distance-education materials prepared for them are likely also to be used by experienced but unqualified teachers studying while inservice; distinctions between inservice and preservice activities are becoming blurred.

2.10 Distance education's most significant role may lie in inservice education, since it allows teachers to continue learning without being removed from the classroom. This has logistical, financial and curricular implications, of which the last may be the most significant; in principle it should be possible to match the curriculum of teacher education more closely to classroom practice where distance education is being used to help serving teachers than is possible in a model that puts all its emphasis on preservice education.

The components of teacher education

2.11 Decisions are also needed about the weight to be given to the different components of a teacher education programme. These are, in large part, a function of the purpose of the programme, and the background of the students. In seeking a balance between general educational level, subject content, pedagogy and classroom

practice we need to recognise that, *the distinction between general education and training is not as obvious as might appear. . . There is a continuous spectrum stretching from what everyone would agree upon as general education to instruction that is quite clearly professional training. Exactly where the line will be drawn between them depends not only upon the individual making the judgement but also upon the stage of development of the school system and upon the grades at which the trainees in question are going to teach. Knowledge that is quite essential stock-in-trade for the teacher at one level may be thought of rather as part of a teacher's cultural and intellectual background at a different level or in a different setting* (Beeby, 1966, p. 83).

2.12 In shaping the curriculum of teacher education, and balancing its different elements, many programmes have failed to match what is taught with what teachers actually do in the classroom. Where there are severe teacher shortages, teachers trained at primary level are, for example, rapidly moved up to teach at junior secondary level, with untrained teachers being brought into the primary schools. Again, the bias of the new model may be towards an emphasis on inservice training that can take better account of the movement of teachers from one type of school to another.

2.13 In planning teacher education we face critical questions about classroom practice. Planners often see training in teaching skills as an essential part of teacher training. These skills, that are likely to embrace subject methods, techniques of assessment and of management, and general classroom methods need, at least in part, to be acquired in the classroom. If distance education and communication technology are to be used, they need to be designed within a structure in which classroom support and supervision can be arranged. Trainees need to get to the classroom, if they are not already working there and their tutors or mentors need to support them while they are there. Tutors need to visit classrooms and may even need training themselves in how to work with teachers in their classrooms to support what was learned in training. And so these facets of teacher training present different logistical demands from those of teaching the more academic elements of teacher training.

The choice of methodology

2.14 A balance needs to be struck between the various available methodologies. Most programmes have sought to use more than one approach. If we are to make the most effective use of communication technology, we need to consider which elements of teacher education are best approached through each technology. In this process of matching curriculum and technology we need also to face questions of location, determining where teacher education is to be based. Increasingly work based in colleges is linked with work based in schools. The establishment in India of DIETs (District Institute for Education and Training), which brings together those working on curriculum and on teacher education in a single location, provides one model. The British Open University post-

Table 4: Strategic choices to be made in planning teacher education given limited financial resources.

- Should the teaching force be expanded or should the quality of the existing teaching force be improved?
- Should the focus be on:
 - Primary, secondary or tertiary level teachers? And, within each of these categories, should the focus be on:
 - qualified teachers with teaching experience
 - qualified teachers without teaching experience
 - unqualified teachers with teaching experience
 - unqualified teachers without teaching experience
- Should the content of the training be on increasing teachers':
 - general educational level
 - subject-matter knowledge
 - understanding of the pedagogy of specific subjects
 - knowledge of curriculum pedagogy
 - skills in methods of teaching, assessing and managing students
 - understanding of their role in society.
- Where should the training be held and which methodology should be used to disseminate the training?
 - within teacher training colleges (often residential and requiring that teachers not be teaching while in training)
 - at the teacher's school (sometimes focusing on the entire school staff)
 - at regional teacher centres
 - using distance education
- How should follow-up support be provided to teachers during or after their training?
- Should the training be planned:
 - centrally
 - in consultation with teachers and head teachers (and other stakeholders, perhaps including parents)
 - developed within individual schools or districts

graduate certificate course has gone further than most programmes in moving from college-based to school-based activity. The course is centred around activity in the school where the trainee is based for practical work. Students are each required to find a school in which to base their classroom practice and to work under the guidance of a mentor. The schools participating in the scheme designate a member of staff as a mentor, who is briefed, supported and paid by the University.

2.15 The choice of technology is not simple. While most media can be used to teach most subjects (cf. e.g. Moore and Kearsley, 1996), they differ in their convenience for learners, in their costs, and in the extent to which they lend themselves to one-way, two-way or multi-way communication. We return to this point in section 3.

The process of programme development

2.16 Alongside decisions about audience and purpose, phasing, content and method there are a further set of decisions about the process of developing teacher education. While many programmes have been designed centrally, with little involvement by those in the field, they are likely to be more effective if the dialogue is a necessary precondition for organisational learning of the type we propose here. Educational reform needs to engage teachers in a dialogue about the reforms, both at the stages of design and implementation' (Villegas-Reimers and Reimers, 1996, p. 484).

2.17 Many of the decisions to be taken in planning teacher education are similar, regardless of the technology or method to be used. And there is a measure of consensus about the weaknesses of many projects of teacher education; one summary of them appears in Box 1. We need, therefore, to ask how far the record of distance education suggests a way of overcoming them and at the same time of advancing towards our new model of teacher education.

The relevance of distance education

2.18 Distance education has been used for a range of different audiences and purposes within teacher education. Some are illustrated in Table 5. They differ in level and geography. But, more important, the record shows that they span the range of educational purposes already identified. An early programme in Kenya, for example, concentrated mainly on raising the basic educational background of the teachers, generally seen as the main barrier to raising quality. Many programmes have combined the learning of subject content with the learning of pedagogy: students in Indonesia spent 80 percent of their time on academic subjects and 20 percent on educational theory and methods (Perraton, 1993, p. 7). And a high proportion of them have grappled, with varying success, with the logistical problems of yoking distance-education methods with supervised classroom practice.

Box 1: Limits of the conventional teacher education model

The teacher education (TE) model (curriculum, pedagogy, organisational and institutional arrangements), both pre- and in-service, is obsolete. The transmissive school - which confuses teaching with learning, and information with knowledge - continues to be nurtured in the institutions, programmes, courses and manuals through which millions of teachers are trained world-wide. Some of the characteristics of such conventional TE models are well-known and identifiable around the developing world.

Each new TE policy, plan or project:

- starts from zero, ignoring or disregarding previous knowledge and experience;
- considers education/training principally - and even solely - as a *need for teachers* and not also for head teachers, supervisors and other human resources linked to the education system in general;
- views *education/training in isolation* from other dimensions of the teaching profession (salaries, working and living conditions, promotion mechanisms, organisational arrangements, etc.);
- ignores *teachers' real conditions* (motivations, concerns, knowledge, available time and resources, etc.);
- adopts a *top-down* approach and sees teachers only in the passive roles of recipients and potential trainees and does not consult teachers or seek their participation in the design of the training plan;
- has a *homogeneous* proposal for 'teachers' in general instead of adjusting to the various types and levels of teachers and their specific needs;
- adopts *narrow and operational approaches* to teacher training (in-service training is viewed as a post-reform announcement device, a tool to persuade and implement a definite policy, programme, project or even a textbook);
- assumes that the need for training is *inversely proportional to the level of teaching*, thus ignoring the importance and complexity of teaching young children in the initial grades;
- resorts to *external incentives* and motivation mechanisms such as scores, promotions and certificates rather than reinforcing the objective of learning and improving the teaching practice;
- addresses *individual teachers* rather than groups, work teams or the school as a unified whole;
- is conducted *outside the workplace* (typically, teachers are brought to the training sites instead of bringing the training to them and making the school the training site);
- is *asystematic* and limited to a *short* period of time, either pre- or in-service, and it is not integral to a continuing education scheme;
- is centred around the *event* (course, seminar, workshop, etc.) as a privileged - and even unique - teaching and learning tool, ignoring or disregarding other modalities such as horizontal exchange, peer group discussions, class observation, distance education, self-study, study visits, etc.;
- disassociates *administrative* and *pedagogical* issues (pedagogical issues are considered the realm of teachers, and administrative issues are consigned to others, without an integral approach to both types of knowledge and skills);
- disassociation *content* and *method* (subject matter and pedagogy, knowing the subject and knowing how to teach it) and promotes the prior over the latter, thus ignoring the inseparability of subject knowledge and pedagogical knowledge in good teaching;
- considers education and training to be *formal* and *rigid*, thereby denying the educational and communicational importance of an informal environment, of play, laughter and enjoyment;
- is focused on the *teaching perspective* much more than on the learning perspective;
- *rejects teachers' previous knowledge* and experience instead of starting from there and building on it;
- is oriented towards *correcting mistakes* and highlighting weaknesses rather than at stimulating and reinforcing strengths;
- is *academic* and *theoretical*, centred around the book while denying actual teaching practice as the most important source for continuous learning;
- is based on the *transmissive teaching* mode (teaching as the transmission of information and learning as the passive assimilation of that information; and
- is essentially *contradictory* to the pedagogical model that is requested of teachers in their classrooms, where teachers are expected to elicit active learning, critical thinking, creativity, etc., which they themselves do not experience in their own education and training process.

Torres 1996, pp. 449 - 450

Table 5: Examples of some distance-education programmes

	<i>Primary</i>	<i>Secondary</i>	<i>Tertiary</i>
Preservice initial training for inexperienced teachers	Tanzania programme for emergency training of 45 000 school leavers for Universal Primary Education	Postgraduate Certificate of Education course, operated the British Open University for graduates with appropriate degrees but no teaching experience or qualifications	
Inservice initial training for experienced teachers	Logos II in Brazil provides secondary equivalence courses which give teachers their basic teaching qualification	Open University in Sri Lanka offers courses for secondary teachers lacking professional qualifications	University of Surrey offered a Diploma in the Practice of Higher Education available both on the campus and at a distance
Continuing Deakin education	University in Australia runs a B.Ed. programme, mainly attended by primary teachers wanting to upgrade their qualifications	University of Nairobi offers a B. Ed. degree at a distance as an inservice programme aimed at the professional development of teachers throughout Kenya	The Surrey diploma has attracted experienced university teachers as well as recent recruits to the profession

Adapted from Perraton 1993, p.4.

2.19 Distance education, like more conventional methodologies, has strengths and weaknesses and the more successful programmes are those that have used its methods in conjunction with other methods. Before considering its methods, however, we need to ask about the legitimacy and effectiveness of this approach.

