2 How we found it

In examining and interpreting the evidence on the costs of open learning we made use of the existing literature on the subject and, in its light, carried out our own case studies. In this chapter we look at the conclusions that can be drawn from the existing literature, examine the use of cost-effectiveness analysis in education and look at the debate on the functions of various educational media. We then go on to look at the mathematical basis of our own research work and to summarise the case studies that were at the core of it.

What was already known

The literature on cost issues in open and distance learning is still very limited and little of it provides empirical data. Two other bodies of literature, also impinging on the question of cost-effective media choice, are growing more vigorously: pedagogical literature exploring the teaching capabilities of the new media and more technically oriented literature on media and educational technology. (We examine the literature in more detail in the bibliographical note page 144).

Much of the early literature concentrated on comparisons between distance and conventional education. The infiltration of educational technologies into distance education, not only in dedicated institutions but also in conventional institutional settings (often referred to as resource-based learning or flexible learning), has however forced a shift of attention from questions of institutional cost-effectiveness to those of cost-effectiveness at course level. Managers are more interested in working out the costs of a course than in comparisons between different kinds of institution. On the level of institutions we have a more or less established consensus on which indicators can be used to compare cost-effectiveness across institutions (i.e. cost per student and cost per graduate). At course level, the question re-emerges: what can be agreed upon as a cost-effectiveness indicator for a specific course? This in turn generates questions about the comparative costs and effectiveness of alternative educational technologies or media.

There is a long tradition of research into the comparative effectiveness of different educational media. As distance education has to rely on media to bridge the distance to the learner, it is necessary to examine whether you can teach as effectively through media as in the conventional classroom. A substantial body of research has been carried out over many years which consistently shows that there are no significant differences between the educational effectiveness of different media (Chu and Schramm, 1968; Russell, 1997). Perraton (1987) summarised this line of argument as media equivalence theory. It was radicalised by Clark in the claim that media do under no circumstance affect learning (1983). This was criticised in a widely quoted article by Kozma (1991), which claimed that media may well influence learning. The debate is succinctly summarised by Carter (1996).

There is a tension here between the solid research findings of media equivalence - that no medium can be expected to be more effective than another (Chu and Schramm, 1968; Russell, 1997) - and the pragmatic view that particular technologies have advantages for particular purposes (cf. Kozma, 1991; Clark, 1983). From the very beginning distance educators have been aware of particular strengths and weaknesses of technologies when applied to different tasks and for different groups of learners. Though in principle the change of medium alone does not guarantee any effect on learning, practitioners argued that different media had different capacities. In order to put the debate about the selection of media into an educational context, we therefore look below at media capabilities.

Before doing so, we can sum up with three broad conclusions from the literature, which formed the starting point for our own review. First, we cannot choose between educational media on the simple assumption that any one medium will teach more effectively than another. A wealth of research has demonstrated that there are no across-the-board findings that will direct us always to use, say, classroom teaching, or print, or computers because of their inherent educational superiority. We need something else to guide us. That guidance is likely to come from a consideration of both pedagogy and economics. Second, there are often practical arguments that will affect our choice of medium. They may have different effects on motivation. Some are more convenient or accessible to students: using television may sound attractive and exciting but has its drawbacks if students have to watch programmes late at night or early in the morning. And there may well be advantages in mixing media in order to benefit from the particular strengths of each. Third, our choice is likely to be affected by information about costs. The costs of open and distance learning behave differently from the costs of conventional education. Where we are using communications media, from print to computers, to distribute teaching material to students we may expect economies of scale through their use that cannot be achieved in conventional education.

Studying cost-effectiveness analysis

If we want to justify the choice of one teaching medium rather than another we will probably want to look at the outcomes: is teaching effective and are achievements improved? Educators are little impressed when managers argue that broadcasting can significantly cut the cost per student and, are more likely to ask questions about educational effectiveness and about the quality of teaching. Educators disengage from the discussion on media choice if effectiveness is ignored. Given their central role in the planning and implementation of distance education, course managers who fail to engage the commitment of educators are unlikely to be successful. The need to bring together the different cultures, of economics and finance, and of education, is reflected in the keyword cost-effectiveness.

Our research began here. Fortunately, a procedure was available to compare the cost-effectiveness of different educational strategies.

