COMMONWEALTH *of* LEARNING

PREST

Practitioner Research and Evaluation Skills Training in Open and Distance Learning

HANDBOOK

B3

Costs and economics of open and distance learning

The PREST training resources aim to help open and distance learning practitioners develop and extend their research and evaluation skills. They can be used on a self-study basis or by training providers. The resources consist of two sets of materials: a six-module foundation course in research and evaluation skills and six handbooks in specific research areas of ODL. There is an accompanying user guide. A full list appears on the back cover.

The print-based materials are freely downloadable from the Commonwealth of Learning (COL) website (www.col.org/prest). Providers wishing to print and bind copies can apply for camera-ready copy which includes colour covers (info@col.org). They were developed by the International Research Foundation for Open Learning (www.irfol.ac.uk) on behalf of COL.

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Handbook B3: Costs and economics of open and distance learning

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Costs and economics of open and distance learning

HANDBOOK

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Handbook overview

This handbook is designed to help you work out the cost of activities, or courses, or projects that use open and distance learning.

The handbook also uses a COL Knowledge Series publication on *Analysing costs/benefits for distance education programmes* by Greville Rumble and a chapter called *Costs and budget* from a publication by Tony Dodds. We suggest in the text where it will be helpful to use them. But you could use this handbook, and those two documents in a quite different way. Both these documents are in your *Resources File*.

Handbook organisation

The handbook is structured into this introduction and six units, as follows.

This introduction:

Unit 1: Introduction (1-2 hrs) – This explains why costing is worth doing and the stages involved in doing it.

Unit 2: Locating information: where are the bodies buried? (1-2 hrs) – The first stage in costing is to locate the data.

Unit 3: Some basic distinctions (1-2 hrs) – Cost analysis requires us to distinguish between recurrent and capital costs and between variable and fixed costs.

Unit 4: Costing one element in a course (1-2 hrs) – A look at the relatively simple job of costing one element within a course.

Unit 5: Costing a course or a programme (1-2 hrs) – The more complicated costing of a whole institution.

Unit 6: Cost functions (1-2 hrs) – These functions answer questions about how the cost per student will with different factors.

Unit structure

Each unit is made up of the following components:

- an introductory paragraph or two that provide an overview of the unit, its focus and outcomes
- an explanation of the key costing concepts
- case studies
- an activity to help you apply the ideas to your own cost data
- a unit summary.

You will need about 10 hours to work through this handbook.

How to use this Handbook

The handbook can be used at various levels:

1. If you want a four-page summary on costing to get an overview of the subject and see how relevant it is to your research, look at *Rumble* in the *Resources File*.
2. If you simply want a guide for managers on how to do basic costing, look at *Dodds* in the *Resources File*.
3. You may find that either or both of them tell you what you want. If not, read on.

Resource	**Short name – as used in this text and in the *Resources File***	**Location**
Rumble, G. 2001 'Analysing costs/benefits for distance education programmes' in *Knowledge Series* Vancouver: Commonwealth of Learning, at http://www.col.org/Knowledge/pdf/ks_costs.pdf	*Rumble*	*Resources File*
Dodds, T. 1983 *Administration of distance-teaching institutions: a manual*, Cambridge: International Extension College	*Dodds*	*Resources File*
Annualisation Factors	*Annualisation Factors*	*Resources File*

Introduction

UNIT 1

Why cost ODL? Because there are sensible questions, that affect policy and affect people's lives, about educational costs, which the researcher and manager often needs to answer. They include questions like:

- Is ODL cheaper or dearer than the alternative?
- I have got some results, which show that our course was working, but was it worth all the money we put into it?
- Is radio cheaper or dearer than print?
- How do I work out the costs of using the web, which my organisation have asked me about as I am their researcher?
- What would happen to our costs if we doubled our number of students?

In principle, answering questions like these is simple and much easier than researching effective learning. And yet they are often neglected. Fifty years after economists like John Vaizey were developing the discipline of educational economics you can still pick up textbooks on educational research that makes no reference to costs and economics at all. The starting point, as with research generally, is to define what kind of thing we are trying to find out and what use will be made of the findings. Then, we often only need to take five steps:

1. Collect and put down all the costs.
2. Find a unit cost (e.g. cost per student).
3. Look for evidence about outcomes in order to make sense of the unit cost.
4. Look at alternatives as a point of comparison.
5. Draw conclusions.

In practice each of the five stages may be more difficult. In the case of the first two, for example, information about costs may be in a number of different places and it may not be immediately clear which unit cost we should look at; cost per student may be quite different from cost per successful student while the cost per half-hour radio broadcast will be quite different from the cost, for the same broadcast, per listener.

Example

These complexities, and some solutions to them, are best explained by illustration. We will use a case from the Malawi Ministry of Agriculture (see Case 1). Here you can see some of the difficulties, and some of the easy bits.

Case 1

Costing of extension aids branch, Malawi Ministry of Agriculture

Some years ago I went to Malawi with Dean Jamison, an economist who was then working at the World Bank, to do a case study of this branch which used radio, films, and printed material to support the agricultural extension service. At that time the Bank was interested in radio as a tool for both formal and nonformal education. The idea was that I would do the narrative part of the case study, Dean would do the economics, but would also show me what he was doing so that I could take the economic role in a later, parallel, case study.

So our aim was to look at the cost of using radio, distributing a magazine to farmers, and running a service of mobile cinema vans. We spent most of our time at the headquarters of the extension aids branch, but also went out with one of the vans to see who came to watch the films (which contained a mixture of agricultural advice, old football matches imported from England and, last in the programme when many had gone away though we had to stay, a film about the life and work of Banda, then the ruler and national leader). Getting information on the costs was relatively simple, partly because the civil service was efficient and had the data to hand and partly because we went with the authority of the Bank and our Malawian colleagues assumed we might be able to encourage some of their funds in its direction. Thus we could put together information on the branch's activities, its staffing, its costs for film-making, radio production and printing, and its travel costs. Many of these costs were for payments to other agencies, like the radio station or the supplier of film stock. Salary information was available and we could make reasonable assumptions, from talking with staff, about how much of staff time should be attributed to each activity. The branch had its own building; in order to allow for this, and present a reasonably complete picture, we found what a comparable building would cost to erect or rent and used that as our starting point, in order to calculate a notional rent. We were able to get information from the ministry of agriculture about the costs of more conventional approaches to extension, through the work of extension agents' visiting farmers and by attendance at farmers' centres.