The legitimacy of distance education

2.20 Distance education grew up on the wrong side of the educational tracks and provokes scepticism about its effectiveness and quality. Distance education programmes often have been marked by high dropout rates and criticised for leading to rote learning. Although there is some data on its appropriateness and effectiveness for teacher education - this data is quite limited. In comparing its strengths and weaknesses with those of conventional education we are, however, hampered by the limited amount of evidence that we have on the effectiveness of conventional approaches to teacher education.

2.21 The effectiveness of distance education can be measured in at least five ways: looking at its success in reaching audiences, in completion rates of those following distance-education courses, in their examination results, in their learning gains, and in the effects on teachers' classroom practice.

2.22 Distance education has been quite successful in expanding the number of trained teachers in classrooms, reaching large numbers in, for example, China, Tanzania and Zimbabwe, and doing so in ways that would not have been possible using conventional teacher training colleges. Perraton (1993) describes some evidence collected on completion and examination pass rates: high rates have been reported particularly where teachers have gained promotion and more pay on completing a course or gaining a certificate. In many of these cases the examinations taken by students were the same as those taken by students of conventional courses or identical to them. Less evidence is available on learning gains

but projects in Indonesia and Sri Lanka give some reassurance that students there did learn effectively at a distance. The evidence on classroom performance is more difficult to interpret: typically students following distance education programmes of initial training spend longer in the classroom and therefore end up as more accomplished in the classroom than those who go to conventional teacher training colleges. So the evidence is moderately positive although limited.

2.23 Both Beeby and Zeichner (quoted above) were concerned with broad changes in the attitude and behaviour of teachers and here we have much less evidence of the outcomes of teacher education, regardless of its methodology. There is room for more research on the quality of the process of various forms of education and on educational influences on attitude. But, so far as it goes, the evidence is consistent and positive enough for distance education to claim legitimacy alongside more conventional approaches. The evidence on effectiveness is summarised in Box 2

2.24 Within a distance-education programme the choice of technology needs to match its purposes. Some of the factors here are severely practical: Indonesia, for example, made extensive use of radio for teacher education to reach trainees in an archipelago country. China has used satellite broadcasting because of the scale on which it needs to work. Some are economic: different modes of teaching have different cost structures which are discussed below (section 4). The most difficult decisions are concerned with providing two-way communication between teachers and tutors and among teachers in the course.

2.25 If teacher education is to take account of the criticisms levelled by Torres (Box 1) and others, and move away from a top-down approach and encourage trainee teachers to analyse and reflect upon their own experience, then mechanisms need to be found for regular two-way interaction between students and tutors. But this seems at first sight to be at odds with the idea of a distance-education programme, based on centrally produced materials, and seeking to achieve economies of scale. Various ways have been sought of reconciling this dilemma. In some cases the new technologies allow for interaction, sometimes with remote students, that would not be possible otherwise. Audio feedback links have been used with satellite broadcasts. Written assignments, and local or regional face-to-face sessions allow for tutor-student interaction. In industrialised countries computer conferencing has been used to overcome teacher isolation. It is suggested, as a working principle, that the need for dialogue between teachers and tutors should be the criterion for determining the choice of medium within a programme of teacher education.

2.26 Above all, the need for a combined, or mixed-mode approach is illustrated by the issue of teaching practice. Teaching is a practical activity and, while classroom practice is only one component in teacher education, it is a critical element in many. Close

links between college and classroom are needed if practice and theory are to inform each other, and if teachers are to avoid dismissing anything taught at their college as irrelevantly theoretical. At the same time the organisation of teaching practice presents severe problems to conventional colleges of education which are magnified where students are learning at a distance, often a long way from their tutors. Distance-education programmes have tried to solve the problems in various ways. In Tanzania, head teachers and adult tutors from the country's extensive adult education service were asked to supervise trainees. Micro-teaching has been used during students' residential courses in some countries. Where distance permits, tutors from the students' college or university can visit them in the field. The planning decisions here may be the most important as well as the most difficult in a new model of teacher education.

Conclusion

2.27 We suggest, then, that an analysis of the strengths and weaknesses of current teacher education makes it possible to sketch out a new model that will strengthen it. That model will seek to achieve appropriate balances between its various components. It is likely to give greater emphasis to inservice education than has been the case. Distance-learning techniques, that allow teachers to increase their competence without leaving their schools, and new technologies that support interaction between students and tutors, have a major role to play. That role is likely to be an effective and rewarding one if it is played on the main stage of teacher education, integrated with the main plot, not acted out as a side-show.

Box 2: Effectiveness of distance education for teacher training

This box is adapted from the final chapter of Distance education for teacher training (Perraton 1993) and is based on a study concentrating mainly on teacher education in Australia, Britain, Brazil, Kenya, Nepal, Nigeria, Pakistan, Tanzania and Zimbabwe.

Many of the programmes started with a numerical imperative. The teacher upgrading project in Tanzania for example, was conceived in order to train between 35,000 and 40,000 teachers needed for universal primary education at a time when the conventional colleges had only 5,000 students in total. The first and simplest measure of success is one of reach: distance-education programmes have a reasonable record of success in reaching audiences. The audiences were not always as large as had been intended. In Pakistan the original plan for the Primary Teachers' Orientation Course was to reach 155,000 teachers in three years; while the enrolment of 46,000 in that time was a considerable educational and logistic achievement, it represented a scaling down of early ambitions. Zimbabwe enrolled 9,000 students through its distance education program called ZINTEC, but there remained large numbers of untrained teachers in the educational service even after they were trained. The audiences reached are sometimes large in relation to those in conventional institutions but may be small in relation to the total size of the teaching force.

Completion rates have varied widely. Whereas a number of earlier upgrading programmes had reported completion rates varying between 77 and 97 percent, the data on distance education vary between 42 percent at the National Teachers' Institute in Nigeria and 83 percent in the most recent programme in Nepal. Two factors seem the most important in explaining the variation: the level of the qualification and the motivation of students. While examination success cannot be equated with teaching capacity, we can legitimately assume that a reasonable examination pass rate demonstrates that a programme was effective in teaching academic subjects. In nine cases there is data on pass rates. With most figures falling between 50 percent and 90 percent we can conclude that distance-teaching methods are, in practice, capable of getting students through their examinations.

In some of our cases we can go one stage further and make a direct comparison between the pass rates of students of distance-education courses and those studying a similar course through conventional methods. In Nepal, the distance students in 1990 achieved markedly worse results than those attained in face-to-face classes; this may demonstrate an unexpected weakness in the distance programme but, as the authors suggest, may result from an unwillingness to fail the other group of students at a time of considerable tension. The figures for the National Teachers' Institute in Nigeria show the opposite phenomenon: their students tended to perform better than those studying in conventional, face-to-face teachers' colleges. Comparisons at degree level are more difficult. Figures from Australia, Britain, Kenya and Nigeria suggest that part-time degree students working at a distance achieve similar results to those of part-time on-campus students.

The programmes varied in their content, and in the balance between teaching subject content, teaching about education, and teaching pedagogical skills. Where programmes aimed to raise classroom skills we need to ask whether trainees could teach better at the end of their course. In Tanzania, two separate research enquiries found similar results: that students trained at a distance tended to perform better than those trained conventionally on a number of measures of classroom performance but rather worse academically and in their command of the subject matter. There was one specific and important negative finding about response to different subjects: students taught conventionally performed significantly better in science than those trained at a distance. In Zimbabwe, while it was not possible to make this kind of comparison, studies of teachers' classroom effectiveness showed positive results while the examination performance of pupils taught by ZINTEC teachers were in line with the national trend. Findings from Indonesia and Sri Lanka are more complex. In both countries students studying face to face had better results in mathematics than those working at a distance. In contrast, distance-teaching methods worked reasonably well for the study of mother-tongue languages. In Sri Lanka distance education performed better than the alternative in teaching language and in developing professional attitudes towards education while in Indonesia neither distance nor conventional education were effective in changing trainee teachers' attitudes. Studies based on self-report from Nepal and Pakistan found students reporting that they found their courses of practical classroom use.

The research findings are notably undramatic; the differences between trainees studying in different ways are relatively small and, so far as they go, do not suggest that distance education must be ruled out, or ruled in, for any particular educational purpose.

Continued page 12

Box 2 (cont.)**Table: Effectiveness of distance education for teacher training**

<i>Programme</i>	<i>Enrolment</i>	<i>Completion rate(%)</i>	<i>Examination pass rate(%)</i>	<i>Effectiveness and teacher performance</i>
PRE-SERVICE TRAINING				
Tanzania TTD Training junior secondary	45,534 total	82	94	Academic subjects comparable with conventional teacher training except in science; classroom performance better
Zimbabwe ZINTEC Training senior secondary leavers as primary teachers	7,353 total	N/A	80	Positive effects both on subject matter knowledge and teacher effectiveness
INSERVICE TRAINING				
Brazil LOGOS II Training primary school teachers with curriculum equivalent to primary and junior secondary	24,400 total	N/A	78	N/A
Sri Lanka National Inst. of Edu. Training primary school teachers with secondary leaving qualifications (OL or AL)	c5,000 (1993)	N/A	N/A	Pre-post gains on subject matter, teaching skills and attitudes; less successful than conventional college in mathematics
Indonesia Open University Upgrading lower secondary	c5,000 currently	N/A	N/A	Pre-post gains on subject mastery and in theory and teachers practice in skills; relatively poor results in maths; apparent decline in attitudes towards teaching
Nepal RETT for primary teachers without school leaving cert	6,429 total (1980-87)	84	54	Main aim raising subject competence; self-report by participants on BTT course claimed classroom implementation of lesson material
BTT Basic education course for SLC-pass teachers	3,374 (1987-90)	83	57	
Nigeria NTI Training primary teachers TCII: following 2-year secondary education	47,131 peak enrolment	42 (1987)	30 (1987) 25 (1988) 46 (1989)	Pass rates higher than those of conventional training but no direct evidence
NCE: tertiary level	31,162	N/A	N/A	N/A
Pakistan AIOU Training primary teachers, mainly secondary graduates, introducing new curriculum	83,658 total (1976-86)	56	68	Self-report by participants claimed course useful and relevant

Cont.

