Activity-Based Costing Models for Alternative Modes of Delivering On-Line Courses

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Abstract

In recent years there has been growth in online distance learning courses. This has been prompted by; new technology such as the Internet, mobile learning, video and audio conferencing: the explosion in student numbers in Higher Education, and the need for outreach to a world wide market. Web-based distance learning is seen as a solution to problems of outreach and course delivery.

This paper considers module costing models to compare the costs of delivery of:

- A traditionally delivered face-to-face module,
- A web-based distance learning module delivered by in-house academic staff
- A web-based distance learning module delivered by external contracted staff.

The model uses Activity Based Costing (ABC) utilising data from HEFCE and other sources; and with assumptions made from practice at Leeds Metropolitan University from over ten years experience of delivering web-based distance learning courses.

Using the models; different scenarios can be run. The paper concludes that there are savings to be achieved by utilising Web-based distance learning. This saving could, in turn, be passed on to students. Furthermore, the student experience, in terms of contact does not have to suffer and may in fact be enhanced by utilising Web-based distance learning.

Keywords

Financial Cost, Activity Based Costing, Delivery, Finance, Cost Modelling

Introduction

Dame Lynne Brindley, Chair of the UK's Online Learning Task Force, in an interview in the Times Higher Education (Attwood R. 2010) recently stated that "the best examples of on-line learning were not cheap alternatives". The same issue also carried a report that budget cuts are driving The University of California, Berkeley to offer fully online undergraduate degree programmes. However, whilst web-based distance learning has been in operation for several years and there is a wealth of research into pedagogic models for developing and delivering web-based distance learning material; research in to the actual costs of such development and delivery has been limited.

Rumble was a pioneer, considering the economics behind distance learning since the early 1990s. Cohen and Nachmias (2006) looked at the broad picture of providing a cost benefit analysis for implementing Web supported academic instruction. Vilaseca and Castillo (2008) also look at the economic efficiency of e-learning. Ling-yun et al (2007) Considered Return on Investment in E-Learning. Garbett (2004) developed a 5 year DCF chart showing the costs in developing and delivering a distance learning course.

The National Board of Employment, Education and Training (1994) "Costs and Quality in Resource-Based Learning On and Off Campus" produced by the Australian Government carried a detailed analysis of costs of distance learning from a range of Universities. However, at that time, the report was mainly concerned with print media and the use of Virtual Learning Environments was in its infancy.

There has been little research into the actual costs of delivering a module by web-based distance learning, using an Activity-Based Costing methodology and actual data from TRAC and from practice.

This paper seeks to fill this gap. The following pages present a series of cost models for distance learning.

The models compare the costs of delivering a typical Level 7 (Masters Level) module by three alternative delivery methods:

- A traditionally delivered face-to-face module,
- A web-based distance learning module delivered by in-house academic staff
- A web-based distance learning module delivered by external contracted staff.

Masters Level modules are used in the model as:

a. This reflects current expertise at Leeds Metropolitan University. The Leeds Metropolitan University MSc in Facilities Management has been delivered via the web since the late 1990's and is believed to be the first fully web-based Masters Level course world-wide.

b. Masters Level students are likely to be more independent than students at lower levels and, therefore, more suitable for distance learning.

Although the examples used in the following models are at Masters Level, the model itself could be utilised for other levels.

An MP4 video of the main features of the model is available by following the link.

Costs

Total Cost is the sum of Fixed Costs plus Variable Costs plus Semi Variable Costs. (TC = FC + VC*N)

In the following cost calculations:

Fixed Costs include, for example, costs associated with Exam Boards. The Exam Board incurs expenditure irrespective of how many students are involved. Similarly, for traditional Face to Face delivery, there will be a fixed cost for delivering a lecture, irrespective of the number of students in the lecture. In practice, a large number of students would require a large lecture hall which would incur more costs than a small lecture delivered in a classroom, however, for the purposes of these models, the marginal difference in room costs is minimal and can be ignored.