Dean's key advice at this stage was to look round, making sure we had not forgotten anything and, in those cases where we could not get a real figure, to make the best guess. Best guesses are often good enough especially for sums that are a small proportion of the whole.

We had two other bits of luck in seeking data. First, the branch had an evaluation unit which kept data on its activities so that they already knew something about how many farmers listened to the radio or came to film shows. Second, the university agriculture students had to do a dissertation as part of their BSc course and several of these had looked at the work of agricultural extension. These two sources meant that we could say something about the outputs of the extension aids branch and the extent to which people had learned from its work and put this into practice. We would really have liked to get at data, based on crop sampling, that showed how far increased production was associated with contact with extension but these data were not available and could not be collected within a modest one-week research visit.

All this made it possible to create tables of the following kind, for radio, and similar ones for other activities.

Costs breakdown	***Malawi 1980 kwacha (US$1.23 = K1.00)***	***Comment***
Recurrent costs		
Personnel	12,000.00	Total cost from payroll allocated to this activity
Sound tapes	600.00	
Travel and miscellaneous	4,700.00	
MBC broadcasting costs	194,900.00	Paid to Malawi Broadcasting Corporation
Total recurrent costs	*213,500.00*	
Capital costs (at 7.5% interest rate) per annum.		These are annual costs. See p. 14 below for discussion on annualising capital costs.
Vehicles	4,150.00	) Appropriate proportion of total cost for these
Buildings	1,850.00	) items allocated to radio
Recording material	2,392.00	)
Total annualised capital costs	*8,392.00*	
Total yearly costs	**221,892.00**	
Unit costs		We knew the number of hours broadcast each year (232) so could easily calculate the cost per hour of radio. Surveys had suggested that a conservative estimate of the size of the audience would be 300,000 which enabled us to derive these other unit costs.
Per hour of broadcasting	956.00	
Per farmer listener per year	0.740	
Per farmer listener per hour	0.0032	

With the other data we collected it was possible to put these figures alongside those for extension visits, or for attendance at a farmer's centre, and to cite the limited evidence available about the effectiveness of radio – with its dramatically low costs – as a means of communicating information to farmers.

Did it matter and was it worth doing? The World Bank published the results as part of a wider review of the use of radio and other non-traditional methods of education and extension (Perraton et al. 1983). It helped to establish that radio can have very low unit costs in terms of costs per listener and was thus one of a number of studies that encouraged increased interest by funding agencies in the use of radio at a time when there was great scepticism about television because of its much higher unit costs. (For reasons which have little to do with the study, the Bank's priorities then seem to have changed and, unlike other agencies, it has since had only limited interest in radio.) The value of our study was limited as we could not, in the time available, get far on the non-cost questions: we did establish that extension visits cost about 3000 times as much per hour as radio but, without more data on effectiveness, could not go very far in establishing how and where best to use each of the methods.

Sources of data

Following similar procedures to those discussed in the Malawi case, we now move on to look at sources of data, or where the bodies are buried and at some basic microeconomic distinctions which we need to make in our analysis. These in turn make it possible to work out costs for one element within a course and then a whole course. From there we can move on to comparing the costs of conventional and distance-teaching approaches. In order to provide a deeper analysis we turn then to look at opportunity costs.

Locating information – where are the bodies buried?

UNIT 2

The researcher's first job is to find the cost data. If you are lucky, as we were in the Malawi example, they will be available in only one or two places. But often they are more scattered. It usually makes sense to begin with the institution being researched since its figures may cover the bulk of expenditure. If a government institution is collaborating with another agency, however, or obtaining services from somewhere else, it will be necessary to seek their figures too. Often figures will be available either from publicly available sources (like government or university standard pay scales) or in the market (like the cost of paper).

The figures will seldom be in the form needed for analysis and we consider below how to develop usable figures from those that are most readily to hand. It is often easier, too, to find figures for budgets than for actual expenditure which may differ widely. In Britain a new building for the Scottish parliament will cost at least ten times the budget.

It is also important to keep in mind that different people may be bearing the costs of different elements of a distance-teaching course. If students need a computer, or have to travel to pick up teaching materials or attend a seminar, some of the costs of study will fall on the student, not on the teaching institution.

Although it will seldom be as neat and tidy as this, we can identify six approaches to getting cost data, which are in sequence like this:

1. **Understand the project**, or programme or institution, in order to have a good idea what kind of costs needs to be collected. This forces us to ask 'Who pays?'. If, for example, to follow a programme of study, the learner has to have a radio, or a computer, we need to ask who is paying for this, as well as asking about the costs met by a college in running the programme.

2. **See if someone has done a similar study before**. One of our colleagues has illustrated this by explaining, 'Some years ago I did a lot of work for one of the development banks. Now if they said, "We need a study of the economics of the tourist industry in Guatemala", one obvious thing was to get on a plane and go to Guatemala. But no. It's much better to start by looking along the shelves as you'll quite likely find that someone did just the same thing two years ago'. Even if there is not an exact replica of your research on the shelf, there may well be existing studies from which you can draw both good ideas and relevant data.

3. **Look for audited accounts** of actual expenditure. If these are in sufficient detail, they are an excellent starting point because they show what was actually spent, not what people intended to spend. Often, however, they are either not available or not at the necessary level of detail.

4. **Look for budget statements**. While these are about intended expenditure, they may be the most reliable and available source.

5. **Look for more detailed information about expenditure** from the people who are doing the job. University accounts, for example, may show global figures for materials development while an individual department may be able to tell you how much time people spent working on a particular set of materials.