Cost-effectiveness analysis: the methodology

The procedure is called cost-effectiveness analysis. It was developed in the United States as a management method to decide between different strategies. Originally it was developed by the Pentagon in order to arbiter between rivalling bids for funds put forward by different sections of the US Army. It was then used in public administration and later, like cost-benefit analysis, filtered into education (Levin, 1983).

The concept is simple. You have different strategies from which to choose, to achieve your objective. The degree to which the objective will be achieved is to be measured and indicates the effectiveness of the strategy used. The cost of the strategy also is measured. From this a cost/effectiveness ratio can be derived. Repeating the same procedure for each strategy provides us with a set of cost-effectiveness ratios, which can be compared. Other things being equal, preference is given to the strategy with the lowest cost-effectiveness ratio. Thus cost-effectiveness analysis looks at the comparative cost of using different approaches to achieving the same result.

This type of analysis was intended as a management strategy. This means that costs and degrees of effectiveness would have to be estimated beforehand. In the case of the original military context this meant that the costs of the weapon systems had to be estimated in advance and the effectiveness would have to be inferred on the basis of their technical specifications.

Cost-effectiveness analysis in education

Obviously such an approach sits uneasily with education. The outcomes of educational processes are difficult to measure. Even where they are measured, educators argue that they do not reflect the whole of the educational experience. Most importantly many educators object to a view of the educational process as a technological one where certain inputs produce predictably consistent effects. They object not only because it does not reflect their experience but also because it conjures up an image of technical manipulation rather than of subjectivity and freedom.

Given this double problem (measurability and the causal relationship of inputs and outcomes), it is not surprising that cost-effectiveness analysis in education has been restricted to specific areas of evaluation and research. The major application of cost-effectiveness analysis in our area was in comparing the cost-effectiveness of distance-teaching institutions to their conventional alternatives using the cost per graduate as a cost-effectiveness indicator (e.g. Jamison and Orivel, 1982).

Cost-effectiveness analysis and the hypothesis of media equivalence

A number of efforts have been made to apply cost-effectiveness analysis to the problem of media choice. One approach was to vary media inputs and see if the change of media had any effect on achievement. The table 2.1 presents a widely quoted example of such a cost-effectiveness comparison (Rumble, 1997, based on Levin *et al.*, 1987). It looked at the evidence on various alternative approaches to raising educational effectiveness including using computers, changing class size, increasing instructional time, and experimenting with different approaches to tutoring.

Table 2.1: Example for a cost-effectiveness calculation

	Effectiveness[b]	Costs[c] ($)	Cost-effectiveness[d]
CAI[a]	1.2	119	1.01
Cross-age tutoring			
peer component	9.7	212	4.58
adult component	6.7	827	0.81
Increasing instructional time	0.3	61	0.49
Reducing class size			
from 35 to 30	0.6	45	1.33
from 30 to 25	0.7	63	1.11
from 25 to 20	0.9	94	0.96
from 35 to 20	2.2	201	1.09

Source: adapted from Rumble (1997: 179, Table 14.7); this table was adapted from Levin *et al*. (1987). Notes: a: CAI Computer aided instruction; this meant 10 min drill exercises with the computer each day; b: estimated increase in effectiveness measured in terms of gain in months of students' academic achievement; c: annual addition cost per student of intervention; d: estimated effectiveness in months of gain in achievement for each additional $100 expenditure per student.

Generally the results of such research show that no such relationship can be established in a consistent manner to recommend one medium over the other. Raising effectiveness cannot be expected from merely changing the teaching media. This result is consistent with the media equivalency hypothesis (Perraton, 1987), which states that media have little or (in a more radical version, Clark, 1983) no effect on learning.

Efficiency and effectiveness

In discussing cost effectiveness we need to distinguish between efficiency and effectiveness. Efficiency is a concept coming from input-output analysis. Generally you have a process (a manufacturing process), into which inputs are fed (say energy and primary materials) and out of which come outputs (say cars). A process A then is said to be more efficient than B if the ratio of inputs over outputs of A is smaller than that of B. More generally, the most efficient process is the one with the lowest ratio of input over output. To speak of ratios obviously implies that inputs and outputs are measurable. If inputs can be measured in monetary form, we can define cost-efficiency as the cost of inputs divided by number of outputs. When comparing several such processes the one with the lowest ratio is said to be the most cost-efficient.