Variable Costs include items such as assessment, individual tuition time. Clearly, the total time spent on assessing students' work varies with the number of students.

Semi Variable Costs arise, for example, with accommodating and staffing tutorials. As the number of students increases, there is an incremental point at which an additional tutorial session is required. In the accompanying spreadsheets maximum tutorial sizes can be adjusted. If student numbers exceed the maximum for a tutorial group, additional tutorial sessions are entered into the cost equation.

Assumptions

For each model the same assumptions are made. These assumptions are grounded in practice and based on a Masters (Level 7) module as delivered on the Leeds Metropolitan University MSc Facilities Management, MSc Building Surveying and MSc Quantity Surveying Commercial Management courses.

1. Modules comprise standard band B, 20 credit points, nominal 200 hour, modules.

2. The material already exists in an appropriate web-based distance learning format, therefore the costs of developing that material have been amortised and there is no further cost involved in developing new material. The cost of updating and maintaining the material is built into the models.

3. The module is delivered during a standard 15 week semester; 13 teaching weeks.

4. Academic time is costed at £429 per day or £57 per hour. This cost is based on an academic member of staff mid range on scale eight (Senior Lecturer) as used in Transparent Approach to Costing (TRAC) guidelines.

5. Administrative time is costed at £370 per day or £49 per hour. This cost is based on a scale six administrative person and, again, comes from the Transparent Approach to Costing (TRAC) guidelines.

6. Module material is updated after every delivery. This maintenance requires 10 hours of academic time

7. Each item of assessment, at Masters Level, takes one hour of academic time to mark, provide feedback and returned to the student. This may be generous, but is based on a compromise between: the results of a survey undertaken by the University and College Union, Open University Branch, which found that the average assessment takes one hour 48 minutes to mark; and the allowance made by the Open University of 45 minutes to mark an assessment.

8. An allowance for academic time for contact with individual students, outside of formal teaching sessions or assessment, is built into the model.

9. A proportion of academic and administrative time taken up with the Exam Board is included in the model.

10. Admin support in terms of admissions or other queries is built into the model.

11. There is no percentage deduction from gross income made to cover any contribution to central overheads. A relevant proportion of the overall University overhead from TRAC of £3695 per Full Time Equivalent (FTE) student, per course is incorporated in the model.

Income

In England, income comprises; Higher Education Funding Council for England (HEFCE) income per student per module; plus fee income per student, per module. For the models a total income of £905 per student per module has been used. This can be readily varied in the model.

Model One. Traditional Face to Face Delivery.

This model looks at a module delivered by traditional face-to-face delivery.

Face To Face Delivery - Cost Assumptions

1. For parity with the distance learning modules, it is assumed that these are part-time students.

2. Admin support, per student, for the module comprises two hours for one administrator costed at £49 per hour.

3. Delivery comprises 12 one-hour lectures +1 one-hour tutorial per tutorial group per week; costed at £57 per hour. The lecturer delivers 1 lecture and 2 tutorials per week over a 12 week teaching period. The number of tutorial sessions varies according to: the maximum number of students per tutorial group and the total number of students taking the module. For example, if a total of 30 students are the taking the module, a tutorial group maximum size of 10 requires 3 tutorial sessions per week.

4. There are two items of assessment, each of which takes one hour for marking and feedback costed at £57 per hour.

5. There is further student-tutor contact on an individual basis via; visits to the office, e-mails, phone calls, etc, comprising a total of two hours per student during the semester, costed at £57 per hour.

6. There are printed handouts distributed to students.

7. As there are eight modules to the course the University overhead (item 11 above) of £3695 per FTE per course equates to £462 per FTE per module. For part-time students, the FTE is reduced by 50%.

8. Contribution to the cost of the Exam Board is 4 full days for admin staff per course (half a day per module) plus one full day for academic staff (.125 days per course).