6. **Look at the market**. It may be easier to get information about the cost of paper, the likely rent of an office building, computer maintenance or even the cost of radio time from the market than from the accounts of an educational institution.

Case 2 illustrates how data were collected, and converted to a usable format, in one study.

Case 2

Collecting data at an open university

The International Research Foundation for Open Learning raised funding from the British Department for International Development (DFID) to look at the cost effectiveness of open universities in Asia. DFID wanted to know whether there was an economic case for investing in open learning in order to raise the skills needed for economic development. IRFOL therefore worked with a number of Asian universities, looking comparatively at their costs and completion rates; the Dr B.R. Ambedkar Open University in Hyderabad, the first open university to be established in India, agreed to work with IRFOL in doing the study.

In order to compare the work of a number of different universities IRFOL looked at courses in computer science and business studies. From individual departments it was possible to get at figures on student enrolments and examination pass rates. The fullest information on costs was in the university's annual volume of estimates. While this is a document of some 60 pages for 2001-2, it does not break down expenditure by departments or by courses. It does, however, have sections (among others) for:

- capital receipts of various kinds
- revenue receipts of various kinds
- budget estimates for non-capital expenditure including salaries
- budget estimates for capital expenditure
- explanatory memoranda under important heads of payments other than salaries
- statement of work wise expenditure of major works
- list of pay scales.

The details of the estimates for non-capital expenditure also included tables for student services and for materials development.

This enabled IRFOL to calculate some costs for expenditure of the university as a whole and, in particular, to look separately at capital and recurrent expenditure (discussed in more detail in the next section of the handbook). The expenditure in any one year was likely to be a small proportion of the total capital expenditure of the university so that the estimate for 2001-2 was not a good guide to the total capital expenditure needed to build a new university. However, the Statement of Work Wise Expenditure for Major Works did set out information about earlier capital expenditure. On the basis of this information, it was possible to check with the university bursar and get a sense of the total capital expenditure since the university was established.

On recurrent expenditure the starting point was not the volume of estimates but discussions with the relevant university departments. From information about their work, it was possible to agree the proportion of university services like materials development and student support which should be attributed to them. Where estimates showed salary expenditure broken down by departments, it was possible to use these figures. Where this information was not available, we had two alternatives. One was to look at the departmental salary expenditure as a proportion of the whole, using the overall estimates for salaries. The other was to use the pay scales so that, knowing how many staff the department had at particular levels, one could work out their pay and allowances.

The accounts also show figures for revenue from, among other sources, government grant, tuition fees and examination fees. This makes it possible to say how much of the total cost of the university were met by government and how much by students; in this way IRFOL could answer questions about 'Who is paying?' as well as 'How much does it cost?'.

To sum up, IRFOL was able to find the data it needed to cost a particular programme by going through the following stages:

Stage	Method
Understanding the problem	Discussions with faculty staff about course development and teaching, and about scale of the department's work as a proportion of the whole
Collecting major source of data	Obtaining budget estimates
Calculating capital cost of the university	Information from budget estimates supplemented by earlier data from university bursar
Calculating recurrent costs for the university generally	Shown in the budget estimates
Calculating recurrent costs for particular course	a) Using actual costs where these are shown in budget estimates b) Attributing university costs to a department proportionately according to its work as compared with that of the university as a whole c) Using salary scales to produce estimates of departmental salary costs

Of course the information obtained in this way is not completely accurate: it is based on budgets, and the process of attributing costs is necessarily arbitrary. And it omits the costs incurred by learners. Nor does it include costs for other agencies. If a course included a broadcast element, for example, one might need to go to the broadcasting authority for the necessary costs. But it may give a close enough approximation for many purposes, and can be supplemented by other data as these become available.

Activity 1 30 mins

Specifying data to collect

If you are planning your own research activity, you should now begin to specify what data you need to collect and where you will find them. You have three starting points.

1 The first is the general issue of defining your research question and breaking it down into subsidiary questions (e.g. if you want to know about the comparative cost effectiveness of distance education you will need to ask questions both about distance education and about conventional education as a point of comparison). This will help you specify just what cost data you want to collect. (Module A2 goes into more detail about defining your research question.)

2 The second is the text in this section and in Case 2.

3 The third is the illustration in Case 1.

4 You may find it helpful to create a summary table of this kind:

Research question to be answered	Data that will help answer it	Possible sources of data

There is no feedback to this activity

Some basic distinctions

UNIT 3

In order to make sense of the cost data, we need to make use of some basic concepts of accounting and micro-economics and in particular to distinguish between capital and recurrent costs and between fixed and variable costs. These distinctions were foreshadowed in Case 2.

The simplest and least useful way of costing is to get hold of an annual budget, add up all the figures in it, and divide by the number of things produced in the year. It might nearly work for a factory producing a single type of widget. But some of the factory costs may not properly belong to that year; if the company bought a new computer-controlled lathe in 2002 for $10,000, which it planned to use for ten years, the costs shown in an annual budget or set of accounts would look too high in 2002 and too low in 2003. To make more useful comparisons we need therefore to distinguish different kinds of costs. We start with the distinction between capital and recurrent costs.

Capital and recurrent costs

Jamison (1982: 275-6) describes the difference between capital and recurrent costs as follows:

'A capital cost is one that is incurred to acquire goods or services that will have a useful lifetime beyond the time of purchase; recurrent costs are incurred for goods or services that are used up as they are bought. The principal cost of traditional schools is the recurrent cost of teachers' time; because teachers are paid while they provide their service, the useful lifetime of what is actually purchased simply coincides with the pay period. ... The cost of a pencil would seem to be a capital cost because, dependent on one's penchant for writing, it could last for several months. In fact pencils are treated as recurrent costs because their expected lifetime is less than the accounting period (usually one year) of school systems. The line between capital and recurrent costs is, then, conventionally drawn at one year; if the lifetime of a piece of equipment exceeds a year, its cost is usually treated as a capital cost.'

Capital costs

A *capital* cost is one that is incurred to acquire goods or services that will have a useful lifetime beyond the time of purchase.

