

Weighing Air: Measuring the Costs of Learning Technology in the UK

Charlotte Ash (presenter), Paul Bacsich
Sheffield Hallam University

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Abstract

This paper discusses the aims, objectives, methodology and outcomes of the UK JISC funded *Costs of Networked Learning* project. The paper focuses on three project outcomes: a course lifecycle model; a financial schema; and a planning document. The project specifically addresses the UK higher education sector, however it is hoped that some of the results will be directly applicable to higher education world-wide.

Introduction

The "Costs of Networked Learning" project was funded by the Committee for Awareness, Liaison and Training (CALT) part of the Joint Information Systems Committee (JISC) of the UK Higher Education and Research Funding Councils (<http://www.jisc.ac.uk/>). Funding was for a six-month period ending in July 1999. Additional support was provided by the Sheffield Hallam University Virtual Campus Programme and the School of Computing and Management Sciences.

The main aims of the project were to identify the unrecorded or hidden costs involved in Networked Learning and to produce a planning document and financial schema that together would accurately record the costs of Networked Learning for the benefit of policy makers, course providers and students.

Staff at the Sheffield Hallam University reviewed previous work on costing innovative learning systems as part of the establishment of the Virtual Campus Programme. They concluded that no one body of work encompassed all of the issues or travelled sufficiently far towards reaching *operational* conclusions, especially in a manner convincing to Finance Departments.

Moonen (1997) identified four reasons why costs are difficult to quantify:

- There is disagreement about which costs should be taken into account.
- Reliable data is unavailable because it is not collected in a systematic manner.
- Recorded costs are unstable and evolving.
- Some data is perceived as confidential and may not be made publicly available.

In order for our project to reach a useable conclusion, these barriers had to be surmounted. In addition to the above, we identified a larger barrier:

- Each previous costings approach uses a different vocabulary: these must be "standardised" before they can be analysed.

Terminology

The phrase 'Networked Learning' is generally taken to be synonymous with 'Online Learning', 'Technology Enhanced Learning' and such like terms. The definition used by the team is:

"using a networked computer for the purposes of learning, blurring the boundaries between on-campus, distance and flexible learning".

Networked Learning can be most successfully identified by the degree to which technology is used in place of, or to enhance, the tutor.

The term 'hidden costs' encompasses costs which are both fundamentally unrecorded (such as academic staff overtime) and more generally absorbed into larger budgets (therefore unable to be attributed to an individual activity or even genre of activity).

Examples of hidden costs include: the time, inconvenience and extra costs incurred by staff away from home on business (such as presenting at a conference or attending a project meeting); student-purchased ink cartridges to use on their home PC to print tutorial notes or multiple copies of assignments for submission; and a networked PC in an open access laboratory being used by students for social email and Internet surfing while students trying to complete assignments are turned away.

The phrase 'Weighing Air' also deserves mention in this section. The conference organisers cleverly chose the title of this session. Weighing air describes the process of quantifying something that quite definitely exists but is normally invisible and can only be measured by using special tools.

During the 1760's, Henry Cavendish developed a method for weighing air by absorbing it on pearl-ash which was weighed before and after a chemical reaction. Cavendish relied upon the Law of Conservation of Mass, which states that *the total mass of the reactants in any chemical reaction is exactly equal to the total mass of the products*. In other words, a chemical reaction is the rearrangement of the same atoms to form different molecules; atoms are conserved both in number and in type whenever a chemical reaction occurs. Similarly, accurate costing is the rearrangement of costs into useful costing categories that conserve the amount and type of costs without inventing new costs.

By identifying hidden costs, we are not inventing new costs and thereby increasing costs; we are providing new costing categories that allow for the accurate recording of all costs.

Context

In the United Kingdom, higher education is primarily funded by a Funding Council; separate councils exist for England, Northern Ireland, Scotland and Wales. Monies are allocated on a student enrolment basis for teaching and learning and on a graded system for research. Additional funds are available on a bidding system for specialist projects. There is currently a drive from the Research Funding Councils for greater 'transparency' - meaning a greater visibility of how research funds are spent within Institutions. Greater transparency of funding for

research inherently means that teaching will be costed in an equally transparent manner though not necessarily via the same method.