Figure 1. Face to Face Delivery

DISTANCE LEARNING COURSES
FINANCIAL APPRAISAL

Chris Garb

MODULE COSTING MODEL

COSTING MODEL	Module Title	Traditional F2F Delivery	Course(s)	MSc (Level 7) Module		
INCOME			COSTS			
HEFCE Income	£280	p student p module	Admin	£370	p day	£49 p.hr
Fee Income	£625	p student p module	Academic	£429	p day	£57 p.hr
					per FTE	
			Contribution to		per	Per P-T student
			Central overheads	£3,696	COURSE	£231 per MODULE
			Printing	£0.03	p page	
			Tutorial size max	12	Students	

MODULE COSTING

INCOME			Student	Module	Totals
HEFCE Income					
say	£280	p student			
FEE Income					
say	£625	p student			
Gross income					
Assume	1	students			
Total GROSS income			£905	£905	£905

OUTGOINGS

Contribution to Central overheads					
say	£231		£231	£231	£231

Admin Support					
Admissions, queries, support					
1	hrs	1	admin, p student		
£49	p.hr				
Assume	1 students		£49	£49	£49

Module Costs					
a)	Development Costs			0	
0					
b)	Maintenance Costs				
Assume have to maintain modules, update materials					
Say	10	hrs updating materials		£570	
10 hrs @	£57	p.hr			
c)	Delivery Costs				
ci)	Fixed Costs				
13	1 hr lectures	13			
Tutorials					
13	1 hr Tutorials	13			
Other Delivery					
		0			
Total		26 hrs @		£1,482	
		£57 p hr			
cii)	Variable Costs				
Assessment					
2	assessments				
Marking and feedback, say	2.00	hrs p student @			
	£57	p hr			
		1 students	£114	£114	
Individual Tuition					
Contact with individual students	1	hrs @			
Emails, phone calls etc. Say	£57	p.hr	£57	£57	
		1 students			
Printing & Repro	40	pages p student			
	£0.03	p page			
	1	students	£1.20	£1.20	
Other	0				
Overheads p student	£0				
	1	students	£0	£0	
TOTAL COST P MODULE				£2,224	£2,224

d)	ADMINISTRATION				
Exam Board					
0.125	day	1	academic		
£429.00 p day p academic			£53.63		
0.5	day	1	admin		
£370.00 p.day p admin			£185.00		
Exam Board Total				£239	£239
TOTAL COSTS			£452	£2,743	£2,743

PROFIT/LOSS

Gross Income p student
£905.00
    1 student per MODULE
Total Gross Income per MODULE
    £905
Total Cost per MODULE   £2,743
Net Income p module   -£1,838

Profit/loss	-£1,838	Per Module

Using the above assumptions a baseline cost of £2,743 for one student is calculated. Breakeven point is achieved at 6 students.

Model Two. In-house delivered, web based distance learning.

This model considers the same module delivered by Web-based distance learning tutored by in-house academic staff.

As the students are at a distance it is likely that there will be increased requirement for admin support. Therefore costs for admin support have been increased to 3 hours per student for one administrative person costed at £49 per hour.

Maintenance costs remain the same at 10 hours to update materials at £57 per hour.

There are no costs for lectures or face to face tutorials. An allowance for four online tutorials, using Elluminate or similar, each comprising one half-hour tutorial has been built in. This is based on existing practice on the MSc Facilities Management and MSc Building Surveying at Leeds Metropolitan University.

Assessment remains at 2 points of assessment.

Contact with individual students by e-mail or phone calls etc is increased to two hours per student.

Although there are no hard copy handouts an allowance has been made for assignments which may be submitted online and staff may elect to print hard copies of their assignments.

The allowance for university overheads, based on £3695 per FTE per course has been reduced by 50% to remove accommodation costs (tutorial rooms and classrooms) from the equation. As before, the allowance per course has been divided by 8 and by 2 to arrive at a cost per module per part-time student.

This results in an overall cost of £1422 per student.

Break even point is achieved with three students.