We can distinguish between price efficiency and technical efficiency (Mace 1992 and 1996). To achieve price efficiency one has to minimise the costs of inputs while keeping the output specifications constant. (Managers in higher education in England and Wales will easily recognise the government requirements for efficiency gains here.) To achieve technical efficiency one has to increase the level of output without any change in inputs. These economic concepts, drawn from studying manufacturing, are increasingly being applied to education.

Efficiency is about doing things right and effectiveness is about doing the right things (Drucker, 1974). The concept of effectiveness introduces a framework of objectives, against which the success of one's activities has to be measured. The measure of output here is the extent to which an objective has been realised. The effectiveness of teaching can, at a crude level, be assessed by a test. The test scores then define the percentage of effectiveness. If these are linked with the costs of the inputs, then it is possible to develop cost-effectiveness ratios. When comparing two strategies according to their cost-effectiveness, we have to compare numerators and denominators of the respective cost-effectiveness ratios. We can distinguish four cases in which we compare approach A - say the use of a non-conventional teaching technology - with approach B - following conventional methods.

1) Cost unchanged or reduced and effectiveness unchanged or reduced (Cost A <= cost B and effectiveness A <= effectiveness B)	2) Cost increased, effectiveness unchanged or reduced (Cost A > cost B and effectiveness A <= effectiveness B)
3) Cost unchanged or reduced and effectiveness raised (Cost A <= cost B and effectiveness A > effectiveness B)	4) Cost increased and effectiveness raised (Cost A > cost B and effectiveness A > effectiveness B)

The manager can easily reject the use of approach A in case (2), with increased costs that yield no improvement and adopt approach A in case (3) where there are improvements without more expenditure. Cost effectiveness will not, however, help us in cases (1) and (4), and the manager will need to look elsewhere for guidance.

Studying media capabilities

As we saw, in a counter-current to the claim that media do not affect learning, educators have continued to explore the strengths and weaknesses of media in practice. Paradoxically writers who on one page claim that 'media cannot affect learning under any condition' discuss on the next page how to harness the specific strengths and capabilities of a medium for the purpose of teaching. (Other writers suggest that media do not affect learning but nevertheless they should be mixed to optimise these effects. They suggest that, if individual learners have preferences for one medium rather than another, a mixture is likely to suit the individual needs of a larger number and so raise effectiveness for the whole group.)

In the discussion of cost structures in chapter one we distinguished between resource and communication media. The distinction has implications for the design of teaching and learning. Educational content needs to be presented and students engaged with the subject matter. Students are likely to need help in understanding the content. This help is generated by interactivity, either internal interactivity, where the educational material is organised to engage the learner, or external interactivity with the teacher and possibly the peer group. External interactivity also permits dialogue that may take the learner away from and beyond the pre-prescribed content.

Resource media can be seen as presenting learning material to students, introducing the essential concepts and subject matter of a particular area of study and the intellectual or practical tools or methods of working that are appropriate to it. Different content may require different media capabilities for presentation: a course on Renaissance art needs to present visual images, while a course on Chinese phonetics may need audio media. A text is likely to be essential for virtually all educational presentation as the most important medium for presentation of concepts.

Students then need opportunities to test and check their understanding. This experience is facilitated by means of either internal or external interactivity. By internal activity we mean a process undertaken by the student alone, which goes beyond passive reading, such as working through examples set out in the text. The level of internal interactivity varies across the media: it starts with in-text questions and multiple-choice forms of self-assessment in print. Digitisation of text may provide opportunities to increase internal interactivity. In literature research or sociology, for example, the browsing of large data bases, on the computer, may be of particular value. Activities such as generating graphs of functions in mathematics, or simulations in economics, made possible with computer-based learning, can also be used to increase internal interactivity.