The UK has recently introduced student fees of £1,025 per academic year. While this does not seem to have discouraged participation in higher education for undergraduates (although mature student enrolments have decreased since the introduction of fees) it has resulted in the student body being more consumer led, with greater demands in terms of quality, access and cost.

Higher education teaching and learning in the UK is changing in a number of different directions. It is moving from a traditionally campus based system to one which is more flexible and more technologically orientated. Meeting the demands of students, future employers, review committees - both teaching and research orientated - and the Funding Council is stretching universities in the UK to the limits.

Methodology

The methodology for this short project aimed to cover a broad slice of the UK higher education sector and then focus upon to a handful of Institutions allowing for more in-depth study.

The first, and indeed ongoing, activity of the project was a broad literature review. Over 100 sources were identified, read and reviewed. Information collected from the literature was used to form a structured list of costs currently being considered. Analysis of previously developed frameworks for costing technology-led education systems was undertaken and a new model developed that is more akin to the UK Higher Education sector.

A survey was written and administered to all UK higher education institutions. The survey questioned the IT capability and structure of the Institution, the availability of student allocated machines; the permeation of Networked Learning into the Institution's teaching and learning; and how the costs of these activities were recorded, if at all. The results from this survey were analysed in conjunction with similar UK based surveys (UCISA, 1999 and Noble, 1999). A response rate of 60% illustrates the interest of the sector in this subject.

The data collected from the survey also helped the team to decide which Institutions to visit in order to interview a range of staff and observe Networked Learning activities. Interviews were conducted at seven institutions. Members of the study team met top-level management through to course facilitators and administrators to discover what they perceived the costs of Networked Learning to be. The Institutions were chosen to be representative of the sector in three areas: geographically diverse, new and old universities, and at differing stages of implementation.

As the study progressed it became apparent that both staff and students absorbed a large number of the hidden costs identified. The study team held a focus group meeting with student representatives and conducted a survey of students at Sheffield Hallam University. The results of the student survey correlated closely with the NUS study on "Hidden Course Costs" (NUS, 1999). It is hoped that a similar survey of staff can be done in the future.

Consultation with experts and other related project teams was ongoing throughout the study.

Outcomes

Originally this project was expected to deliver one main outcome - the planning framework, comprised of a planning document and accompanying financial schema. As part of this

deliverable, a course lifecycle model was developed for institutions that do not already have one in place. It is believed that using these three schemas an accurate picture of the costs of Networked Learning can be established.

The development of a course lifecycle model

The provisional course lifecycle model was developed as a result of the literature review. Cost items mentioned by other authors were listed and a short report compiled to analyse the currently available models used for costing educational practice. The study team had already discussed at length the inappropriateness of traditional financial management accounting procedures, which are not suited to exposing the hidden costs of Networked Learning.

In addition, the team held a series of short consultative meetings with a number of academics at Sheffield Hallam University about the lifecycle of course development and delivery. A three-unit human resource model of academic staff, support staff and students and a five-phase cyclic model which encompassed providing both the learning experience and the learning environment was proposed. The model aimed to show the relationship between people and activities and therefore expose possible areas of hidden costs.

This model was tested at two stages in the course of the project; with interviewees during the Institutional visits and at a one-day workshop held to progress the thoughts of the study team.

Subsequently, it was decided by the study team that the five-phase model was too complex and that the four-phase BPR model, as proposed by the workshop attendees, would not resonate with the UK Higher Education sector, or make apparent the hidden costs. Therefore a three-phase model was proposed.