Figure 2. In-House Web-Based Distance Learning Delivery

COSTING MODEL	Module Title	In-House DL Delivery		Course(s)	MSc (Level 7) Module			
INCOME				COSTS				
HEFCE Income		£280	p student p module	Admin	£370	p day	£49	
Fee Income		£625	p student p module	Academic	£429	p day	£57	
				Contribution to		per FTE		accomm
				Central overheads	£3,695	per COURSE	£115	50.00% costs
				Printing	£0.03	p page		
			-£450					

MODULE COSTING

INCOME

HEFCE Income				Student	Module	Totals
say	£280	p student				
FEE Income						
say	£625	p student				
Gross Income						
Assume	1	students				
Total GROSS Income				£905	£905	£905

OUTGOINGS

Contribution to Central overheads						
say	£115			£115	£115	£115

Admin Support						
Admissions, queries, support						
2	hrs	1	admin. p student			
£49	p.hr					
Assume	1 students			£98	£98	£98

Module Costs						
a)	Development Costs				0	
0						
b)	Maintenance Costs					
Assume have to maintain modules, update materials						
Say	10	hrs updating				
10 hrs @	£57	p.hr			£570	
c)	Delivery Costs					
ci)	Fixed Costs					
Lectures						
0	1 hr lectures	0				
Tutorials						
0	1 hr Tutorials	0				
Other Delivery						
4	1/2 hour OLT	4				
Total		2	hrs @		£114.00	
		£57	p hr			
cii)	Variable Costs					
Assessment						
2	assessments					
Marking and feedback, say	2.00	hrs p student @				
	£57	p hr				
	1 students			£114	£114	
Individual Tuition						
Contact with individual students	2	hrs @				
Emails, phone calls etc. Say	£57	p.hr				
	1 students			£114	£114	
Printing & Repro	40	pages p student				
Printing off student submissions	£0.03	p page		£1.20		
	1	students			£1.20	
Other	0					
Overheads p student	£0			£0		
	1	students			£0.00	
TOTAL COST P MODULE					£913	£913

d)	ADMINISTRATION					
Exam Board						
0.125	day	1	academic	£53.63		
£429.00 p day p academic						
0.5	day	1	admin	£185.00		
£370.00 p day p admin						
Exam Board Total						
					£239	£239
TOTAL COSTS				£443	£1,365	£1,365

PROFIT/LOSS

Gross Income p student		
£905.00		
1 student per MODULE		
Total Gross Income per MODULE		
		£905
Total Cost per MODULE		£1,365
Net Income p module		-£450
Profit/loss	-£450	Per Module

(right margin annotations:)
All modules are fully developed
Time spent updating materials, preparation
on-line tutorials, Elluminate or similar
Increased amount of assessment to ensure
Assume increased (double compared to F.
Assume assignments submitted on-line an

Model Three. Externally house delivered (Outsourced), web based distance learning.

This mode is essentially the same as Model Two. However, instead of tuition being delivered by in-house academic staff; tuition is provided by external staff, similar to the Associate Lecturer employed by the Open University. In effect, tuition is outsourced to external providers. These tutors could be retired academics or professionals, "portfolio" employees, etc.

Unlike the Open University Associate Lecturer, who is employed on a nominal hourly basis, external tutors under the outsourcing model are recruited on a price per student basis.

Clearly, there would be costs involved in training p-t staff and updating their skills. For staff recruited ab initio into teaching, it is reasonable to assume an initial 3 day course at a cost of say, £900 (£300 p day). If utilising retired academic staff, this initial training would not be required.

In addition, there would be a requirement for ongoing staff development, estimated at, say 10 hours

training per annum at £35 p hour, i.e. £350 pa.

These costs have not been included in the presented model. Staff training and development has not been included in the other two models and in each case is assumed to be a central overhead covered by the University overhead.

On the outsourcing model, admin support is further increased to 4 hours per student, to allow for any increased contact between the University and the tutor or for students having difficulty contacting the tutor.

An additional item is included for in-house staff monitoring and managing the module. It is assumed that a defined sample of assessments will be monitored by the in-house tutor. This may be particularly relevant if there are large numbers of students and several outsourced tutors. Management and monitoring has been assumed at ½ hour in-house staff time, per student.