Box 2 (cont.) Table: Effectiveness of distance education for teacher training

<i>Programme</i>	<i>Enrolment</i>	<i>Completion rate(%)</i>	<i>Examination pass rate(%)</i>	<i>Effectiveness and teacher performance</i>
CONTINUING EDUCATION				
OU Britain Undergraduate and postgraduate courses in education, at university level but without formal entry requirements to BA courses	9,869 student/courses (1989) 3,606 undergrad. (1989) 1,432 post-graduate	76 90	68 88	Degrees accepted as comparable with conventional; some evidence of direct and indirect educational effects
U of Nairobi Kenya B.Ed programme for secondary teachers	594 (1986 enrolment)	47	66 passed 25 to take supplementaries	N/A
U of Lagos Nigeria B.Ed programme for secondary teachers	Rose from 300 to 4,000 between 1975 to 1980	N/A	86	N/A

3. Instructional Media and Technologies for Teacher Education

3.1 In this section, we briefly examine the role of instructional media and technologies in distance education and specifically in the training of teachers. We begin by noting that distance education is primarily carried out through print-based correspondence study. However, advances in telecommunications offer exciting new opportunities for using various technologies in distance education in countries that have the required infrastructure. We then look at the instructional benefits of media and technology and examine how radio, television, and computers are being used in educating teachers at a distance. We conclude the section pointing to some of the conditions for the successful use of technology in educating teachers at a distance, taking account of the model in section 2.

3.2 In the developed countries, telecommunications and information technologies are increasingly being used in the conduct of distance education, yet in the United States there are still more people studying at a distance by correspondence than any other means. Likewise, more advanced telecommunications technologies are still not a prevalent feature of programs in the developing world. Indeed, most distance education programs in developing countries, including those for training teachers, are still primarily conducted through correspondence using the postal service or other delivery systems. They have used correspondence lessons as a staple, 'seizing the advantages of a medium which could reach students anywhere-though some students more quickly than others-and could give them a text on which to rely' (Perraton, 1993). While

correspondence has been the main methodology in teacher education programs at a distance, it has seldom been used alone. Developing countries have over the years, with varying degrees of success, incorporated radio and television broadcasts and cassettes in their programs as well as face-to-face support. And more recently, where circumstance permit, some are beginning to use computer technology for on-line teaching and learning.

3.3 The information age challenges us to rethink the strategies that we use for teaching and learning at a distance and to find new and improved ways of using telecommunications and information technologies. We are only beginning to learn how to use some of these technologies effectively and much remains to be learned. We already know that technology is not a cure-all for the ills of teacher education. However, thoughtfully used, these technologies can introduce many promising improvements over traditional modes of teaching and learning at a distance. What are the benefits of using these technologies? How do they help both traditional correspondence study and remote classroom teaching? There are several ways:

3.4 First, telecommunications and information technologies, particularly those which are interactive and offer, sound, animation and visualisation, facilitate and enrich teaching and learning. These technologies enable teacher training courses at a distance to demonstrate good teaching practice, enable visualisation of difficult or abstract concepts, and create opportunities for effective simulation of experience.

3.5 Second, technologies can provide teachers with new sources of information and knowledge that can be used for self development as well as incorporated into classroom instruction. The Internet is one of the most exciting tools for exploring information and knowledge. There are a growing number of Web sites around the world to choose from, although educators in most developing countries have yet to get engaged in designing their own national web sites for education.

3.6 Third, within many distance learning institutions, there is recognition of the need to enhance interaction and feedback between students and teachers, and increasingly among students and teachers themselves. Active two-way communications keeps learners involved, thereby enhancing the learning process. E-mail and other computer-based communication systems have facilitated such communication, thereby reducing the isolation experienced by many distance learners. They also stimulate the exchange of ideas between teachers and learners and among the learners themselves.

3.7 Fourth, there is also a recognition that telecommunications and information technologies can be a more efficient and possibly even more cost-effective means for increasing access of teachers to education and training, particularly in countries where the postal service is slow and unreliable in remote areas.

3.8 Despite the benefits of using these technologies in educating teachers, they are only one, albeit an important component, of a distance education system. The effective use of distance education for teacher training, as we have discussed in section 2, requires attention to the planning and execution of a whole series of other components such as course design and production, learner support, student assessment and sound overall administrative and financial management.

3.9 Typically, where these technologies are used to provide distance education, they involve a combination of broadcast, wired or satellite-relayed transmissions, and students respond through some combination of mail, fax, telephone, microphone, keypad, or computer transmissions. However, there are many other combinations in use, both simple and sophisticated. Radio, television, computers and other instructional media and technologies are all being used in distance education for the training of teachers. How are developing countries using technology for teacher education at a distance? Which are already being used on a significant scale in teacher education in developing countries and which ones are just arriving? Where are some of the more interesting experiences and what are the future trends?

3.10 *Radio and audio cassettes.* Radio (one-way) and audio cassettes are being widely used in distance teaching and have been generally effective educationally. Because radio is so widely available, it has great potential as an instructional media, but is undervalued by educational decision makers (Bates, 1995). Radio has

been used in many ways in education, including school broadcasting, informal general education, social action programming and adult basic education and literacy. Indeed, it is widely used for basic education and literacy in various parts of the world, particularly in Latin America, and for direct teaching in classrooms in many developing countries. Audio cassettes, combined with print, are widely used in higher education in industrialised countries, and can have economic advantages over radio for relatively small audiences.

3.11 A new role for radio has been created through the use of a new methodology called Interactive Radio Instruction (IRI). IRI began as a tool for classroom use to counteract low levels of teacher training, poor achievement among learners, and limited resources. Its interactive features are fostered by the IRI methodology which, according to Bosch "requires learners to react to questions and exercises through verbal response to radio characters, group work and physical and intellectual activities while the program is on the air". For both the teacher and student, the lesson becomes an immediate hands-on experimental guide. "Short pauses are provided throughout the lessons after questions and during exercises to ensure that students have the time to adequately think and respond. Interactivity is also encouraged between teacher and learners as they work together to conduct short experiments, do activities, and solve problems using local resources and imaginative situations and stories." Projects using IRI have been implemented with considerable success in some ten developing countries world-wide with donor support mainly from USAID (Bosch, 1997).

3.12 Traditional radio broadcasting and Interactive Radio Instruction have been used to provide teacher education at a distance. An early example was Nepal's Radio Education Teacher Training Project (RETTTP) which used radio broadcasts and other instructional media to target 5,000 untrained primary school teachers yearly (Holmes in Perraton, 1993). IRI projects in Bolivia and El Salvador providing math instruction are at the same time, helping teachers improve their knowledge about math, as well as acquiring improved methods for teaching math through listening to the broadcasts. In Nepal and South Africa radio is being used as a hands-on training tool for caregivers and kindergarten teachers. All India Radio also has used instructional radio for training teachers in English language and to train daycare providers in collaboration with the National Council for Educational Research and Training. In the Dominican Republic, radio is helping in the teaching of a 72 credit-hour in-service associate degree program consisting of subject matter and pedagogy. Radio instruction covers subject matter courses such as math, Spanish, natural science and social studies. Pedagogical instruction involves teachers in preparing lesson plans, solving simulated community problems, and applying new teaching methods. Honduras is planning to replicate the Dominican Republic's experience with the use of radio for teacher education.

3.13 Digital satellite radio is around the corner. Worldspace, Inc., a Washington, DC-based company, is currently developing a global, satellite-based digital audio broadcasting (DAB) system which would send digital radio signals directly to hand-held receivers. The radios, which are currently under development, are expected to be ready early next year. The radio signals will be delivered by three geostationary satellites now being built by the French firm Alcatel. Plans call for providing coverage to the entire African continent and much of the Middle East, Asia, and Latin America. The DAB offers exciting possibilities for achieving reliable and widespread coverage in many developing countries where more advanced technologies are not yet affordable on a national scale. However, there are many technical and cost hurdles to overcome before the system will become operational.

3.14 *Television.* Television (including video cassettes) has become a widely used telecommunications medium for distance education and for the professional development of teachers in the United States and Canada. Instructional television use in developing countries is considerably more limited. Two main models of instructional television have emerged over the years: the pre-produced, pre-recorded model (Instructional Package Approach) and the live, interactive model (Interactive Course Approach). Some of the characteristics of each are shown in Table 6 adapted from Durr (1996).

3.15 The instructional package approach is the most widely used in educational television. Telecommunications permitting, these packages are broadcast directly to classrooms, homes or viewing centres synchronously. However, quite often, instructional packages are distributed in the form of pre-recorded videocassettes and videodiscs to schools or homes for use by the teacher or learner at their convenience.

3.16 Live interactive television commonly uses one-way video, two-way audio teleconferencing for instruction. The talkback capability is usually added by means of a telephone for calling the instructor or assistants in the originating studio. If large numbers of students participate in a live course, the number of telephone lines and assistants need to be increased to ensure effective interactivity. Live broadcasts via satellite use keypads to permit interactivity between instructor and learners. Two-way video, two-way audio is also used for instruction.

3.17 Television has been used for teacher education over the past several decades in both developed and less-developed countries. However, as noted above, because of relatively high production and transmission costs, its diffusion has been relatively slow in the less-developed countries or its use has been limited, often supplementing text-based correspondence and other distance methods. A few notable examples of television use for teacher education in developing countries are the following:

Table 6: Models of Instructional Television

Instructional Package Approach	Interactive Course Approach
<ul style="list-style-type: none"> -Pre-produced, pre-recorded -Heavy design and production by a team of national or international academics and production experts -Mostly original production, some acquisitions -One-way distribution -Synchronous or asynchronous use -Local adaptation expected -Local support by local teacher -Feedback by mail, phone, or e-mail -Re-usable courses -High cost, amortized over many uses -Quality guaranteed through evaluation and revision -Challenge: to keep students actively involved 	<ul style="list-style-type: none"> -Live, interactive -Modest design, by a faculty member or local design team -Modest production by faculty member and local production team -Mostly faculty presentation, with AV materials -Two-way interaction -Synchronous use -Centralized control expected -Local support by local teacher or aide -Feedback by VSAT, phone, or e-mail -Mostly one-time courses -Low cost, recurring -Quality varies with each offering -Challenge: to take advantage of the value of interactivity

- China has been a major user of television for over 30 years. It established a Television University System (TVU) in the 1960s to train science teachers and other professionals. Closed during the Cultural Revolution, it reopened in 1979. A World Bank higher education loan approved in the early 1980s, assisted both the Central Radio and Television University and 28 principal television universities to train staff and science teachers, construct and equip transmission stations, production centres, laboratory and printing facilities, study centres and classrooms. The Government also launched an educational television channel and an in-service teacher training program to broadcast instructional packages from Beijing to other parts of the country via satellite.