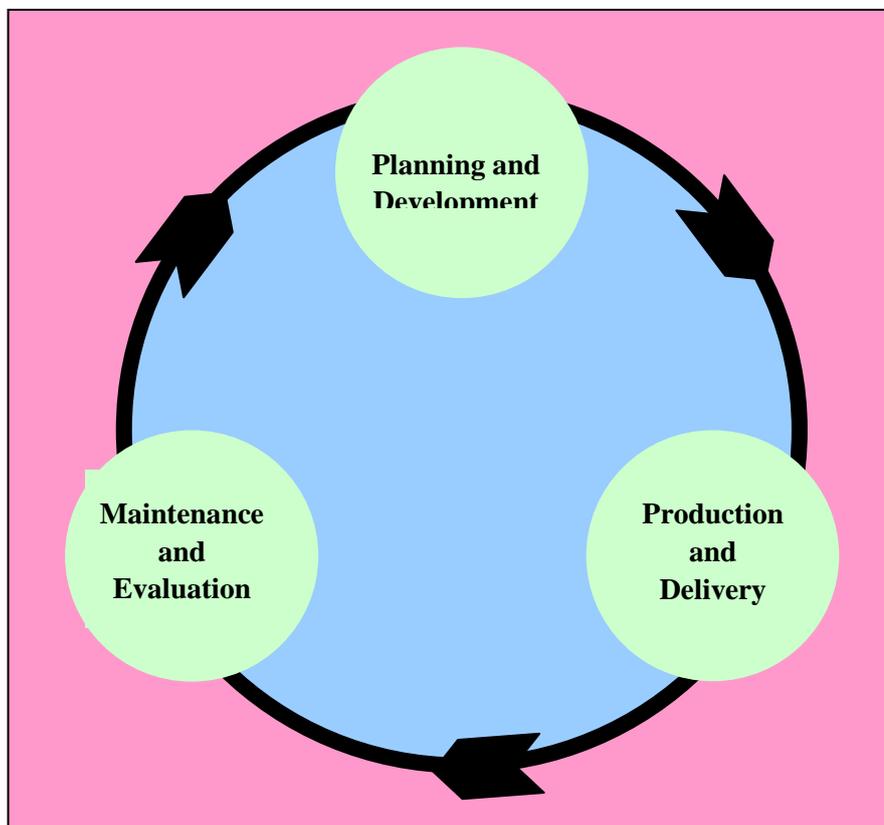


Figure 1. Three-phase model.

The following table illustrates how some course related activities fit into the above model:

Planning and Development	collecting materials coming up with - or being told - the idea writing the business plan purchasing and evaluating existing materials or developing your own writing user guides or course publicity the revision of material
Production and Delivery	curriculum delivery duplication of materials distribution and/or transmission progress monitoring tutorial guidance marking and feedback
Evaluation and Maintenance	quality assurance exercises replacement and updating of materials evaluation against course aims outlined in business plan and student feedback

Table one - Breakdown of three-phase model

The new model was then rechecked against the literature including additional training-focused literature (analysed later on in the project, due to its bias towards Activity Based Costing). The table below contains a summary showing how the most significant models compare:

Standard	Bates (1995)	Rumble (1997)	Stahmer (1995)	Moonen (1997)
Planning & Development	Production	Production including Development	Research & Planning Development	Development
Production & Delivery	Delivery	Transmission & Distribution Reception	Delivery	Production, Delivery, Operation...
Maintenance & Evaluation	(omitted)	(omitted)	(omitted)	... and Maintenance

It is worth noting that evaluation is not covered when costs are considered, even though the authors involved are well aware of evaluation issues.

The Financial Schema

Our research showed that the "traditional" financial model used in the UK, which underpins university, department, and course planning, is defective in at least four ways:

- It takes no account of the costs incurred (or saved) by the additional stakeholders in the learning process other than the Institution - in other words, it treats the Institution as a *closed system*.
- It assumes a crude allocation of overheads (e.g. by simple cost drivers such as staff numbers or space occupied) rather than an approach based on usage (e.g. number of online student hours per year).
- It takes little account of the division of academic time into research, teaching and administration.
- It takes no account of the activities *within* the course development process.

One of the main problems leading to the above deficiencies is the lack of a concise, usable financial *proforma* which is flexible enough to apply to a number of different learning situations.

During the study we analysed around 10 different schemas. These include the KPMG Costing Guidelines (1997) for university financial planning, the US Flashlight Cost Analysis Handbook (Delinger et al, 1999) which is rapidly gaining popularity in US HE, and a number of more traditional schemas including some from the training sector.