Module updating and maintenance is undertaken by the in-house staff and, as previously, costed at 10 hours at £57 per hour.

All delivery is included in the cost per outsourced tutor, per student. In the presented example, this is £150 per student to include; costs of administering on line tutorials, assessment and feedback, and any individual tuition.

Assessment remains at 2 points of assessment.

Contribution to Exam Board expenses remains as previous.

Figure 3. Outsourced Web-Based Distance Learning Delivery

MODULE COSTING MODEL

COSTING MODEL	Module Title	Out-sourced DL Delivery	Course(s)	MSc (Level 7) Module		
INCOME			**COSTS**			
HEFCE Income	£260	p student p module	Admin	£370	p day	£49
Fee Income	£625	p student p module	Academic Staff	£429	p day	£57
			Academic Part-time	£150	p. STUDENT	
			Contribution to		per FTE	
			Central overheads	£3,695	per COURSE	£115 50.00%
			Printing	£0.03	p page	

MODULE COSTING

			Student	Module	Totals	Notes
INCOME						
HEFCE Income						
say	£260	p student				
FEE Income						
say	£625	p student				
Gross Income			£905			
Assume	1	students				
Total GROSS income				£905	£905	
OUTGOINGS						
Contribution to Central overheads						
say	£115		£115	£115	£115	
Admin Support						
Admissions, queries, support						
4	hrs	1 admin, p student				
£57	p.hr					
Assume	1 students		£228	£0	£0.00	
Monitoring and Management						
1	Students	0.5 hrs p student @	£28.50		£28.50	
		£57 p student				
Module Costs						
a)	Development Costs			0		
0						
b)	Maintenance Costs					
Assume have to maintain modules, update materials						
Say	10	hrs updating		£570		
10 hrs @	£57	p.hr				
c)	Delivery Costs					
ci)	Fixed Costs					
Lectures						
0	1 hr lectures	0				
Tutorials						
0	1 hr Tutorials	0				
Other Delivery						
1	£150			£150.00		
Students	p.student					
Total				£0.00		
cii)	Variable Costs					
Assessment						
2	assessments					
Marking and feedback, say	0.00	hrs p student @				
		p hr				
	1 students		£0.00	£0.00		
Individual Tuition						
Contact with individual students	0	hrs @				
Emails, phone calls etc. Say	£0	p.hr	£0.00	£0.00		
	1 students					
Printing & Repro						
Printing off student submissions	0	pages p student				
	£0.03	p page	£0.00			
	1	students		£0.00		
Other						
Overheads p student	0					
	£0		£0			
	1	students		£0.00		
TOTAL COST P MODULE				£720	£720	
d)	ADMINISTRATION					
Exam Board						
0.125	day	1 academic				
£429.00 p day p academic			£53.63			
0.5	day	1 admin				
£0.00 p.day p admin			£370.00			
Exam Board Total				£424	£424	
TOTAL COSTS			£257	£1,144	£1,172	

PROFIT/LOSS

Gross Income p student	£905.00	
	1 student per MODULE	
Total Gross Income per MODULE		£905
Total Cost per MODULE		£1,172
Net Income p module		-£267
Profit/loss	-£267	Per Module

On these assumptions, the cost per individual student is £1,172. Break even is achieved at two students, (if the annual CPD for tutors is included in the module cost, break even is achieved at 4 students).

Student Individual Contact

Face to Face Student Contact

The traditional Face to Face delivery postulated above allows for varying contact in tutorial time. Assuming, say 13 students per tutorial group over the semester this equates to 1 hours personal contact in tutorials, (though this proportion varies with the numbers of students and tutorials). There is also the equivalent to 2 hours individual attention in assessment and feedback, plus 1 hour additional contact outside of scheduled hours. Total individual academic time is 4 hours.

In-House Distance Learning Student Contact

In-house delivery of distance learning allows for 2 hours individual contact, plus the equivalent of 2 hours individual attention in assessment and feedback.