- Thailand's Sukhothai Thammathirat Open University's School of Education (STOU) has been offering in-service programs for the professional upgrading of teachers. They consist of 4-year and 2-year degree programs and one-year teaching certificates. Students study mainly at home from distance learning packages mailed to them and from radio and television broadcasts. Some students also attend 10-15 hours face to face tutorial sessions provided at various local study centres throughout the country. STOU's six-credit courses consist of 15 units of printed texts and workbooks, 15 twenty-minute radio programs, and 3-5 half-hour TV programs; 1-3 audio cassettes; 10-25 hours of face to face tutorials (Brahmawong, 1993).

- Brazil's two programs: *Salto para o Futuro* launched in 1992 and by 1995 was reaching 245,000 teachers in 27 states, and TV-Escola, launched in 1995, are using television broadcasting extensively for teacher education and are generally considered popular among teachers. A second in-service program for the training of 90,000 primary school teachers for teaching Portuguese and math in the state of Minas Gerais is about to be implemented under a World Bank loan. The program will use pre-recorded videos and text, rather than broadcast television, and will be supported by facilitators in each school.

3.18 India's National Council of Educational Research and Training (NCERT) is operating an ambitious project of providing short-term training to about 1.8 million primary school teachers under the Ministry of Human Resources Development scheme called Special Orientation of the Primary School Teachers (SOPT). SOPT is attempting to train teachers, via one-way video-two way audio, (supplemented by telephone and fax) uplinking instructional programs from studios of the Indira Gandhi National Open University. The 7-day training program, consisting of both content and pedagogy, was launched on a pilot basis in 1996 in the state of Karnataka, and was favourably evaluated, in general, upon its completion, despite considerable problems with TV reception (Phutela, 1996).

3.19 When television is used in education, it is often used very badly, in that its presentational characteristics are grossly underexploited. Very few institutions use television as part of an integrated mixed-media teaching system which, in addition to the television programs, consists of print materials (study guides, textbooks), supplementary materials (audio cassettes), the learners, the on-camera teacher, and the classroom teacher or aide. All these components need to be carefully thought through from the very beginning of development and fit together in a complete system. However, this rarely happens.

3.20 *The computer.* Computers are beginning to become an important technology for the conduct of on-line distance education courses in higher education in the more developed countries. Some institutions have begun to use computer conferencing as the principal medium of communication, on-line courses provide new and different opportunities and challenges compared with traditional distance education courses. In offering among many users, computers can bring different peoples' perspectives to bear on a problem or issues, important in many instructional situations. Computer conferencing can be an excellent support for collaborative and peer learning; it is also convenient for learning because it permits asynchronous interactions among learners.

3.21 Professional development courses for teachers, particularly in the use of educational technology, but also in other subjects, are being offered on-line or are under preparation around the world by the University of South Queensland, the British Open University, George Washington University, the Virtual University of Mexico and several other universities.

3.22 Computers are also being used to create on-line learning communities for the professional development of elementary and middle school teachers. One of the first on-line learning communities to be established was in the United States. Known as LabNet, and established in 1989 by the Technical Education Research Centres (TERC), with support from the National Science Foundation, the project set out to enhance the quality of physics teaching in primary and secondary schools by supporting the creation of structured knowledge exchange among science teachers on-line led by a facilitator (Ruopp, 1993). The Mathematics Learning Forums project, funded under the umbrella of the Annenberg/CPB Math and Science Project, has offered K-8 teachers intensive eight-week seminars on content and teaching issues in mathematics. The Forums are designed to help teachers introduce new mathematics teaching practices into their classrooms in accordance with current math reform efforts in the United States (Honey, 1994).

3.23 On the assumption that African educators will have access to the Internet and on-line computer technology, UNESCO is promoting the establishment of learning networks for African teachers within the framework of Africa's Information Society Initiative and the United Nations System-wide Special Initiative on Africa.

The project proposes to establish learning resource centres in Africa's teacher training colleges in some 20 countries to support the professional development of teacher educators and trainee teachers. Each of the centres would be provided full access to the Internet and encouraged through this access to establish dialogues with other centres to exchange information, develop appropriate teaching and learning materials, and to share experiences. The project would also assist the centres to establish and update www sites.

3.24 Computers also have been used as the primary tool for delivering instruction, often incorporating video, sound, animation, and graphics. These combinations of technologies have variously been referred to as interactive videodisc, CD-ROM, or multimedia. Although there are subtle technical differences among these and other computer-based learning approaches, all provide learners with a pre-designed package of course material and opportunities for the learner to interact with the material by answering questions and choosing among various branches through the material. The computer is programmed to provide feedback to student responses and can control learner routes through the course. It also can be designed to test and maintain a record of student learning. The benefits of computer-based learning are that there is a consistency in quality across training settings, and students can work at their own pace, review segments of the lesson repeatedly, "interact" with the computer, and receive immediate feedback on their progress. However, it is difficult to program the computer to provide the extensive interactivity that may be required for learning more complex skills and concepts. Studies on the effectiveness of the use of interactive videodisc for training have found consistently positive effects, in some cases, even more effective than traditional classroom settings.

3.25 *Globalization.* Satellites introduced a major new chapter in distance education. Used for a wide variety of national communication needs, they have also made possible broadcasting of various kinds of telecommunications signson, radio, voice and data across national frontiers and throughout the world. The globalization of distance education is a fact of today's world and is taking many forms. Developed country universities are offering their courses to students all over the world using a variety of communications channels from teleconferencing to computers to texts; unities in developed and developing countries are collaborating with one another in preparing and offering courses to their respective students on line and by other means; private companies, using satellites and other technologies, are offering courses to learners at work, at home, or in other universities.

3.26 In teacher education, Galaxy Latin America, a subsidiary of Hughes Corporation, the Cisneros Group of Companies and DirectTV, recently offered the Latin American and Caribbean countries free access to two of its 200 direct TV satellite channels, for educational purposes. Galaxy's satellite footprint covers virtually all of Latin America and the Caribbean. To determine how the

countries of the region might best utilise these channels, the World Bank and the Inter-American Bank, sponsored a workshop with Galaxy in Mexico in 1996. At the workshop, it was agreed that the satellite would best be used to transmit a wide range of audio-visual instructional materials for examination and use in teacher education pilot projects organised by the countries. Proposals are now being developed on a national regional scale for possible funding by the Banks, themselves, or other sources.

3.27 *The Virtual University.* Virtual universities, or universities without walls, are in their infancy, but appear to have huge potential. New technologies make possible the creation of virtual universities; in principle they enable teaching resources, libraries and even laboratories to be shared by people and organisations in physically unconnected places. Driven by a model of marginal cost pricing, such universities may provide an opportunity for sharing resources at affordable prices to a large numbers of learners. The pedagogical advantages afforded by the model of virtual universities may be even more significant: they enable the introduction of programs of studies and curriculum content to adapt to demand and keep up with the latest advances in rapidly changing disciplines of studies. The virtual universities use a variety of interactive technologies to foster communication with instructors and other students and enhance learner participation in instructional programs. Two noteworthy virtual universities which have emerged in the developing countries are the *Universidad Virtual of the Instituto Tecnológico de Monterrey* and the African Virtual University.

3.28 The *Universidad Virtual of the Instituto Tecnológico de Monterrey* in Mexico is one of the more established virtual universities engaged in teacher education, having been created some 9 years ago. With an enrolment of some 70,000 students and 5,600 faculty, it offers undergraduate, advanced degree and professional development courses. Its instruction programs, currently consisting of 147 courses per semester, are delivered through a combination of text and broadcasts via satellite over television (live and pre-recorded) and via computer. The virtual university's student population is both within and outside of Mexico. The university tries to make its courses as interactive as possible, using telephones, computers, and keypads. A pilot Faculty Development Program is currently in its first year of operation.

3.29 The African Virtual University is a project sponsored by the World Bank to provide satellite/technology-based distance education through public and private tertiary education institutions in Sub-Saharan Africa in the disciplines of science and engineering. It was designed as a collection of educational franchises located throughout Africa, co-ordinated by a central umbrella organisation. The objectives of the AVU are to train engineers, scientists, business managers and health-care providers, and to promote the production of academic content and research by African academics. It is intended that courses will be offered by satellite and supplemented by the Internet and offered at a price the average African higher-

education student can afford. However, it is expected to generate enough profit to be attractive to franchisees. To do this, the headquarters staff of the AVU will identify and purchase the best distance education curricula and instructional materials available worldwide and adapt them for local use. In addition, they will provide tutoring, train professors and assistants, and install and service required hard- and software. Local country franchisees will guide learners' studies and provide a standardized set of support services. Now in its pilot phase, the AVU has seven satellite receive sites operational in Ethiopia, Kenya, Uganda, and Zimbabwe, with an additional five sites becoming operational in Ghana and Tanzania in September 1997 and nine more by November 1997. A course in calculus was offered during the summer of 1997 to 28 students at Kenyatta University in Nairobi, and a non-credit seminar series in business was offered to seven sites with 265 participants. An additional 13 courses and training for African university faculty in how to produce courses for on-line or satellite distribution are expected to be downloaded to both French and English-speaking universities by early 1998. Partners of the AVU include the World Bank, several African Universities, and several universities in Europe, Ireland, Canada, and the United States (Baranshamaje, 1995).

Comparative costs of technology

3.30 What are the comparative costs of using communications media and information technologies in distance education projects? This topic is briefly touched on in this section while other comparative cost and funding issues are discussed in section 4. Bates (1995) has condensed available cost information for Britain into two very useful tables relating cost per student to the number of students. The precise numbers for cost-per-student-study-hour are only indicative and certainly would not be directly applicable to any given developing country, but his depiction of the relative costs of the various modes is a helpful guide in thinking about the cost aspects of technology in distance education. For instance, in Figure 1 (top panel), at 125 students per year for eight years, radio is four times as expensive as audio cassettes (at Britain's Open University); at 1,250 students per year, however, the differing costs-per student-study-hour have largely converged and audio cassettes are now a mere one-third cheaper than radio.