Recurrent costs

Recurrent costs are incurred for goods or services that are used up as they are bought.

In distance education, then, the cost of a tape recorder used to make teaching tapes will be treated as capital while individual tapes, which are sent to students and not collected back again, will be treated as recurrent costs.

Fixed and variable costs

Then we often need to distinguish between fixed costs and variable costs. Fixed costs (not necessarily the same as capital costs) are the same, regardless

of the number of students, or books produced, or programmes made. Variable costs vary with the number of units. If we are costing a print-based course the cost of acquiring the printing press, and the cost of writing and editing course material are fixed as they stay the same, regardless how many students enrol or books are printed. In addition to these fixed costs there will be variable costs for paper where the total cost is affected by the number of items produced.

An occasional source of confusion is between fixed costs and capital costs. Some fixed costs are recurrent; an example is the electric power required to operate a television transmitter. Likewise, some capital costs are variable; an example is the receiver component of reception costs [e.g. the total cost needed to provide 1000 learners with television sets is double that needed for 500]. Thus, the concepts of fixed costs and capital costs are distinct, though it is often true that major capital expenditures are associated with substantial fixed costs.

(ibid.)

We an illustrate this by example. The annual estimates for Dr B R Ambedkar Open University, discussed in Case 2, usefully separated out recurrent and capital expenditure so that, in 2001-2, it was possible to see that it was proposed to spend:

Item	Rupees '000
Capital	56,901
Recurrent	212,772

The capital figure is remarkably low as a proportion of the whole but, as noted in Case 2, in order to get a fuller picture we need to look at capital expenditure over a number of years.

But we also need to go one stage further and look in more detail at the recurrent expenditure. The estimates summarise expenditure as in Table 1.

Table 1 Estimated expenditure

Section	*Head of account*	*Estimates 2001-2 '000 rupees*
1 Administration	Salaries	9,020
	Contingencies	39,325
2 Academic	Salaries	17,426
	Contingencies	3,101
3 Student services	Salaries	21,594
	Contingencies	17,960
Material production	Salaries	5,570
	Contingencies	24,125
5 Evaluation	Salaries	1,464
	Contingencies	35
6 Staff training and development	Salaries	1,069
	Contingencies	70
7 Audio, video programmes	Salaries	3,481
	Contingencies	161
Other headings		66,372
Total		**212,772**

Notes: The estimates use the term 'contingencies' for all non-salary expenditure. Figures in the original are presented in the document in rupees and lakhs of rupees but have been converted to thousands for our purpose.

Much of this expenditure, such as salaries and staff training, is clearly recurrent. But it is necessary to look at the detail of the figures to see if others should be regarded as capital. Within item 7 (audio and video programmes) there may be expenditure on equipment which will last for more than a year. It is therefore necessary to go behind the summary figures and ask about the detail.

There is one more complication. It may make sense to treat expenditure on course development as capital expenditure: it is about money spent to develop courses that will be used over a number of years. Similarly, in analysing the figures, we need to look at the estimates for audio and video programmes to see how far these should be regarded as capital or recurrent. The guiding principle is that, if something is used for a number of years, the costs of making it may be regarded as a capital investment rather than recurrent expenditure.

The figures also illustrate the distinction between fixed and variable costs. Capital expenditure, and the salaries on administration, for example, are clearly fixed as they will not go up or down significantly with changes in the number of students. But the costs for student support are likely to be variable. Where they cover the costs of marking student assignments, or face-to-face meetings between tutors and students, the costs will vary with the number of

students. Similarly the detailed tables in the estimates show a figure for the costs of paper for material production. This too is a variable cost, driven by the number of copies of courses that are printed and so, ultimately, by the number of students.

Converting capital costs into an annual costs

This analysis does not go far enough. We need to find a way of converting capital costs – like the lathe that would last for ten years – into annual costs so that, in any one year, we can look at both recurrent costs (like labour and the supply of mild bright steel) and capital costs. In conventional accountancy we may do this by depreciating the asset each year. In this case the capital cost would be divided by ten (for an item with a ten year life) and the value of the asset in the balance sheet written down, year by year. Economists and researchers, however, use a different approach. Much of the economic literature on education argues that, in looking at capital costs, we should also look at the other uses to which the capital might have been placed. Thus, if the $10,000 had not been spent on the lathe, it might have been invested and brought in an income of, say, 2.5%. In order to allow for the depreciation of an asset over time, we therefore need a formula which takes account of the initial value of the asset, its life in years, and the prevailing rate of interest. The formula most often used is:

$$a(r, n) = \frac{[r(1+r)^n]}{[(1+r)^n - 1]}$$

where a(*r, n*) is the annualisation factor which we will use in our calculations as the annual cost, *n* is the life of the capital equipment and *r* is the prevailing rate of interest. Fortunately we can use a set of tables (see *Annualisation Figures* in the *Resources File*) instead of computing this every time. Alternatively, as suggested below, you can use a spreadsheet. To illustrate, let us assume that in 2003 a distance-teaching institution decides to invest in a new course in mathematics. It assumes that the course will have a life of eight years and that, to develop the course, it will need to pay authors, editors, and desktop publishing costs of a total of $83,000. The institution is in a country with comparatively high interest rates so that, if it were to borrow the money for the course, it would need to pay 7.5%. The capital cost of course development is therefore $83,000. From the table in the Annualisation Factors resource we can see that the annual cost for an eight-year life will then be:

$$0.171 \times 83{,}000 \text{ or } \$14{,}193.$$

This figure is, of course, higher than the cost we would get simply by dividing the total cost by 8 (83,000/8 or $10,375) because it is allowing for the cost of borrowing the money. (In practice the total cost of the course over its eight-year life will be higher than this if it is updated from time to time.)

If you are using a spreadsheet, the relevant part of it will look like Figure 1.