There is also the opportunity for individual contact during the on-line or audio tutorials. The suggested four half-hour tutorials are based on practice on some Leeds Met modules. At four students, this gives ½ hour individual attention; though clearly this diminishes as the student numbers rise. Total individual academic time is 4+ hours.

Outsourced Distance Learning

The outsourced distance learning model has the same assumptions as the in-house distance learning model. In addition, there is the equivalent to ½ hour individual attention in the monitoring process.

Total academic time for the individual student is 4½+ hours.

Conclusion

Marginal Costs and Revenue

Marginal costs and revenue can be calculated for a range of students.

This can be graphed to show marginal Profit/Loss

Figure 4. Table of comparable Costs/Income

F2F Profit/Loss	In House DL Profit/Loss	Outsourced DL Profit/Loss	Students
Marginal Profit/Loss Profiles			
-£1,838	-£460	-£267	1
-£1,385	£2	£459	2
-£932	£464	£1,186	3
-£479	£927	£1,912	4
-£26	£1,389	£2,639	5
£427	£1,851	£3,365	6
£879	£2,314	£4,092	7
£1,332	£2,776	£4,818	8
£1,785	£3,238	£5,545	9
£2,238	£3,701	£6,271	10
£2,691	£4,163	£6,998	11
£2,403	£4,625	£7,724	12
£2,856	£5,088	£8,451	13
£3,308	£5,550	£9,177	14
£3,761	£6,012	£9,904	15
£4,214	£6,475	£10,630	16
£4,667	£6,937	£11,357	17
£5,120	£7,399	£12,083	18
£5,573	£7,862	£12,810	19
£6,026	£8,324	£13,536	20
£6,478	£8,786	£14,263	21
£6,931	£9,249	£14,989	22
£7,384	£9,711	£15,716	23
£7,096	£10,173	£16,442	24
£7,549	£10,636	£17,169	25
£8,002	£11,098	£17,895	26
£8,455	£11,560	£18,622	27
£8,908	£12,023	£19,348	28
£9,360	£12,485	£20,075	29
£9,813	£12,947	£20,801	30
£10,266	£13,410	£21,528	31
£10,719	£13,872	£22,254	32
£11,172	£14,334	£22,981	33
£11,625	£14,797	£23,707	34
£12,078	£15,259	£24,434	35
£11,789	£15,721	£25,160	36
£12,242	£16,184	£25,887	37
£12,695	£16,646	£26,613	38
£13,148	£17,108	£27,340	39
£13,601	£17,571	£28,066	40
£14,054	£18,033	£28,793	41
£14,507	£18,495	£29,519	42
£14,959	£18,958	£30,246	43
£15,412	£19,420	£30,972	44
£15,865	£19,882	£31,699	45
£16,318	£20,345	£32,425	46
£16,771	£20,807	£33,152	47
£17,224	£21,269	£33,878	48
£17,677	£21,732	£34,605	49
£18,130	£22,194	£35,331	50