3.31 Those media with large up-front production costs - for equipment or course production - and low per student variable costs - have more steeply falling costs by scale than those with smaller up-front and relatively larger per student variable costs. Instruction based on broadcast TV, for instance, has more steeply falling costs than computer based learning (CBL) [Fig.1, top panel]. The two lines will cross at some point off the graph, and broadcast TV will become the cheaper of the two. In Fig.1, bottom panel, where interactive technologies are displayed, beyond 250 students per year, most of the media depicted show minimal economies to scale, except for interactive lectures (one-way video and two-way audio), and the cost-per-student of this medium, even, flattens out starting

at about 500 students per year. The key point illustrated by Fig. 1 is that it is very difficult to evaluate the economics of a distance education program without having a fairly precise idea of its scale.

3.32 *Media choice.* It follows from this that small courses in small, poor countries will have restricted choice of media compared to large courses in large, rich countries. Conversely, to see this as a 'glass half-full', there *are* media that are financially feasible even for relatively small distance education programs in small, poor countries. How much in educational effectiveness will such programs have to give up because of restricted choice of media? Unfortunately, there is little recent research on the subject. The available research, mostly from the 1960s and 1970s and cited in Carter (1996) in the most recent literature review on the subject does not support the idea that more expensive or complex media produce better educational outcomes. Carter states that the idea that motivated students can learn from any medium that is competently used is widely accepted among distance educators. This conclusion needs to be revisited in the light of the multimedia revolution, but it needs to be noted that new technology in recent years has not only been in the direction of higher cost and complexity; there have been significant low-cost, low-complexity developments, as well. E-mail for asynchronous learner support, for instance, is an inexpensive but powerful development, as is the existence of widely available off-the-shelf computer software.

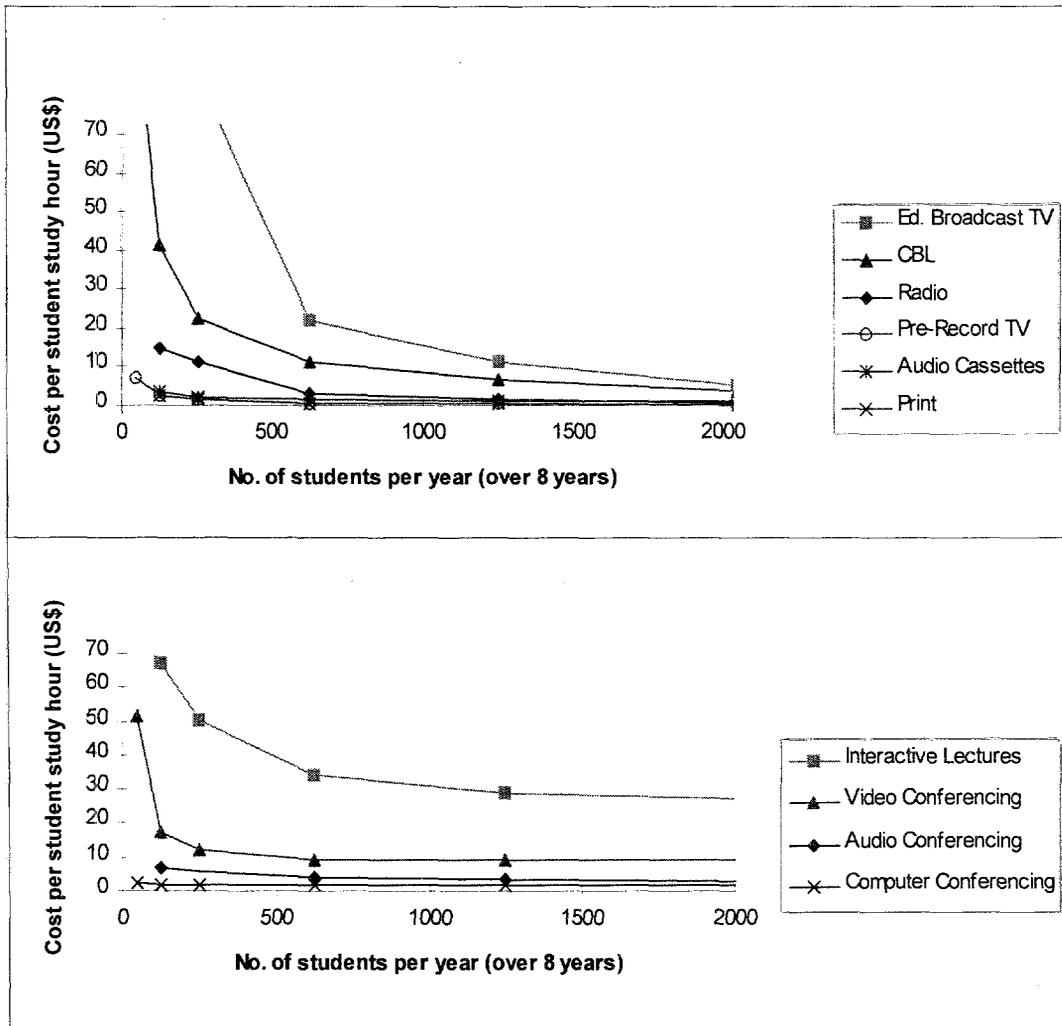
Conditions for the successful use of technology

3.33 What factors contribute to the successful use of telecommunications and information technologies in the training of teachers at a distance?

3.34 For these technologies to be effective in teacher training at whatever level, courses themselves must be well designed and must model effective instructional practice. That is, they must have learning objectives, attend to the active engagement of learners through a variety of methods including co-operative activities and hands-on work, and attend to the different styles of learners. Technology does not make up for poor course design.

3.35 Making the correct choices in the use of technologies is crucial for the effective delivery of education and training programs. Infrastructure prerequisites, price considerations, and availability of the technology to the learner are important parts of the equation. However, pedagogical considerations are also important. There is general agreement that using several technologies, including text, is often the best approach to the successful use of technology in instruction. Furthermore, technology choices should be made on the basis of their relative effectiveness for instruction. This implies acquiring knowledge and experience regarding the use and relative effectiveness of the different instructional technologies on the market.

Fig. 1 Comparative Costs of Distance Education Technologies



Source: Bates (1995), with axes extended. Data are estimates for the United Kingdom.

3.36 Technologies also have to work to be effective. This is rather obvious, yet all too often, courses are not successfully delivered because the instructional media or technology doesn't work as planned. There are any number of reasons as to why this occurs, but often it is due to insufficient pre-course testing of media and technology configurations at the onset and to poor operations and maintenance during the course of implementation.

3.37 If technologies are to be successfully used in distance education instruction, they need to be both accessible and conveniently located for learners. In developed countries, many learners have television sets and computers in their homes to receive broadcasts or participate in computer conferences. However, in developing countries, community-based resource centres are needed. These centres could house classrooms, conference rooms, laboratories, libraries, and media and technologies for distance education..

3.38 One element often overlooked in any distance learning situation is the access learners have to resource materials. If teacher education programs wish to have teachers engage in research or other types of learning activities, they will need access to relevant materials. The learner at a distant site should not be disadvantaged because of limited resources.

3.39 Evaluation research also is an essential ingredient for the successful use of technology in the education and training of teachers. However, evaluation studies are seldom conducted that actually measure whether teachers are applying what they learned in training in their classroom practice. Since teacher education and training are such a large part of a developing country's budget, it is important that evaluation studies be conducted to determine the impact of training on teaching. It is not enough to ask teachers what they thought of the training or for them to pass a test: teachers, like doctors, should be assessed on the job, and the worth of the teacher education or training program should also be assessed by teachers' performance on the job. Are they using what they learned in the classroom? And, are they using it in a way that contributes to learning?

4: Costs and funding

What then is the significance of economic science? . . . Surely it consists in just this, that, when we are faced with a choice between ultimates, it enables us to choose with full awareness of the implications of what we are choosing . . . For rationality in choice is nothing more and nothing less than choice with complete awareness of the alternative rejected. And it is just here that economics acquires its practical significance.

Robbins, 1935

4.1 There is only a complicated answer to the simple question, 'is distance education cheaper or dearer than conventional education?' The complications follow partly from differences between the economic structures of distance and conventional education, and partly from the quality of the data.

Comparative studies and their limitations

4.2 The pattern of expenditure for distance education differs from that of conventional education, with different relationships between fixed and variable costs. In conventional education, staff costs are generally the largest single item in a budget. They tend to vary with the number of students, because education is a labour-intensive activity. However, in distance education, teaching can be recorded in advance, reproduced, and distributed to large numbers of students. While significant costs are incurred in developing the teaching materials, the costs of teaching one additional student may be modest. Distance education is thus more capital intensive than conventional education with higher fixed costs, mainly for the development and production of teaching materials, and lower variable costs, as fewer teaching hours are devoted to the teaching of each student or group of students. Within distance education it is therefore possible to expect some economies of scale, and for the cost-per-student to drop as the number of students increases. At the same time, supervised teaching practice and learner support generally, does not allow these economies of scale. The cost of this element in a distance-education programme for teachers is likely to vary with the number of students.

4.3 In comparing the costs of conventional and distance education, or looking at the consequences of expanding or contracting a programme, it is not possible to simply take annual expenditure for the two modes of study and divide it by the number of students. (In any one year a significant proportion of the costs of distance education may be for the development of teaching materials that are used over a number of years.) Instead, more sophisticated comparisons are needed. Two main approaches are used. A number of studies, particularly those produced in the late 1970s and early 1980s, analysed the cost-per-hour of study for different modes of education. More recently, studies have tended to look at the comparative costs of following a course-of-study or obtaining a qualification through different methods of study.

4.4 These make it possible to reach some fairly robust conclusions about the circumstances in which distance education is at an advantage or disadvantage when compared with alternatives. At the same time, the conclusions must be qualified as they are based on data of varying quality. One review noted the following difficulties that need to be surmounted in interpretation (Perraton, 1994, p. 20-21):

- studies of distance education vary in the extent to which they include capital as well as recurrent costs;

- institutions vary widely in their organisational structure, choice of teaching media, and assumptions about the amount, and therefore cost, of staff members' time devoted to teaching as contrasted with administration or research;
- there are often significant differences in the social and educational backgrounds of students in conventional and distance-education institutions or courses;
- a number of comparative studies have looked at costs-per-student without citing graduation rates.