Figure 1 Example of annualisation calculation

Item	*Cost in $*	*Life in years*	*Interest rate %*	*Annual cost*
New maths course	83,000	7	7.5	=(D2*(1+D2)^C2)/((1+D2)^C2-1)

Notes on Figure 1:

1. You must enter the interest rate as a decimal, e.g. 7.5% is entered as 0.075.
2. The formula for annualisation in Figure 1 will need adjusting if you put your data in different spreadsheet cells to the ones shown in our example.
3. You will find that a spreadsheet will give a more precise result than you get from the *Annualisation Factors* resource. For example, in the example above, the annual cost given by the spreadsheet is $14,710 against $14,193 from the *Annualisation Factors* resource.

Summary – cost analysis

To analyse costs and make sense of them we need to:

- gather all the data, or the best guesses we can make
- identify recurrent and capital costs
- distinguish between fixed and variable costs
- use an annualisation factor to express capital costs in terms of annual expenditure

Reading

You may find it helpful at this point to look at *Rumble* in the *Resources file*, in particular at its introduction and first two main sections on *Costing distance education* and *Cost analysis*.

Activity 2 30 mins

This activity has two versions, depending on the data available to you.

Version 1

If you have access to information on costs for the project or programme which you are researching, you can now analyse it and see:

1 What are the capital costs?

2 What do these mean in terms of annual costs? (Make reasonable assumptions about interest rates and the life of assets.)

3 What are the fixed costs?

4 What are the variable costs and what do they vary with? (e.g. number of students)

Version 2

Or you can now look at the *Dodds* reading in the *Resources File* which follows a slightly different approach and do Exercise B. If you do this, bear in mind that this exercise is essentially about recurrent costs and leaves aside the treatment of capital discussed above.

There is no feedback to this activity

Costing one element in a course

UNIT 4

In Case 1 we showed how it was possible to calculate the cost of a single radio programme in Malawi from readily accessible data. It is often necessary to make this kind of calculation, most often to decide whether there is an economic case for using a particular medium and to compare costs between media.

We can illustrate the process by an example from Britain where IRFOL was carrying out a set of case studies of the costs of open learning on behalf of the European Commission. One of these studies looked at a course offered by the school of advanced nursing at Anglia Polytechnic University (APU) which used print, interactive computer communication and videoconferencing with links between eight videoconference sites. This account is based on the discussion and figures which broke down the costs for the course into its separate elements. From discussion with APU staff members the researcher, Thomas Hülsmann, found that there were only three main elements in the cost of the videoconference element of the course: staff time, the costs of videoconferencing and line costs. As the focus of the case study was on the cost to APU of running the course these calculations left out of account the overheads of the university.

His report explains:

'All tutorial work is done by lecturers. The midpoint salary of a senior lecturer is £23,800. The lecturer is supposed to teach 550 hours per year. In addition a lecturer is supposed to spend 35% of the time in research. Neglecting the administrative duties, the lecturer then has to work 296 + 550 = 846 hours per year. This would give us the estimate of the cost per hour of £23,800/846 = £28 per hour. ...

Five videoconferences were to be held. However, each such conference demands about one extra hour of preparation including teaching staff as well as technical and support staff. Two guest speakers have been invited.

A video system is available at a wide price range. It was indicated that the system used in APU costs about £20,000 plus VAT (value added tax). We entered the cost here as £25,000. The initial cost has been depreciated here over three years assuming a usage rate of 765 hours per year (i.e. 51 weeks five days a week for three hours' Hülsmann (2000).

[As there were 75 students on the course] we may calculate the unit cost due to videoconferencing at £2380/75 = £31.

Source: Hülsmann 2000: 124-5

The figures are set out in Table 2

Table 2 Cost of videoconferencing at APU

Inputs	*Cost per hour*[1]	*No. of hours*	*No. of sites*	*Total costs*
Depreciated equipment cost	6.5	10	8	520
Line cost	25	10		250
Personnel cost				
3 lecturers	28	30[2]		840
1 guest speaker	45	2		90
1 support staff	8.5	10	8	680
Total				**2,380**

1 Currency: 1998 £ sterling

2 Including preparation time

Source Hulsmann 2000: 125

This example illustrates three points referred to previously. First, all the costs here can be treated as fixed costs since they would not be changed if, say, there were another five students at each videoconference centre making a total of 115 instead of 75 students. Second, most of the data were not difficult to find: staff at the university were able to locate the costs of videoconferencing equipment, for staff time, and for line rental. The university had already made assumptions about the amount of use to be made of the videoconferencing equipment over a year and its life which made possible the calculation of the cost per hour. Third, in a number of cases broad estimates were used rather than actual figures. In calculating staff costs, for example, it made more sense to get an average salary for a staff member at a particular grade rather than to work from actual salaries.

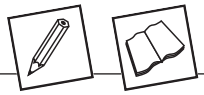
One other point is important – the omission of overheads. In Hülsmann's study it was found that institutions varied widely in how they treated overheads and the extent to which these were allocated to an individual department. This made it difficult to compare findings between institutions. But one of the points of this particular calculation was to look at the comparative costs of videoconferencing and other media within the institution concerned. The general conclusion is that the researcher may have to be satisfied with partial information or may find that is enough for the purpose concerned, but needs to be open about what is and is not included within particular figures. In this case, if it had been necessary to calculate overheads, it would have been possible to look for, say, the total figures for the university, and the total number of academic staff, in order to do a rough estimate of the overhead cost per academic staff member. It would then have been possible to calculate the appropriate overhead to be added to the figure of £28 per teaching hour used in the calculation.

Summary – calculating the cost for one element in a course

To calculate the cost for one element in a course:

- identify the elements that make up the total cost for the course
- collect data on the recurrent cost of each of these elements making estimates where appropriate (e.g. looking at average staff costs and at the amount of staff time to be devoted to a particular activity)
- collect data on capital costs and annualise this
- relate all these figures to an appropriate unit (e.g. learning hour or student)
- consider the significance of any figures omitted for practical reasons from the calculations (e.g. overheads).