Table 2.2: Media capabilities I

	A Reading B Listening C Viewing D Dynamic images				A In-text questions B In-text activities C Self assessment D Browsing E Simulations					A Discussion B Assessment C Collaboration D Witness learning				
	Presentation				*Internal interactivity*					*External interactivity*				*Total SLH*
Resource media	A	B	C	D	A	B	C	D	E	A	B	C	D	
Print	148				15		5							168
Radio														
Television			2											2
Audio														
Video														
Computer-based teaching														
Hypertext	10				5		5							20
Computer-marked assignments (CMA)							5							5
interactive CMA					10	5	5							20
Computer tools														
Computer-searchable databases														
Computer-assisted learning (CAL)														
Multi media CAL				10			5							15
Communication media														
Computer-mediated conferencing (CMC)										5				5
Videoconferencing														
Tutorials														
Tutor-marked assignment											40			40
Subtotals	158		2	10	30	5	25			5	40			
Totals	170				60					45				275

Notes: The shaded area indicates the media capabilities. For example, television supports presentation but does not facilitate interactivity. CMC on the other hand, though allowing presentation, is strong in facilitating external interactivity.

External interactivity may include interaction between student and tutor or interaction among students. The former allows for individual questioning and discussion, external assessment, and monitoring as well as enabling tutors to offer individual encouragement and support to students. Student:student

interaction allows witness learning, where the student can observe other students' interactions with the tutor and peer collaboration. (It is interesting to note that this mode of learning, so prevalent in conventional education, is referred to in computer mediated conferencing rather scornfully as 'lurking'.)

Table 2.3: Media capabilities II

	Attending	*Practising*	*Discussing*	*Articulating*	Totals
Resource media					
Print	150				150
Radio					
Television	2				2
Audio					
Video					
Computer-based teaching					
Hypertext	20				20
Computer-marked assignments (CMA)		5			5
interactive CMA		20			20
Computer tools					
Computer-searchable databases					
Computer-assisted learning (CAL)					
Multi media CAL		10			10
Communication media					
Computer-mediated conferencing (CMC)			5		5
Videoconferencing					
Tutorials					
Tutor-marked assignment				40	40
Totals	172	35	5	40	252

Source: The model links student activities to media. It is based on a presentation of Laurillard, 1993 at the Regional Office of the OU in Cambridge.

Managers may seek to match their choice of resource medium, used for presentation of the subject matter, to its content and will then want to provide appropriate opportunities for internal and external interactivity. A number of attempts have been made to match teaching purposes against particular media, taking account of the advantages and disadvantages of a particular medium for presenting content or encouraging interaction. In table 2.2, which sets out the allocation of time within a particular course to different media, the educational manager has made deliberate choices of the medium to be used for presenting material to learners, for internal interactivity and for external interactivity. The

main teaching burden is carried by text - with 160 student learning hours out of a total time of 275 hours - but a wider range of media are used to encourage internal interactivity by the student.

Similar formats, varying in their complexity, have been proposed in the literature and used in practice. Laurillard (1993), for example, has developed a model in which the advantages of particular media are examined in relation to some twelve aspects of teaching and learning. A somewhat simpler model is set out in table 2.3 and based on processes developed at the British Open University. It assumes that we can usefully distinguish between four different activities in the part of a student: attending to the teaching material (e.g. reading, listening, viewing), practising what is presented (e.g. solving problems, answering questions), discussing the subject matter, and articulating what has been learned and their own perception and understanding of it (e.g. through tutor-marked assignments). In this example, too, print is mainly used for the presentation of material while computer communication is used to enable students to practise and discuss it. The right hand column of the table summarises the distribution of learning hours to each medium.

When tables like this are combined with information on cost per student learning hour (as in table 4.7), they can be used as the starting point for a rapid cost appraisal. This is outlined in some detail in chapter four.

Costing methodology

In order to use a cost-effectiveness approach to educational planning, and take advantage of what we know about the qualities of different teaching media and their costs, we need now to look further into techniques of analysing and comparing costs. As noted in chapter one, these techniques are necessary for any economic or financial analysis of open and distance learning, or of computer-based teaching, because their costs are different in kind from those of conventional education.

The total cost function

We can classify costs as fixed or variable. Fixed costs are those that remain the same, regardless of the number of students. Variable costs are those that vary with the number of students, rising as more students are enrolled. If, for example, it costs £50 000 to make a 25-minute television lecture on Fourier Transformations then this is a fixed cost, unaffected by the number of students who watch it. Conventional class teaching provides a contrast. As student numbers rise, more teachers need to be employed and paid. Their salary costs – and so the greater part of conventional educational costs – are variable. In the simplest cost model, costs are either fixed or variable. The total costs for an educational project, for a given number of students are therefore made up of the fixed cost plus the variable cost multiplied by the number of students. We can write this in an equation:

Equation 2.1:

$$TC(s) = F + V \times s$$

where	TC	stands for:	total cost
	F	stands for:	fixed cost
	V	stands for:	variable cost
	s	stands for:	the number of students

The average cost function

We can calculate the average cost per student in the same way. The average cost (AC) is the total cost divided by the number of students or the sum of the fixed cost divided by the total number of students and the variable cost per student. This is shown in the following equation:

Equation 2.2:

$$AC = \frac{TC}{s} = \frac{F + (V \times s)}{s} \Rightarrow$$

$$AC = \frac{F}{s} + V$$

This equation makes it possible to see the economic strength of open and distance learning. As student numbers increase, so the fixed costs can be shared among an ever-growing number of learners, thus gradually reducing the average cost per student. Provided that the variable costs of distance education - for tutoring or the distribution of materials in particular - can be held down, it may therefore bring economies of scale.

Distance education may be attractive to policy makers because the composition of fixed and variable costs tends to differ from that of conventional education. Distance education is associated with comparatively higher fixed costs and lower variable costs. It needs more substantial investment up front for course development but these costs are then spread over an increasing number of students. A case in point is a book. It costs more to write a book and design it than to deliver a lecture. But the replication costs of the book may be low whereas in the alternative case for each batch of new students new lecturing costs are incurred.

The behaviour of costs for distance education and for conventional education are set out in figure 2.1 and 2.2. Figure 2.1 shows how, with a small number of students, the total cost for a distance education programme may exceed that of conventional education. As student numbers grow, however, the heavy

fixed cost becomes a decreasing proportion of the average cost per student (Figure 2.2). In this example once there are over 31 000 students, the average cost per student of distance-education falls below that of conventional education. We can sum up that we will expect the fixed costs of distance education to be higher than those of conventional education but the variable costs lower.

Adopting the convention that the subscript DE denotes distance education and CE conventional education, we can express this as

$F_{DE} > F_{CE}$ and $V_{DE} < V_{CE}$

We can draw practical recommendations from this. We may urge managers to watch the variable cost. If we allow this to be too high it may be difficult ever to achieve the economies of scale that give distance education a potential economic advantage. The combination of high fixed costs and high variable costs cannot be competitive. An alternative approach to this is to stress the importance of the break-even point, where costs per student are the same for distance education as for conventional education and ensure that it is well below the likely maximum enrolment level. If we cannot expect to achieve the break-even point, the costs of distance education will remain above those of conventional education. (The break-even point is marked with an arrow in figures 2.1 and 2.2) We can find the break-even point mathematically by solving the equation $AC_{DE} = AC_{CE}$ for s.

We get:

$$\frac{F_{DE}}{s} + V_{DE} = \frac{F_{CE}}{s} + V_{CE} \Rightarrow$$

$$\frac{F_{DE} - F_{DE}}{s} = V_{CE} - V_{DE} \Rightarrow$$

$$s = \frac{F_{DE} - F_{DE}}{V_{CE} - V_{DE}}$$

Figure 2.1: Total cost graph

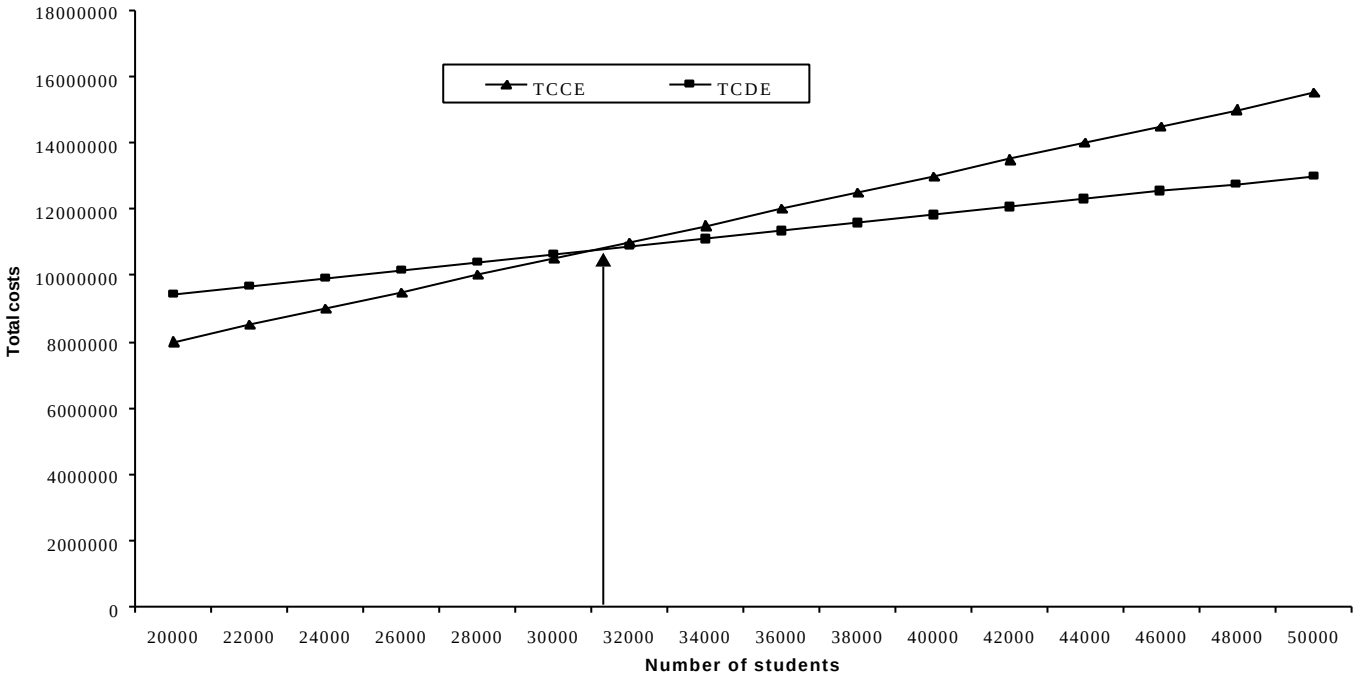
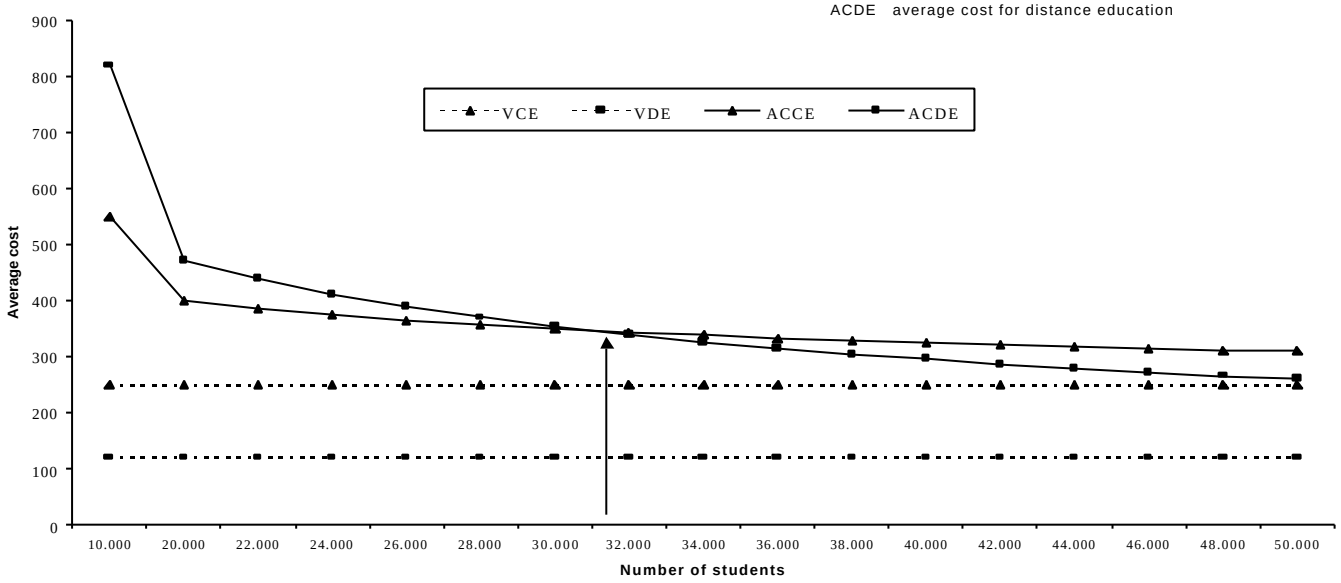


Figure 2.2: Average cost graph

VCE variable cost for conventional education
VDE variable cost for distance education
ACCE average cost for conventional education
ACDE average cost for distance education



Model and reality

From this excursion into the economics of distance education it could be concluded that, to make distance education outperform its rival in terms of average costs, only a few benchmark rules need to be observed:

Keep the unit cost of your teaching strategy below the unit cost of any alternative;

Keep the fixed costs small enough so that the break-even point is smaller than the likely maximum enrolment level.