Costs and outcomes

4.5 With these caveats, the evidence from cost-effectiveness studies permits some conclusions about the comparative cost of distance and conventional education. Table 7 sets out data on a number of programmes of teacher education and higher education; for the most part the latter relate to institutions that had teacher training as one of a number of functions. All of the data come from studies that appear to have followed standard techniques of microeconomic analysis and to be robust enough to have confidence in the conclusions. As noted above, it is important to distinguish between cost-per-student and cost-per-graduate. A number of studies, especially of open universities, have shown figures for costs-per-student but without examining graduation rates. As a result, while it is possible to compare the cost per student with that of conventional education, it is not always possible to answer questions about the comparative cost of producing a graduate or successful course completion.

4.6 Six conclusions can be drawn from the figures in Table 7 and from the studies on which they are based.

4.7 The first is that there are circumstances in which distance education is at an economic advantage as compared with conventional education. Where it has been possible to measure effectiveness, teacher training at a distance has been shown to be effective and its costs often tend to be lower than those of conventional education. It is reasonable to conclude that distance-education programmes can be designed for teachers at a cost of between one-third and two-thirds that of conventional programmes. To some extent, in Pakistan or Tanzania for example, this is because they have operated at a large scale and often achieved high successful completion rates. Typically these were programmes in which successful completion guaranteed more pay. High completion rates narrowed the gap between the cost-per-student and the cost-per-graduate.

4.8 This finding is consistent with other reported data. In China, for example, where only limited data were available for a comparison between the cost of the Radio and Television Universities (RTVU) and others, Wei and Tong suggested that the RTVU system was probably 'saving a third of the cost of producing a con-

ventional graduate' (1994, p. 98). Although it used a somewhat different methodology from that of most of the studies, the other findings are consistent with a review of teacher upgrading through distance education in southern Africa (Taylor, 1983, p. 30). In Britain there is, as yet, no published cost study of the Open University's Postgraduate Certificate in Education but its costs are understood to be about half of those of the conventional alternative (personal communication).

4.9 Thus, in a number of the cases where reliable data are available, distance education has been shown to achieve the economies of scale that allow the cost-per-student to fall below that of alternatives.

4.10 The second conclusion is that some distance-education projects were probably too small to show economies of scale. Three of the projects shown in Table 7 (Kenya, Nigeria, and Uganda) did not show dramatic economies as compared with conventional programmes of teacher education. Indeed, it was probably more costly to produce examination passes through the early programme in Kenya than in conventional schools, although the programme was seen as having the benefit of reaching remote teachers who could not be taken out of the classroom for full-time education. There were similar benefits to the recent small-scale project in Uganda. These projects had enrolments in the range 500 to 3,000. In contrast, the comparative costs of a number of larger distance-education programmes have been much more favourable.

4.11 Third, one of the major economic advantages of using distance education is that it does not demand full-time residence or attendance at a college over a period of years. This means that a distance-education programme is likely to result in a number of different savings in public expenditure, including the cost of providing residential colleges and, in some jurisdictions, of paying students a maintenance allowance while they are at college. Students in Ghana, for example, receive a living allowance if they attend university to follow a B.Ed. course but do not get an allowance if they are following a parallel distance-education course. The cost of student residence is reduced when students attend a college for face-to-face sessions only occasionally, or for shorter periods than in conventional full-time programmes, and colleges are therefore used more intensively.

4.12 The savings in the cost of residence, and the economies of scale made possible through the use of communication media, have brought the unit costs of many distance-education programmes below those of alternatives. But there are limits to the economies of scale that can be expected through the expansion of distance-education programmes where there is a significant element of supervised classroom teaching. Where extensive support is provided to students, or arrangements made for thorough supervision of their teaching practice, the variable cost of programmes is relatively high; supervision and support costs necessarily rise in proportion to the

Table 7: Some costs and success rates for teacher training and tertiary-level distance education

Country, institution and date of studies	GNP per capita 1992 US\$	Approx. annual enrolment	Cost per student per annum of distance educ.	Cost in 1992US\$ ^a per graduate or successful course completer	Measure of success		Comparison between distance and conventional education
					Measures used	Rate %	
Australia: Deakin University 1989 ^b	17,483		2,614 ^c				Cost per student 97.5% of cost of on-campus student
Australia: 8 Distance Education Centres 1990 ^d	17,483	2,750 - 9,125 ^e		4,417 - 6,735			Cost per external student 90-99% of on-campus student
Britain: Open University 1989 ^f	17,790	25,000	2,342	15,834 ordin. BA 22,160 honors BA			Cost per graduate lower than cost at conventional university ^g
Costa Rica: Universidad Estatal a Distancia 1980 ^h	1,960	8,150	1,276				Cost per student lower than at conventional universities; cost per credit comparable with larger conventional universities
India: Indira Gandhi National Open University 1991/92 ⁱ	310	52,000	116		Graduation rate	22.5	Cost per student between 8% and 40% of costs at conventional universities but comparable performance rates of latter are in range 55-60%
Indonesia: Open University teacher training 1988/89 ^j	670	5,000	678				Cost about 60% of conventional course
Japan: University of the Air 1989/92 ^k	28,190	3,600	2,101	23,233			Cost per graduate lower than at national university but higher than private or correspondence programme
Kenya: University of Nairobi BEd 1989 ^j	310	151	923				Cost thought to be lower than cost of full-time equivalent
Nigeria: University of Lagos COSIT 1988 ^j	320	2,000	294 ^c	1,098			Cost slightly lower than cost on campus

Table 7: Some costs and success rates for teacher training and tertiary-level distance education (cont.)

Pakistan: Allama Iqbal Open University Primary Teachers Orientation Course 1976/86 ^j	420	8,360		91-125	Successful completion rate	37.9	Cost per AIOU graduate 45-70% of conventional
Sri Lanka: National Institute of Education 1974/88 ^j	540	5,000	98				Costs 1/6 to 1/3 of alternative
Tanzania: Teacher training at a distance 1979/84 ^j	110	15,000	1,569	6,162	Successful completion rate	93	Cost about half conventional education
Uganda: Mubende Integrated Teacher Education Project 1991/95 ^l	170	900 ^m	521	4,525	Successful completion rate	34	Cost 17% higher than for conventional institutions
USA: National Technological University 1989/90 ⁿ	23,240	3,640	3,366		Course completion rate	85	Breakeven point at enrolment 9,000 students on 200 courses

Notes

- a Costs based on those in Perraton, 1994, where they were in constant 1988 US\$, generally converted by using the exchange rate in \$ for the year being reported and then converted to 1988\$. Costs now converted to 1992\$, using the USA GDP deflator shown in World Bank *World Tables*.
- b Deakin University, 1989
- c Recurrent costs only per full-time student equivalent
- d Harman, 1991. Enrolment and cost figures are for full-time equivalent student units; for conversion purposes they are treated as 1989 data.
- e Figures appear to be total full-time student equivalent, not annual.
- f Open University 1991
- g Horlock, 1984 calculates cost at 62% of the cost of a degree at conventional university with OU graduation rate of 57%. His calculations give a cost per graduate in 1981/82 of 1992 \$17,279
- h Perraton, 1982a pp 30-1 (where fuller references are cited).
- i Ansari, 1993, taking his reference to performance as a graduation rate, and Kulandai, Swamy and Pillai 1994
- j Perraton, 1993 pp 386-7.
- k Rumble, 1992 and Muta and Sakomoto, 1989, taking their figures as in 1985 currency.
- l Robinson and Murphy, 1996. I am indebted to the authors for permission to quote from this draft study. These costs converted from 1994 to 1992\$ using the US CPI index.
- m Total enrolment for the single cohort of students over a three-year period was 900.
- n Bih-jen Fwu et al., 1992. The cost-per-student is for a 3-unit course, apparently stated in 1989\$ in original.

number of students so that economies of scale are not possible for this element of the programme.

4.13 Fifth, the comparison between the costs of distance and conventional education in part reflects the high cost of conventional methods of teacher education. Lockheed and Verspoor (1991, p. 96), in commenting on the high cost of much teacher education, have suggested, as noted in section 1, that where its content is much the same as that of secondary education, it would be cheaper to provide that education through secondary schools. The Tanzania teacher-training scheme is a striking example of these two points; its costs look dramatically high for a low-income country and demonstrate both the high degree of face-to-face supervision provided to the distance-education students and the high cost of conventional teachers' colleges.

4.14 Sixth, there are considerable opportunity costs for students in undertaking part-time study. Some of the costs are social, others are financial: students spend less time with their children, spouses or friends. While economists can estimate a shadow cost for students' time, teachers doing a part-time degree in both Kenya and Nigeria reported that they were using time that they could otherwise have spent doing private, paid tuition (Perraton, 1993, p. 288). Their opportunity cost was a real one, easily measured in shillings or naira.

4.15 The opportunity costs of various modes of study may fall on students or their employers. One of the attractions for employers of the National Technological University, which feeds training into its learners' work places, is that it cuts the opportunity cost of attending campus by eliminating travel time. The conclusion is that, if we want to undertake cost-effectiveness analysis of distance education, we need to consider the value of learners' time and ask who is paying for that time. Comparisons between the cost effectiveness of distance and conventional education may turn on just this issue — who pays the opportunity cost.

4.16 To sum up, the cost evidence is consistent in showing that students can obtain teaching qualifications through distance education at costs that compare favourably with conventional alternatives. In interpreting the data, it is important to consider the opportunity cost of studying at a distance and the question of who is meeting this cost. Furthermore, while it is legitimate to compare the costs of obtaining the same qualification through different kinds of programmes, in a thorough evaluation, one should be concerned with how teachers perform in the classroom, particularly in relation to the ways they have been trained. This question is seldom addressed even with conventional approaches to teacher training and is an area in which more research is needed.

Comparative costs of different media

4.17 Given this reassurance about the possible economic advantages of distance education, we can move on and ask about the educational and cost implications of choosing one medium rather than another. The educational evidence is reassuring: comparative studies over many years have found no significant difference in the effectiveness of different educational media (e.g. Chu and Schramm, 1968; Moore and Kearsley, 1996, p. 60-67). We can therefore make decisions about the choice of medium, or of a combination of media, in light of its convenience for students, its apparent appropriateness for the educational job to be done, and its cost.