Activity 3 1–3 hrs



Again you have a choice. In the light of the discussion so far you can either cost one element of the project or programme which you are researching or do Exercise D in the *Dodds reading* in the *Resources File*.

There is no feedback to this activity

Costing a course or programme

UNIT 5

In practice, we often want to cost more than one element in a course and quite often to look at the whole range of costs. This is usually necessary if we want, say, to compare conventional and distance-teaching costs. Thus, many cost calculations will look at a range of different kinds of costs which may include the development and use of printed materials, broadcasts, face-to-face support and computer communication. If you want a simple, detailed, account of how to do this you may want to look at Dodds resource now, if you have not done so previously.

The principles involved in doing this kind of costing are the same as those already identified but the calculations are necessarily more complex. This is illustrated in the case study of Telesecundaria summarised in Case 3 but set out more fully in Calderoni (1998). Table 3 sets out all the basic financial figures for this project which used television to provide an education to children in rural schools. It shows how financial analysis for a complete programme as for one element in it, demands that we identify the basic data about the programme, distinguish between capital and recurrent items, produce a total annual cost and relate this to the unit in whose cost we are interested.

Case 3

The Mexico Telesecundaria

In the 1960s the Mexican government wanted to find a way of expanding secondary education in rural areas where there were shortages of schools and of teachers. It decided to use television to solve these problems and set up Telesecundaria. It has, since 1968, been broadcasting educational television programmes to large numbers of students – 6,500 in the first year and 800,000 by the late 1990s. Telesecundaria has become a significant part of the national educational system, with some 16 per cent of the overall junior-secondary enrolment.

Students attend schools which are equipped with a television set, a satellite decoder, a satellite dish, and printed learning materials. Schools also have normal school furniture, a library, and science equipment. Some materials are made available on cassette as well as through satellite broadcasts. Each school has at least one teacher; in the early days of Telesecundaria these were monitors, rather than trained teachers, but as time has gone on their qualifications, and their salaries, have been raised.

Calderoni (1998) explains:

'Instruction is delivered through three mechanisms: television broadcasts, teachers and texts. Each lesson consists of a 15-minute televised program, followed by a carefully guided 35-minute teacher-student dialogue, and a 10-minute break

before the next TV lesson begins. Lessons are broadcast twice each day to accommodate morning and evening streams .... There are over one-hundred televised programs for each subject and grade. For example, there are 181 lessons in 7th grade mathematics, 105 in biology, etc.'

To support the television programmes, students are provided with two kinds of book, one of basic concepts and the other a student learning guide. Teachers have a printed teacher's guide. Teachers also benefit from a programme of in-service training, geared to their particular job in a television-based school.

All this means that the total expenditure on Telesecundaria includes:

- television costs for making programmes and developing printed materials and for television equipment in schools
- costs for setting up an equipping each school
- broadcasting costs
- salaries and support costs for teachers
- maintenance costs at each school
- central administrative costs.

Table 3 Costs of the Telesecundaria Program (US$)/1

Program Parameters										
Students	*Modules at 130 per subject/2*	*Student-class ratio*	*Total classes*	*Teachers at 0.91 per class*	*Schools at 3.17 Classes*	*Opportunity cost of finance*	*Average sq.m per student*	*School space per sq.m*	*Average hours broadcast per subject*	*Cost per channel hour*
767,700	3,900	19	40,100	36,400	12,700	10%	4	$30	65	$1,000

Cost item	*Unit*	*Useful life of investment*	*Number of units*	*Investment cost*		*Annual or annualised cost per unit/3*	*Annual cost*	*Annual cost per student*	*% total*	*% rec*
				Per unit	*Total*					
Investment cost										
Television related										
Scripts	Module	8	3,900	10,000	39,000,000	1,874	7,310,317	9.52	1.7	
Program production	Module	8	3,900	30,000	117,000,000	5,623	21,930,950	28.57	5.2	
Printed materials, preparation	Module	8	3,900	10,000	39,000,000	1,847	7,310,317	9.52	1.7	
Satellite antenna (inc.decoder)	School	5	12,700	1,000	12,700,000	264	3,350,228	4.36	0.8	
TV receivers(3per school)	School	5	38,100	375	14,287,500	99	3,769,007	4.91	0.9	
VCRs	School	5	12,700	200	2,540,000	53	670,046	0.87	0.2	
Subtotal					*224,527,500*		*44,340,864*	*57.76*	*10.4*	
Start-up costs (planning, training)	Subject	8	30	25,000	750,000	4,686	140,583	0.18	0.0	
Other facilities and equipment										
Basic classroom space	Student	40	767,700	120	92,124,000	12	9,420,546	12.27	2.2	
Library and books	School	10	12,700	3,000	38,100,000	488	6,200,600	8.08	1.5	
Video library and materials	School	10	12,700	1,800	22,860,000	293	3,720,360	4.85	0.9	
Renovation, wiring, laboratory	School	12	12,700	10,000	127,000,000	1,468	18,638,941	24.28	4.4	
School furniture	Student	15	767,700	100	76,770,000	13	10.093,242	13.15	2.4	
Science lab and equipment	School	8	12,700	1,000	12,700,000	187	2,380,539	3.10	0.6	
Total investment cost/4				***594,831,500***		***94,935,674***	***123,66***	***22.3***		
Recurrent cost										
Television related										
Space segment (broadcast)/5	Subject		30			65,000	1,950,000	2.54	0.5	0.5
Continuing program development	Subject		30			3,000	90,000	0.12	0.0	0.0
Personnel										
Principals' salaries & fringes	School		12,700			4,200	53,340,000	69.48	12.5	16.1
Teachers salaries & fringes/6	Teacher		23,700			4,000	94,800,000	123.49	22.3	28.7
Training & training supplies	Teacher		36,400			500	18,200,000	23.71	4.3	5.5
Maintenance and operation										
Equipment maintenance	Class		40,100			250	10,025,000	13.06	2.4	3.0
Building maintenance	School		12,700			2,000	25,400,000	33.09	6.0	7.7
Print materials	Student		767,700			15	11,515,500	15.00	2.7	3.5
Distribution of print	Student		767,700			9	6,909,300	9.00	1.6	2.1
Distribution blank cassettes	School		12,700			50	635,000	0.83	0.1	0.2
Electricity, phone, water	School		12,700			1,500	19,050,000	24.81	4.5	5.8
Insurance, theft &/or loss	School		12,700			1,000	12,700,000	16.54	3.0	3.8
Supplies, other	School		12,700			1,000	12,700,000	16.54	3.0	3.8
State & central admin costs	School		12,700			5,000	63,500,000	82.71	14.9	19.2
Total recurrent cost							***330,814,800***	***430.92***	***77.7***	***100.0***
Total annual investment and recurrent cost							**425,750,474**	**554,58**	**100.0**	