There are, however, some complications. Lowering fixed costs (e.g. by shifting from CD-ROM to print as means of delivery) may predictably slide the break-even point to the left, making it possible to break even with a smaller student enrolment. But the course may lose so much of its attractiveness that enrolment drops below the level required to break even. Again, extensive student support services may increase average costs per student but at the same time reduce drop-out rates and so lower the average cost per graduate. And, of course, questions of scale are critically important. Heavy investment in materials development can be justified for large numbers of students.

Research methodology

So far we have been drawing a general distinction between conventional and distance education, an approach that has been used in comparing the cost effectiveness of the two approaches generally. Within distance education we need to go on and distinguish those parts of its systems, of materials and of student support, that have fixed and variable costs.

Student support costs are generally variable. (We noted in chapter one that, where support is given to groups of students, the cost will vary with group size.) They are likely to include the cost of marking assignments - tutors' pay - and the use of communication media for student support.

Some of the costs involved in the development, production and distribution of teaching materials are fixed and some variable. The initial costs of developing teaching materials are fixed. For some media there is further a production, or better still reproduction or replication cost, which varies with the number of copies made. Thus, with printed materials, there is a variable reproduction cost while a television programme has only fixed costs. Distribution costs are also variable.

This cost classification allows us to interpret Equation 2.1 and Equation 2.2 in a way appropriate for distance education. We get:

Equation 2.3:

Total cost = Development cost + (Unit cost of Production + Distribution + Support) x Number of students

Equation 2.4:

$$\text{Average cost} = \frac{\text{Development cost}}{\text{Number of students}} + \text{Unit cost Production} + \text{Distribution} + \text{Support}$$

Especially Equation 2.4 provides a good guideline for data collection.

Our research

Our research included both an examination of existing knowledge about cost effectiveness - briefly summarised above - and a set of case studies carried out with colleagues within a number of European colleges and universities that are using open and distance learning. Gathering information from a group of institutions means that our findings reflect general experience, rather than being limited to a single approach or single educational philosophy. But this in turn creates problems; we have had to find an approach that can be used under widely differing circumstances and to choose indicators, or measuring rods, that are generally applicable.

For the most part, following standard techniques of micro-economics as they have been applied to education, we have collected data that separates fixed and variable costs and then looked at the number of students following a particular course. This makes it possible to determine the cost functions discussed above and so look at the effects of different choices of educational media in relation to the numbers of students likely to be enrolled. In order to facilitate comparisons across media and across disciplines, we have then examined the cost per student learning hour and, where courses use a variety of media, the cost that can be attributed to each medium.

Thus, our findings, on the costs of both resource and communication media, are based on a set of case studies, eleven of which appear in the second part of the book. They were drawn from seven European countries and range from mathematical modelling to pre-school education. The media used vary widely although all but one include a strong print component: despite the rhetoric about new media, print remains central for much open and distance learning.

The first two cases are taken from the British Open University (UKOU). It was founded in 1969 and now has nearly 160 000 students, including more than 20 000 from outside Britain. It offers degree courses across a wide range of disciplines, using technologies from print to computer-based teaching, and has gained a high reputation for the quality of its teaching material. We were given access to cost data for several courses, two of which are included in part II. One of them looks at a course in social

sciences, which is largely print-based though some video input is provided. The other course is taken from mathematics and includes CD-ROMs, television and videotapes besides print. Since the OU does not record cost per medium it was difficult to calculate costs by medium. However, from the data available it was possible to estimate the costs for the non-print media, - television and CD-ROM. What can be seen is that the cost of material development per student learning hour at the OU is quite high though average costs are competitive, because of the relatively high enrolment on these courses.