4.18 A critical distinction affecting the planner's choice is between media that allow one-way interaction and those allowing two-way or multi-way interaction. Broadcast radio and television are one-way media. Printed materials sent through the post may stimulate two-way interaction if students are provided with assignments that are returned to a tutor for grading and comment and then returned to the student. There is limited experience in providing one-way television with two-way audio signals and offering telephone tutorial sessions to students. The costs of doing so, and the demands on the communication infrastructure, mean that these approaches, and computer conferencing, are at present of limited relevance in most developing countries. The position is changing rapidly and computer conferencing, for example, is beginning to be used in Eastern Europe. But for many countries two-way communication within distance education is likely to depend on face-to-face contact with students and on correspondence tuition in which tutors comment on their students' written assignments. In all these cases the cost varies with the number of students and the level of interaction with them so that economies of scale are not available to these components of a programme.

Funding

4.19 There are no major differences of principle between the issues concerning the funding of a distance education programme for educating teachers and a conventional programme. In both cases it is likely that the major part of the recurrent costs will fall on government. Where programmes are offered in-service, to teachers who are receiving a salary, it will not be necessary for them to receive an allowance as is sometimes the case with residential training. However, allowances may be necessary for short periods of face-to-face study.

4.20 Two features of distance education have implications for funding which are in contrast with conventional education. First, it may be possible for the costs of some elements of a distance education programme to be shared with entities other than a ministry of education. Where broadcasts are used, for example, it may be possible for educators to have access to broadcast time at preferential

rates. Similarly, it may be possible for the costs of some parts of teacher training to be shared with other parts of the educational budget; where local district or regional teacher centres are used then their costs may not fall on the teacher education budget. None of these may represent savings in a full economic analysis: they may appear as practical savings on an educational budget.

4.21 Second, while distance education may save on capital investment in residential buildings for students, it does demand up-front capital investment in the preparation, development and production of good distance teaching materials. Many projects have underestimated these costs and the time needed to produce good material. The unit cost-per-student of investment in materials may prove to be readily justifiable because of numbers of students, but nevertheless presents the planner with a demand for funds early on.

4.22 Where trainee teachers are studying in-service, funds for teacher education have usually come from one or more of three sources: regular government budgets at central, regional or local levels; funding agencies including the development banks; and student fees. Recurrent costs have usually fallen on government budgets and student fees. Whether or not fees are charged, some costs are likely to fall on the student. Where trainee teachers are in-service, policy on funding a training programme will need to take into account their salary costs, the extent to which training will take them away from the classroom, and the eventual effect on salary budgets if they get increased pay on completion.

4.23 Policy on student fees has varied. Many programmes of teacher education have charged no fees; indeed, some have paid allowances. There are, however, examples of programmes funded in part by fees; this was the case for some teacher upgrading programmes in Indonesia and Sri Lanka. Where teachers are following a degree course from an open university, they have generally been charged fees. Current thinking is to press for the use of fees to recover some of the cost of tertiary education (cf. World Bank, 1995, p. 72). If fees are charged, the level at which they are set may determine the extent to which a programme can be expanded. If fees are calculated so that they cover all the variable costs of a programme, leaving some or all of the fixed costs to be found from other revenue, then there is no cost limit on the expansion of a programme. Where fees meet only some of the variable costs, then the total expenditure of a programme is in part a function of student numbers.

4.24 This is, however, a double-edged sword. In Indonesia it was found that 'distance-education trainees begin to lose their incentive to pursue the course once its costs are beyond 16 percent of their annual earnings, a level found in the case of many trainees' (Nielsen and Tatto, 1993, p. 129). Furthermore, where an open university derives a high proportion of its income from student fees it is under pressure from those students to keep fees as low as possible. This in turn encourages the university to hold down its ex-

penditure on the labour-intensive activities of student support, even though these are the very activities that may raise its success rates. The desirability, and realism, of charging student fees will vary so much from one jurisdiction to another that the analysis is not carried further.

4.25 This paper has summarised what is known about the effective use of distance education to support and educate teachers. The analysis suggests that, while many developing countries have used distance education for teacher training, the record is mixed. There are both successes and failures. On the one hand, the evidence suggests that distance education can play a significant and useful role in teacher education and often has advantages in terms of cost and its capacity to reach students. But, on the other hand, in many countries it remains something at the margin, outside the central and regular activities of teacher education and support, used to resolve occasional crises but not something to be taken as seriously as conventional educational methods.

Appendix: Follow-up to Toronto Conference on Global Knowledge 97: Action Plan to Strengthen Teacher Education

5.1 This analysis was presented at the Colloquium on Teacher Education at the Toronto Global Knowledge Conference and subsequent discussions engaged in at the conference suggested at least four important areas are in need of attention: (1) identifying effective pedagogical strategies for improving both the general education of teachers and their specific competencies including practical classroom skills; (2) making the best use of the various technologies becoming available in order to reach large numbers of teachers and to provide them with better resources for their teaching; (3) designing efficient, educationally sound and cost-effective systems of distance education for teacher training; and (4) building up the capacity of all institutions involved in the training of teachers to plan and implement high quality teacher education, using both conventional approaches and those that rely on distance education and communication technology.

5.2 Based on discussions held at the Colloquium, the following section highlights what the World Bank and other agencies can do to support an international agenda for action to strengthen teacher education.

What The World Bank and others might do

5.3 The Bank is prepared to join other development agencies, governments, and the private sector, in supporting an action plan developed during the colloquium to strengthen teacher education in developing countries. Bank support would likely fall into four main areas of action: knowledge development, dissemination and exchange of knowledge and experience, professional development, and developing demonstration projects and testbeds in teacher edu-

cation using telecommunications and information technologies. Each is discussed briefly below.

Knowledge development

5.4 Despite the ever-increasing number of new publications on distance education, there is only a limited amount written on the experiences of developing countries in distance education for teacher training. Further, while there are some case studies that can provide useful lessons to policy makers and program managers contemplating investments in distance education, there is room for further case-study reporting and for analyses of the experience. Accordingly, there is a need to support research of all kinds in developing countries, and especially evaluation research, for knowledge development, and to disseminate that knowledge worldwide through both conventional and newer channels such as the Internet.

Dissemination and exchange of knowledge

5.5 The exchange of experiences between countries and regions can provide valuable insights for those preparing and managing distance education programs. Conferences usually serve this purpose, but in the information age, there are other alternatives. For example, in the same way that on-line learning communities, listserves, and other communications tools provide useful benefits to teachers in developing their knowledge and skills for teaching, so they can be established to lend support to policy makers and technical support staff in developing policies and programs in distance education and teacher training. These and other efforts at enhancing the exchange of experiences among policy makers and practitioners needs to be facilitated and strengthened on a regional and worldwide basis.

Professional development

5.6 Countries and institutions that opt for increasing the role of technologies and distance education, need more skilled and experienced professionals working as teams to formulate viable programs, implement them efficiently, and evaluate their outcomes. This is a tall order, but an essential one in view of the projected rapid growth of investments. The Bank's Economic Development Institute (EDI), working in collaboration with other partner agencies and institutions, is prepared to develop and deliver professional development programs over the next several years in distance education and the use of technologies, with a special focus on the education of teachers. These would supplement the range of activities already available through other agencies. Such programs could be delivered in several ways, including the use of modern technologies.

Project demonstration testbeds

5.7 There is need for more experimentation in the use of distance education to identify improved and cost-effective ways of

training teachers. While there probably have been several hundred programmes of teacher education using distance education, these are a minority of the overall number of teacher education programs. Even fewer programs employ modern technologies. Moreover, as noted above, the outcomes of teacher education programs have often fallen far short of needs. The World Bank is interested in joining with other partners in supporting project demonstration testbeds which explore new and improved methods of offering teacher education at a distance. While the Bank itself does not have large amounts of grant funds, it could provide some joint funding and technical support with others. It is also prepared to explore with client countries, the use of ongoing and new projects, to undertake demonstration projects in teacher education.

Other Agencies

5.8 A number of other international agencies have interests in distance education, which may be able to support an Action Plan in follow up to the Toronto colloquium.

- Regional development banks have funded distance education projects and have a professional interest in its application. The Asian Development Bank, for example, has provided funds for the Bangladesh Open University and hosted a meeting in 1996 on distance education for the training of primary school teachers. The Caribbean Development Bank made a loan to the University of the West Indies for the development of distance education.
- Both the Commonwealth and *la francophonie* have set up specialist agencies to promote co-operation in distance education - the Commonwealth of Learning (COL), with its headquarters in Vancouver, and the *Consortium International Francophone de Formation à Distance* (CIFIAD), based in Bordeaux. Both agencies have provided technical assistance in distance education and supported transitional activities. COL has recently completed a study on Teacher Education in Asia for the Asian Development Bank, which may suggest priorities for follow-up to the Toronto Conference.
- UNESCO has provided support for distance-education programmes for over 30 years. It has organised international consultations and seminars on its use and published reports and handbooks in its own series and those of the International Institute of Educational Planning. At present it is exploring the possibility of expanding the use of distance education in nine high population countries (Bangladesh, Brazil, China, Egypt, India, Indonesia, Mexico, Nigeria and Pakistan) in its 'Learning Without Frontiers' project.

- The European Union has a growing interest in the use of open and distance learning in both higher and secondary education and has funded projects under the Socrates programme within member countries of the European Union and under PHARE in Eastern Europe.

Proposed agenda for working groups

5.9 The purpose of this part of the paper is to suggest questions that may form the agenda of working groups which will be organised during the colloquium to contribute to the preparation of an Action Plan to strengthen teacher education. In doing so, we want to explore what measures will strengthen teacher education and make more effective use of the new technologies. We do not want to limit that discussion in any way and hope and expect that groups will identify new and different issues, and approach the work at different angles from those already used. But, as a starting point, number of issues are identified that preliminary work suggests are important in relation to the development of knowledge, its dissemination, training, and demonstration.

The development of knowledge

5.10 Under this general heading is both the better exchange of existing knowledge and experience — mechanisms for reporting on and sharing what is known — and research to fill gaps in our understanding. The categories may overlap. As Box 3 suggests, part of the research agenda involves asking questions that apply to any form of teacher education and do not focus on distance education. Other parts of the agenda are more specific to distance education. In defining an agenda focused on distance education and communication technology it may be useful to consider areas of research under the headings of communication, curriculum and organisation. On communication, educators cannot always find the information they need to make choices that may require heavy allocation of resources: part of the agenda is to respond to the need for this information. Among the questions on curriculum are those about matching particular elements in the curriculum to the most appropriate methodologies. Related questions on organisation concern the most appropriate organisational structures for distance education in a variety of conditions. Within this part of the agenda, too, are the critical questions of the organisation, supervision and assessment of teaching practice.