Source: *Calderoni 1998: 9.* Table reproduced with the kind permission of the World Bank

Notes
1 Based on actual costs, estimated costs or estimated opportunity costs, adjusted for inflation to 1997.
2 Average number of modules per subject assumes 10 subjects a year for total of 30 subjects in the program. The 130 average also includes training and summer modules.
3 Investment coasts are annualised to estimate combined depreciation and financial costs.
4 Total figures reported assume that Telesecundaria went to full scale inside of one year. Investments were actually accumulated over a 30 year period. Please see "cost" section in text for further explanation.
5 Cost per channel hour of transponder time estimated from current public and commercial satellite costs or charges.
6 Not including principal, who is also a teacher.

We can illustrate this by working through the table in detail. The first line sets our the parameters, giving the basic data about how to conduct a financial analysis for a whole course. The information set out here is needed to carry out the calculations in the body of the table. Calderoni needed, for example, to know the total number of students as he was aiming to calculate a cost per student and the number of modules per subject in order to calculate the total cost for the whole programme of teaching.

Footnotes 1 and 4 remind us of the complication which inflation brings to studies. The value of most currencies changes over time so that, using indices of inflation, it is necessary to convert currency to constant values. And, as in this case, it is often necessary to bring together expenditure over a number of years in order to get at total costs. In this case, expenditure on television production was spread over 30 years but, by converting the actual costs of programmes, Calderoni was able to express them all in 1997 US$. Rates of inflation, shown in tables such as retail price index or consumer price index, are generally available from government statistical services or, internationally, in the World Bank's *World Tables* or the IMF monthly *International Financial Statistics*. If you are working in US$$, you can find the US consumer price index at http://www.bls.gov/cpi/home.htm

Having set out the parameters for the study, Calderoni then distinguished between capital or investment costs, set out in the top half of the table, and recurrent costs in the bottom half. In both cases he defines the unit for which he was collecting the costs (e.g. per module or per school or per student); his source of information differed with the unit so that some information was available from Telesecundaria centrally while some depended on information flowing back from the individual school. He then identified all the elements which needed to be costed; the first of these, on television scripts, illustrates the process:

It made sense to do this analysis in terms of modules and Telesecundaria practice meant that a module was used for eight years.

We know from the parameters that there were 130 modules per subject with 30 subjects in the programme as a whole, as shown in Footnote 2, so that the total number of modules was 130 × 30 or 3900.

As it cost $10,000 for each script, it was possible to calculate the total investment cost at $39,000,000 and then, annualising the cost over the eight-year life of the module at an interest rate of 10%, to derive an annual cost per unit and a total annual cost for all 3,900 modules. (The table of annualisation factors in the *Annualisation Factors* resource gives a value of 0.187 for 8 years at 10%; Calderoni was working more precisely to get his annualised figure of $1874 for each $10,000 script.)

Given the number of students this made it possible to work out the cost per student and, once all the figures had been computed, to look at the cost of television scripts as a proportion of the total.

The other figures in the upper part of the table are worked out in the same way. In the lower part of the table, the recurrent costs already represent expenditure for a single year so that the calculations do not include any annualisation. Starting with the first line again, for the cost of broadcasting the television programmes via the satellite:

- analysis is in terms of the 30 subjects of the curriculum
- from the parameters we know that 65 hours are broadcast each year for each subject and the cost per channel hour is $1000 giving us the total cost per subject of $65,000
- with 30 subjects in the curriculum the total cost is 65,000 × 30 or $1,950,000 from which the total and proportional cost per student can be calculated.

This analysis therefore takes us a long way to establishing the costs of Telesecundaria: important enough for countries that are grappling with the problems of expanding education in rural areas. At the same time, and to illustrate how research often needs to go beyond costs, there are other questions which the researcher may want to answer and which cannot be found from Calderoni's valuable cost analysis, even though it lays the basis for looking at them. In a commentary on the Calderoni study Castro *et al* (1999) note that Calderoni did not compare Telesecundaria costs with those of urban secondary schools; when the comparison is done Telesecundaria costs are only 16 per cent higher per student despite having a more generous staffing ratio and the significant costs of the television programmes. They also look at questions of effectiveness, suggesting that one might look at flow rates (or the number of children who remain in school rather than dropping out) and measures of learning gain collected by means of student tests. In doing so they recognise the difficulty of comparing Telesecundaria's rural students with the urban students in many conventional schools. Thus, the analysis of costs, takes us into issues about the measurement of educational effectiveness, which is the theme of the other modules and handbooks in this series.

There is one further question which the researcher may want to ask: where are the costs falling? This will very often be of interest. If a distance education programme has been set up in the interests of equity, then the researcher will want to know whether the learner is being asked to bear a proportion of the costs which conflicts with this aim. On the other hand, if a programme is designed so that it both increases the skills of the workforce and enables them to earn more, managers will need to consider how far they want costs to fall on the teaching institution, or the employer, or the learner. Good cost analysis enables discussion to be informed and influenced by reliable figures.

Summary – Costing a course or programme

To analyse the costs of a programme or institution:

- follow much the same procedures that we use when looking at a single course
- watch out for expenditure that falls outside the institution being studied
- look at points of comparison and evidence on effectiveness.