Figure 5. Graph of Costs/Revenue Alternative Forms of Delivery
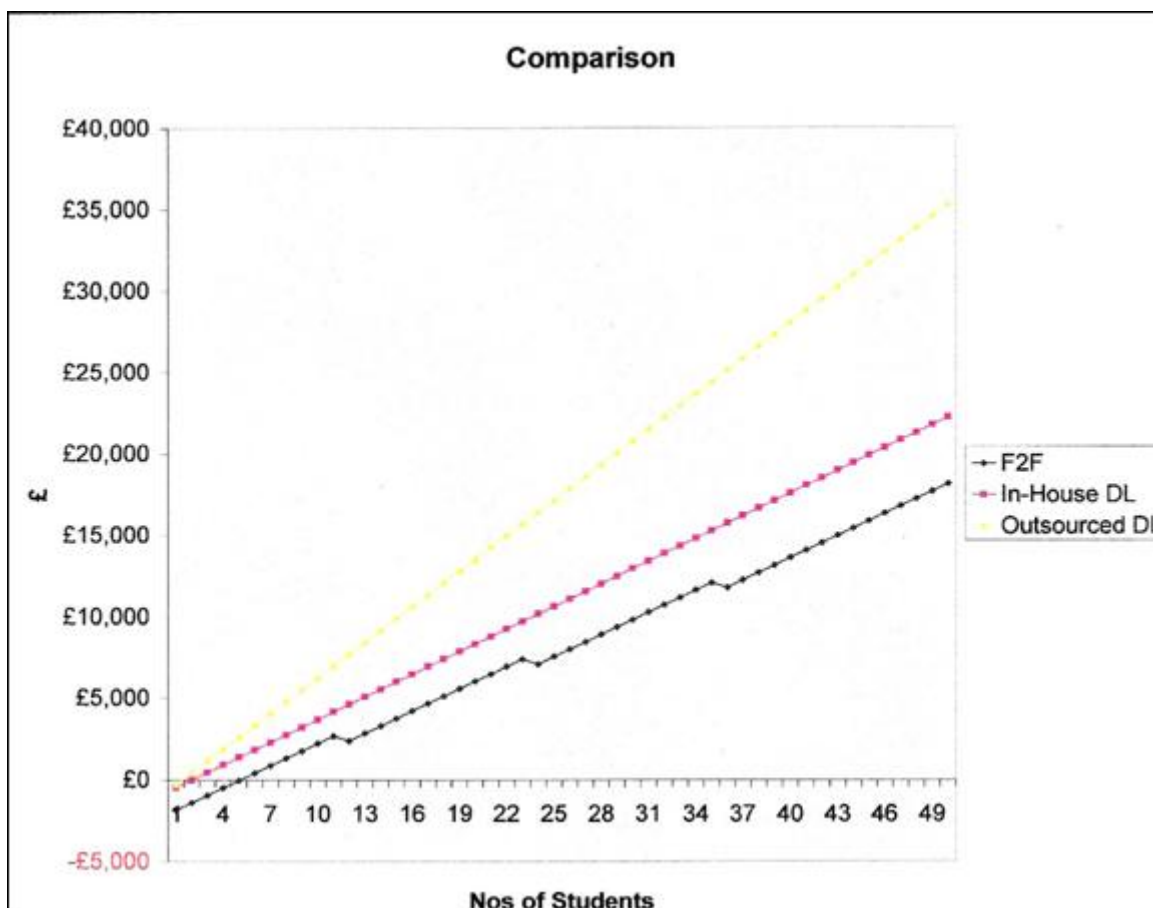
The least cost effective method of delivery is the traditional face to face lecture. The most cost effective is the outsourced method of distance learning, more than twice as profitable as face to face learning.

The model can be varied to show the effects of differential changes. For example, if Distance Learning courses are given a further assessment to promote staff-student contact, the cost profiles move; but distance learning still shows a distinct advantage over face to face delivery, at least in smaller class numbers; there is some divergence as numbers rise.

Figure 6. Graph of Costs/Revenue Alternative Forms of Delivery, 2 Assessments C/F 3 Assessments for Distance Learning