The financial schema adopts Activity Based Costing (ABC) at its heart. The Flashlight Cost Analysis Handbook describes ABC thus:

Traditional accounting breaks costs down by organisational units and usually attends only to expenditures and revenues. Activity-based costing breaks down costs by basic types of activities. These costs may cut across organisational boundaries ... (Delinger et al., 1999).

The KPMG Guidelines were completed in 1997 as a venture between the joint Funding Councils and KPMG Management Consultants. Two main conclusions were reached based on a survey administered by the Funding Council and a review of costing practices at ten volunteer Institutions. These conclusions were:

- The UK HE sector places a high importance on accurate costing information.
- An acceptable method of recording staff costs against activities is needed.

The report states that a typical UK university expenditure account will contain four categories: staff costs, including wages, salaries, social security and pension costs; depreciation; other operating expenses; and interest payable. To ensure that the schema works on a number of levels, we have excluded interest payable and included overheads, as this category is so easily misunderstood. If we link the stakeholder categories (agreed upon earlier in the project), *Institution, Staff and Students*, to the expenditure categories, we get the following matrix (possible examples entered in italics):

Expenditure dimension	Stakeholder dimension			Total
	Institution	Student	Staff	
Staff costs	<i>Salaries, wages, pensions etc.</i>	<i>Opportunity cost of learning not earning</i>	<i>Opportunity cost of not doing a better job</i>	
Depreciation	<i>Buildings, computing provision</i>	<i>Own home computer and accessories</i>	<i>Own home computer and accessories</i>	
Expenses	<i>Subsistence, registration</i>	<i>Computer consumables, connection charges</i>	<i>Entertainment expenses incurred on business travel</i>	
Overhead	<i>Software licences</i>	<i>Additional insurance</i>	<i>Additional energy requirements</i>	
Total				

Table two - Example of the financial schema

Each methodology was mapped onto the standard KPMG framework in turn. In addition to the Flashlight work, the following were also considered: Rumble (1997); Stahmer (1995); Crabb (1990); Temple (1995); Jewett (1998); Shepherd (1998); Oliver, Conole and Bonetti (1999); Sharratt (1993); Moonen (1997); Cukier, (1997); HEFCE (1997); HEFCE (in press).

It is clear using this process that the KPMG framework stands up well when judged against the other experts, and that the Flashlight work is, after KPMG, the most systematic work available relevant to the problem. In conclusion, we have decided to accept the multi-stakeholder approach and take the KPMG work as the basis of our work. We then factored in Flashlight, classical costing methodologies and finally insights from our own study.

The Planning Document

Any proposed planning framework needs to resonate with financial managers, planners, and administrative and academic staff. It therefore needs to be understandable and usable with the minimum amount of guidance. It also needs to be based on tried and accepted methods. The framework is expected to be relevant to different approaches to Networked Learning and make apparent which costs should be recorded and where, thus eliminating hidden costs.

A planning document was proposed with similar features to our proposals for the financial schema, such as the levels of operability and focus on Activity Based Costing.

The Study Team surveyed the research literature produced by major academic authorities that is relevant to the area of planning and decision-making in the use of Communications and Information Technology (C&IT) for teaching in higher education. There is, in our view, relatively little in the literature of value to planners and finance staff, with the exception of Tony Bates' ACTIONS methodology (1995).

HEFCE (1999) has recently looked again at the planning process, in "Appraising Investment Decisions". Annex C to this document outlines how the proposed methodology can be used to decide on a teaching and learning issue. One of the study team rewrote the HEFCE document to reposition it fully to the development of courses, and in the team's view the result is surprisingly convincing.

What the HEFCE document lacks is the *educational* framework. We recommend that this is added from the authoritative work of Bates (1995).

Conclusions

Unfortunately, it is impossible to test as well as develop a methodology of this nature in six months and therefore work will continue on the framework during the next few months. In the future we wish to produce a number of annexes to the report detailing the usage of the framework in an educational setting.

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