Activity 4 5–10 hrs

Again, there are two versions of this activity, depending on the data that you have access to.

Version 1

If you have been working on actual cost data from a project or institution, you can now do a first cost analysis of the whole institution, with the aim of seeing what is the cost per student.

Version 2

If you are not working on actual cost data from a project or institution, then you can explore Calderoni's figures by working through them and seeing:

(a) what options you would have if budget cuts were proposed and you wanted to save $5 per student

(b) how you would choose to improve the system by spending an extra $10,000,000 and what the effect would be on the cost per student.

There is no feedback to this activity

Cost functions

UNIT 6

Cost functions are simple in principle and useful if we want to look at the effects of expanding or contracting a distance-teaching programme. Distance teaching is often acclaimed because it can produce economies of scale so that, as enrolments go up, the cost per enrolment goes down. This is illustrated by an early case study (Hawkridge et al, 1982) of a course run by the University of Nairobi which used print, radio and residential sessions to teach a secondary equivalence course. In order to facilitate comparison with conventional education, and allow for the fact that students might be studying anything from one to seven subjects at the same time, the researchers used as their unit the subject-equivalent, or the cost of teaching one subject to secondary examination level.

Case 4

Using the techniques of data collection discussed above, the researchers were able to compile the costs for 1977 which are summarised in Table 4. In that year students were following 790 subject equivalents.

Cost functions

A cost function is a formula for calculating costs of a specific type.

Table 4 Costs of Kenya Junior Secondary course 1977

Item	***Cost[1]***
Fixed costs	
Administrative costs	7,530
Costs of radio programmes	29,570
Development of printed materials	26,370
Total fixed costs	*63,400*
Variable costs	
Printing of materials and marking of assignments	23,300
Distribution of materials	6,850
Residential sessions	4,500
Total variable costs	*34,650*
Total (fixed and variable)	**97,970**

Notes

[1] Currency: 1977 Kenya pounds

Source: *Hawkridge et al. 1982: 202*

We can see from Table 4 that, with 790 subject equivalents, the cost per student equivalent was 97,970/790 or K£124. By this time enrolments had fallen and the course was running below its possible capacity so that this cost did not compare well with the cost of conventional education. But the distinction between fixed and variable costs makes it possible to calculate a cost function and see the effect of expanding the number of students. Of the figures in Table 4, the first three items, for administration, making radio programmes and developing materials are fixed costs which stay the same regardless of student numbers. Costs for the remaining items, for printing each set of materials, distributing them, and teaching students residentially vary with the number of students. We can then see that the variable cost per subject equivalent was 34,650/790 or K£43.86. It is helpful to express this in the formulae below.

Total cost and average cost formulae

$$TC = F + VC(N)$$

and $$AC = TC/N$$

Where:

TC = the total cost
F = the fixed cost
VC = the variable cost per student
N = the total number of students
AC = the average cost.

From Table 4 we can then see that the actual costs for 1977, in the same format, were:

$$TC = 63{,}400 + 43.86(790) = 97{,}970$$

$$AC = 97{,}970/790 = 124.01$$

We can now calculate a new function in order to see what the effect would be of increasing the number of student enrolments to 2000. The fixed cost will remain the same but the variable cost will rise proportionately with the number of students so that we get:

$$TC = 63{,}400 + 43{,}86(2000) = 151{,}120$$

But when we turn to the average cost we can see that economies of scale are affecting the cost per subject equivalent:

$$AC = 151{,}120/2000 = 75.56$$

We could go on and calculate the cost for different numbers of enrolments or, using the procedures discussed above, look at the effects on numbers on different components within a course.

Of course in reality cost functions are likely to be more complex than this. In this case there was a simple division between fixed and variable costs while, in

practice, there are often semi-variable costs. A given level of administration, say, or a given investment in desktop publishing software and hardware, may be adequate for producing between five and ten courses a year, so that the costs are fixed within that range. But further investment is likely to be needed if the institution want to jump to producing 30 courses a year. (There is a useful discussion of this in Chapter 4 of Rumble (1998). It is often useful, too, to develop different cost functions for different components in a course as, while it may make sense to look at costs per student for some purposes, it may be more important to look at, say, costs per hour of study or per hour of broadcast for others. The principles of analysis remain the same.

Opportunity cost of students' time

There is one further complication: the opportunity cost of students' time.

If we spend time studying then we lose the opportunity of using that time to do something more financially profitable. One study of teachers, studying for a postgraduate qualification, found that they needed to give up offering private tuition, through which they made some extra money over their regular salary, in order to spend time studying. Many studies of educational economics leave such opportunity costs out of account; it is convenient to assume that school children would not be earning anything if they were not at school, even though this will not always be true. But, if we want a more complete cost picture, we may want to include the opportunity cost of students' time as part of the cost that is falling on them as individuals.

This is not just abstract economics. Take the case of the National Technological University, based in USA, which offers postgraduate degree courses in professional subjects such as engineering, by satellite video link. It has learning centres, which students can attend, within large companies. Its costs are competitive with those of conventional colleges because students do not waste time travelling to class. Where student fees are paid by an employer, this opportunity cost is one of considerable significance for them.

If opportunity costs are to be considered in a cost study you may want either to seek general data on wage levels and calculate a figure from that or discover what sort of earnings the students you are researching might actually receive if they were not studying.

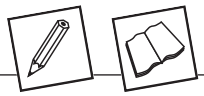
Summary – cost functions

Cost functions make it possible to calculate the effects of increasing or reducing enrolments or sales on both total and average costs

To find a cost function, sort out the fixed and variable costs, as discussed previously, and decide the unit to be used on carrying out the analysis (e.g. per student, or per student/subject, or per learning hour). Then calculate the fixed cost, and the variable cost per student

The function TC = FC +VC(N) makes it possible to look at the effect of scale on unit costs. Look at semi-variable costs and consider whether different components within a course or programme need to be costed and analysed separately.

Activity 5 1 hours



Either using your own data, or that for Telesecundaria, develop a cost function of the kind shown.

There is no feedback to this activity

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