Comparison
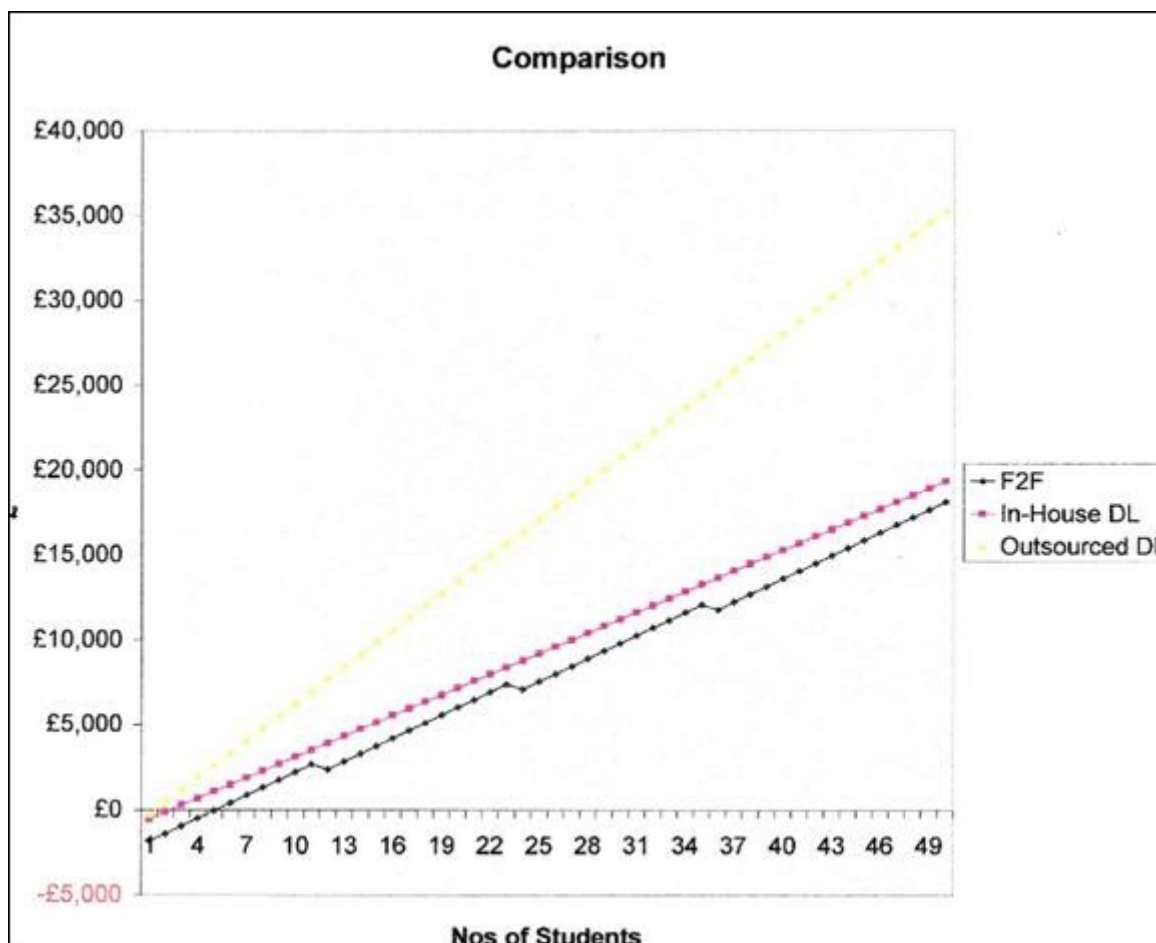
Recommendations and Further Considerations

The above models, of course, assume that all material is already available in distance learning format. The cost of producing, or converting material into Distance Learning format has to be incorporated into any models where distance learning is being developed ab initio. However, costs of producing material are falling as more material becomes available in the form of Open Access Learning Objects.

With, say 15 students, the net surplus for in-house web based delivery is £5,157 compared to a surplus for traditional face to face delivery of £3,761. Assuming that the module is delivered once per year, this gives a net annual surplus of £1,396 pa. Capitalising this at, say, 4% yield gives a Capital Equivalent of £34,900

Similarly, the Capital Equivalent of the surplus from in-house web-based delivery is £153,575.

These figures; £34,900 and £153,575 represent the capital available to produce the web-based material.

The costs of producing a distance learning module are currently being researched as a separate exercise.

A further consideration is the relative costs to the student of studying full-time, attended part-time, or by distance learning. Again, this is being separately researched.

Environmental costs of different forms of delivery also have to be considered. Clearly there environmental benefits in distance learning in terms of: journey to work (study) costs, land and buildings usage, and production of hard copy materials. Again, this is subject to separate research.

Appendix A

Figure 7. Spreadsheet for F2F Delivery, showing formulae

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