5.11 The colloquium will be asked to think about the research agenda and its priorities among the issues identified here, or indeed about others to be added. Once these have been considered and the list refined, related questions can be asked about the agencies and mechanisms that should be used or put in place.

Training

5.12 The expansion of distance education has forced educators to learn about new ways of working which in turn has stimulated the development of training programmes and activities. Some of these are set out in Box 4. We can distinguish several different audiences of people from whom there is likely to be a demand for training about distance education and the use of technologies. These include:

- educational policy makers working in governments, universities and funding agencies who may want to know how distance education should fit into educational decision-making. This may be a diverse group with widely different needs and background experience.
- managers, who will be working within distance-teaching institutions, and are faced with organisational questions that are different in kind from those addressed by the manager of a conventional institution;
- academic staff, some who may need a broad orientation to distance education to see what its role is alongside more conventional forms of education, while others will need specific training on the production of teaching materials in a variety of formats;
- specialist practitioners within distance education, such as instructional designers, editors and media producers. These may be people who already have a background, perhaps in editing or media production, but need to develop the specialist skills demanded by distance education.
- the staff of existing teachers' colleges and faculties and departments of education. As distance education moves towards the educational mainstream, it will become necessary to incorporate a necessity material about its practice into regular curricula.

5.13 Training in this area has been carried out through formal and informal methods. The colloquium will need to consider how far the various needs are already being addressed and how far new developments should be stimulated and supported, on a world or regional basis or more narrowly. Starting points may be to ask about the extent to which the sound development of distance education is at present being inhibited by a lack of understanding of its potential among various audiences and about particular skill shortages. Given the range of existing courses and materials we will then need to go on to ask about the training methods and kinds of activities that are of the highest priority

Box 3: Shaping the Research Agenda

The context of research on distance education for teachers is defined by questions that are common to research on teacher education, regardless of its methodology. The literature suggests we start by asking:

- Can we set parameters to the length and content of teacher education that relate to the prior education of trainee teachers? In other words, if trainees have received, say, only nine years of education before they start their training, should there be a different balance between elements in their curriculum from that appropriate for trainees with twelve years of education?
- Can we say anything about the appropriate allocation of resources to preservice and inservice education, again in relation to the background education of the teaching force?
- What should be the match between different methods of training teachers and the different competencies that they need to develop.

Then there is a further broad set of questions to tell us about the best ways of using distance education for teacher training. The existing research is quite limited. Only a handful of studies have gone beyond simple measures of student enrolment and examination performance to ask about classroom behaviour or teacher attitudes. There are only about 20 good data sets on costs. There is need, therefore, for work that would get out the costs in a standard format and would ask about outcomes in terms of enrolments, completion rates and at least one deeper measure of performance such as increase in teacher knowledge, improvement in pupil scores on tests, increased pupil retention rate, changes in classroom performance, and changes in teacher attitude.

Beyond these general reviews, is a set of themes that fall under three headings: communication, curriculum, and organisation.

Communication

The overarching question is, 'what opportunities do recent developments in communication technology offer for developing countries, and at what cost?' Among the topics to be addressed are the current uses and costs of various technologies, work on broadcasting, and work on internationalisation.

To address the first we might undertake a mapping exercise to determine the current use and costs of a selected range of technologies in both industrialised and developing countries. On the basis of this kind of mapping, it would be possible to design action research activities in connection with continuing programmes of teacher education that would widen our knowledge of the practicalities, costs and benefits of using different technologies. Then, there is valuable but scattered evidence on instructional broadcasting, going back to the history of television in Cote d'Ivoire 20 years ago, but also examining more recent experience with radio. In considering the questions of scale that are bound up with the use of mass communication we may ask how far it makes sense to think on a larger than national scale. There is a paradox here. On the one hand educators often want to develop their own teaching materials rather than use those from a different country, or even county. On the other, textbooks are marketed easily across frontiers as are television programmes for entertainment.

(Cont.)

Box 3 (cont.)*Curriculum*

Questions of curriculum are bound up with those of technology and those of structure. We need to look at the match between the intended outcomes of teacher education and the available methods. Here, as with questions of structure, we need to ask about correlations between variables in terms of audience, curriculum and structure, and outcomes. Some of these go back to the broad agenda of research on teacher education.

Thus, in relation to distance education, it is important to study the comparative effectiveness of different forms of education for audiences that differ in their educational background, and about the comparative merits of preservice and inservice education.

Our knowledge of distance education in teacher training remains much less specific than it needs to be for good planning. Little work has been done in matching a particular teaching medium or technology to an element in the curriculum or competence to be achieved, to its method of assessment, and to its cost. Differences of gender may be significant here. Work on this kind of matching should help suggest which elements in the curriculum, or changes in teacher attitudes and classroom activity, demand face-to-face interaction with its high variable costs and which can be achieved through communication technology where economies of scale are possible.

One further specific area of research concerns a particular use of distance education. Many countries are moving from near-universal primary education toward universal junior secondary education. Teachers with primary-teaching qualifications are being moved up to teach at higher levels, often without appropriate training or content knowledge. Anecdotal evidence suggests that they face particular difficulties in teaching mathematics and science. The research question is simple: can we develop distance-education programmes to meet this particular need and, perhaps, to do so across national frontiers?

Organisation

The impact of distance-education programmes has been weakened by failures in their organisational structure. A further research theme would draw from case study evidence guiding on effective structure and organisation and asking about the strengths and weaknesses of different organisational models for teacher training. Programmes have, for example, been run by university faculties of education, by teachers' colleges, and by open universities. Collaborative structures of various kinds have been developed. There are few research data on costs and outputs in relation to structure.

While the form of integration between teacher training at a distance and other ways of supporting teachers will vary from one jurisdiction to another, there may be general conclusions to be drawn from a review of these links. The Indian experience of creating District Institutes of Education and Training may provide a useful model and an exploration of their actual and potential role in distance education is likely to be of general interest.

The successful organisation, supervision and assessment of teaching practice is likely to be a necessary element in any programme concerned with classroom competency. But this has often been the weakest element in distance-education programmes. There is a range of experience, with responsibility falling variously on head teachers, the staff of teachers' colleges, the inspectorate, and mentors appointed by the schools where trainees are working. The aim would be to discover what kinds of structure have proved viable at what levels of cost within a range of different educational contexts, and examine relationships between the structures and educational outcomes.

This box is adapted from a paper produced by the International Research Foundation for Open Learning for an EDI/World Bank seminar on teacher education last year.

Box 4: Methods for providing training in distance education

Distance education presents unfamiliar demands to both teachers and managers. Training in distance education has been provided through five different means:

On-the-job training

Many of those working in distance education have moved from a background in conventional education, or another relevant area such as radio production or book editing. Learning on the job has been a significant part of their training.

Short training seminars

These have been arranged, often within institutions. They have been particularly important for academic staff, who are unable to attend a longer course, and have been widely used to train people in the techniques of writing distance-education materials. Often seminars of this kind have combined training with the first stages of producing materials.

Formal specialist courses

As distance education has expanded, so a number of institutions have begun to arrange specialist courses. These have ranged in length from one to two-week seminars through courses of a few months to full-scale degree programmes generally at masters level. Some have focused on the development of particular skills - course writing or radio production for example - others on the array of disciplines needed by practitioners in distance education. Courses are offered both face-to-face and through distance education where the University of London, Indira Gandhi National Open University and Deakin University are among the major actors.

Elements within conventional educational courses

Similarly, components about distance education are moving into the curriculum of regular courses on education in schools and faculties of education.

Training materials

These have been developed, often in connection with training programmes, so that there are how-to-do-it materials on the market for any aspects of distance education. They vary in quality and tend to be oriented more to higher education than to teacher education and more to rich, industrialised nations than to developing countries.

The agencies involved have included:

Most institutions teaching at a distance, for their own staff, especially in providing on-the-job training and producing in-house manuals of good practice.

International agencies with interests in the area, e.g., Commonwealth of Learning, Consortium International Francophone de Formation à Distance, the International Institute of Educational Planning and the Economic Development Institute of the World Bank.

Specialist agencies with a particular interest in distance education which include the International Extension College in Britain and the Academy for Educational Development in the United States.

Universities with a particular interest in the area which include both those which are themselves specialising in distance education and others whose interest in education generally has led them into work on distance education.

Professional associations of practitioners, which include regional associations and have organised training seminars in various parts of the world.

Training activities have been at all levels, from those conducted within a single institution, through courses that are run for a particular region to those which seek to draw students internationally.

Project demonstration testbeds

5.14 Testbeds provide a unique opportunity for countries to experiment with the use of distance education for teacher training. As there is a good deal of experimentation already underway in countries, particularly using new pedagogies and technologies, working groups should take these activities into account in determining whether and how they might serve as project demonstration testbeds. As noted earlier, while the World Bank does not have large amounts of grant funds, it could provide some joint funding and technical support in collaboration with its partners which do have funds. Alternatively, it could explore with client countries, the use of ongoing and new projects, to undertake demonstration projects in teacher education. In selecting project demonstration testbeds, working groups would need to give attention to issues such as: (a) the lessons to be learned from a project; b) its current state of implementation; and (c) funding requirements.

Curriculum

5.15 We touched earlier on the comparative importance of the different elements within programmes of teacher education and on the relation between preservice and inservice training. Working groups may want to discuss the content of teacher education and the balance between its different elements. There also may be scope to explore the possibility of developing co-operative projects across frontiers, with countries facing similar issues in teacher education.

Management

5.16 Good distance-education programmes for teachers are likely to need links of two kinds — to those with skills and competence in educational media or communication technology, and to those involved with teacher education generally. The latter are likely to include curriculum divisions, teachers' centres, regional or district offices, examining bodies, the inspectorate and teacher training colleges among others. Some of the relationships cross ground that is often contested between, for example, universities and ministries of education. Success or failure is likely to depend on the development of effective structures for co-operation. They are of particular significance where programmes include classroom practice, demanding co-operative activity for its supervision and management. In considering management we may also want to look at strategies for innovation in teacher education, asking about the best ways of introducing new styles of teaching into the education and management systems.

Conclusion

5.17 The general theme of this paper is that distance education has established its legitimacy. It has a role to play in teacher education but, for this to be an effective and convincing one, it needs to be played in harmony with conventional teacher education. The

purpose of the Toronto colloquium was to explore ways in which this can be done through the co-operation and collaboration of the international community following Global Knowledge 97.

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