NKS Fernundervisning in Norway is a well-known private provider of post-secondary education working closely with the public sector. The history of the NKS goes far back to 1914 when E.G. Mortensen founded a correspondence school in Oslo. It is a much smaller institution than the Open University with lower enrolments. Its teaching is overwhelmingly print-based with some use of tapes and cassettes. Our case study refers to two courses.

The next case study comes from the Fachhochschulfernstudienverbund der Länder (FVL) in Germany. FVL is a consortium of institutions, founded after 1994 to pull together the resources of technical universities in the former East Germany. We were given access to cost data, which allowed us to estimate the costs of a complete degree course (business engineering). This course is largely print-based but with approximately 25% of face-to-face teaching. High graduation rates were reported.

The next case study is about the idea of networking. The Centre for Distance Education at Oldenburg University was able to develop with some minor initial funding a number of study guides for further training of nurses. The content must have hit the mark since nurses enrolled and paid for the course (still unusual in Germany) even without receiving any formal certificate. Moreover, a number of universities became interested. Leasing the course to those partner institutions (who would provide for the course presentation) for a fee only marginally above the production cost of the course material, the Centre for Distance Education was able to generate an income stream which was invested in continuously updating and adaptation of the course. The idea to outsource the course presentation allowed to keep the costs for the Centre for Distance Education in Oldenburg at a minimum.

Anglia Polytechnic University (APU) is based in East Anglia and achieved university status in 1992. It is developing a variety of approaches to open learning alongside its conventional teaching. APU worked with us on several case studies, one of which, on health and social welfare is reported here. It must be regarded as a pilot project and was not intended to be cost-efficient in the sense of getting low average costs. Our aim was to estimate the cost per student learning hour of the various media used in the interest of comparisons between them.

The French case refers to a consortium. The Centre de Télé-enseignement Universitaire (CTU) of the University of Rheims is part of the FIT-EST (or Féderation Universitaire d'Est). There is some division of labour between the participating universities in the sense that each centre specialises, within this programme, in teaching a specific subject area. Rheims deals with philosophy and psychology. The budget arrangements are different from most of those we encountered. There is no specific budget for course development. Instead, staff are seconded to the Distance Teaching Centre and freed from teaching duties on the understanding that they will produce a certain amount of resource material, which uses print and audio. Student support is limited to the marking of assignments. The system could in principle accommodate many more students and so reduce average costs.

The Politecnico di Milano in Italy has two faculties: engineering (30 000 students) and architecture (15 000 students). As the university expanded, a second campus was founded 40 km away in Como; videoconferencing is used to link the two. In the light of experience, the engineering faculty is developing an appropriate classroom design for teaching by means of videoconferencing. We were provided with data on the costs of delivering lectures by videoconferencing. The case study does not refer to a specific course but gives a more general discussion of the cost structure of videoconferencing, which is evaluated on the basis of the Milan data.

The Virtual Seminar is a co-operation between the University of Maryland in the United States and the Centre for Distance Teaching at the University of Oldenburg in Germany. The Centre for Distance Teaching is also linked with the Fernuniversität in Hagen, the biggest and best known provider of distance education in Germany. This arrangement allowed the Centre to launch its own initiative in international co-operation in setting up the Virtual Seminar. This is the only case study of a course which did not use print at all but was taught completely over the Internet. Average costs per student are high. However, since the target audience was a group of professionals working in institutions around the globe, it was argued that the costs should be compared with an international conference rather than with a course.

The Catalan Open University in Barcelona is still in a process of transition from being a print-based to a completely virtual institution. The University has been in operation only since 1995. It is a private university, but has the backing of the Catalan regional government, which brought together various regional institutions to support the new university. The university is intended to provide for the cultural and linguistic needs of the region. In the long run, it is proposed to use computer-based communication for all contact with students. However, up to the time of our data collection, course material was essentially print-based. It is assumed that changing from print-based provision to digitised provision over the Internet will reduce production and distribution costs significantly, but will entail high reception costs for the learner. It is suggested that such costs can be balanced by the savings for students in being able to study at home.

Basic information about the case studies appeared in table 1.1. (p. 11)

Conclusion

Throughout our research we sought to apply the methodology discussed in this chapter to this set of case studies. This makes it possible to move on and look at ways of applying our findings and turning them into a practical tool for the manager. There are, however, some practical differences of interpretation which we need to examine first. These are the theme of chapter three.