HOW SHOULD WE MEASURE THE COSTS OF COMPUTER AIDED ASSESSMENT?

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Abstract

There is little in the literature which helps us measure the costs of introducing CAA. A trawl through the past four CAA Conferences gives only one paper (Pollock, Whittington & Doughty, 2000) and this is restricted to a single course. The book by Brown, Race & Bull (1999) contains no article on costs. Perhaps this is not surprising during this period of CAA development in HE. Many universities are now introducing CAA, either explicitly as part as their educational strategies, or implicitly as a by-product of introducing a virtual learning environment. In most cases, the introduction is justified on educational, rather than financial, grounds.

In most universities the cost of assessment is a cost per student, whereas the cost of teaching is more related to the hours per course, rather than hours per student. The increase in student numbers means that the cost of assessment

will usually increase directly in line with student numbers, whereas the cost of teaching will not. Hence, it has been said that the cost of assessment in higher education now surpasses the cost of teaching.

As part of our institution-wide introduction of CAA we were asked by our Academic Board to produce a cost-benefit analysis. This proved to be very difficult. First, we were faced with the issue of whether we should be looking at cost-benefit, or cost-effectiveness, or a cost comparison between CAA and existing assessment systems. Second, we were faced with the problem of getting accurate costings of many activities. We believe that all of us who are working with CAA need to think about these issues.

The purpose of this paper is to encourage debate around the issue of costs associated with the introduction of CAA. We suggest a framework for evaluating the costs and benefits in relation to the institution, academic staff and students. We also provide a potential list of activities which might lead to detailed activity-based costing. Finally, we discuss the nature of changing staff roles if CAA is introduced university-wide.

Keywords: cost-benefit; cost-effectiveness; pedagogic effectiveness

Introduction

Higher education is rapidly increasing the use of technology in teaching and learning. Many of the arguments for moving this way are well rehearsed, but initial suggestions that they are cost effective for institutions are now largely refuted. The amount of staff time absorbed in teaching is relatively easy to quantify through timetabling procedures and so the costs of delivery, including the change from face-to-face to technology-supported, can be relatively easily compared. In the UK, the Joint Information Systems Committee (JISC) has funded a number of projects which aim to evaluate the costs of technology in teaching (see, for example the 'Cost of Networked Learning' project at http://www.shu.ac.uk/cnl/). The ELEN Conference in Lincoln at Easter 2001 contained an excellent review on 'Cost Effectiveness' of learning technologies by James Wisdom (unpublished). This looked at a number of well-funded initiatives, particularly the Teaching and Learning Technology Programme (TLTP http://www.ncteam.ac.uk/projects/tltp/) and the Fund for the Development of Teaching and Learning (FDTL http://www.ncteam.ac.uk/projects/fdtl/) and the lack of emphasis on cost effectiveness.

The costs of introduction of technology into assessment (rather than teaching and learning) has received less attention. For example, the book by Brown, Race & Bull (1999) contains no article on costs. Many practitioners introduce CAA for pedagogical, rather than economic, reasons. Nevertheless, one of the arguments for the introduction of CAA is that it is a more effective use of staff time (Bull, 1994). In most institutions the costs of assessment are less well understood than those of teaching. The time staff spend on setting and marking assessments is not usually recorded. The use of space for assessment can be recorded for invigilated assessments, but this is a relatively small part of to the total assessment cost. Pollock et al (2000) provide a useful example of the costs and benefits at course level, but many of the introductions of CAA now are University-wide, with all the associated support mechanisms. One of the side effects of introducing new systems is that their costs can be tracked more easily than for existing systems. So, with more institutions making the strategic decision to use CAA, the time is ripe for a wider debate about the costs and benefits of CAA.

Possible approaches

Wisdom (ELEN Conference, 2001, unpublished) notes the difference between cost-benefit and cost-effectiveness as follows.

1. Cost-benefit analysis works when benefits can be expressed in monetary terms.
2. Cost-effectiveness assesses outcomes in relation to a goal (useful when outcomes cannot be expressed in monetary terms).
3. Pedagogic effectiveness (learners learning, and learning better) must be part of cost-effectiveness.

Bacsich and colleagues (1999) have espoused the idea of activity-based costing for assessing the costs and benefits of introducing learning technologies. Pollock et al (2000) looked at the costs (expressed as staff time) of a number of simple assessment activities, and the effect of changing to CAA in a mathematics course. In our own university we have tried to provide a framework for assessing costs and benefits of introducing CAA across the institution. This has led to us to look at costs and benefits at three different levels: the university, academic staff, and students. Table 1 on the next page shows our suggested structure. The table contains many items which we think can be costed, but some of the items fall into the 'pedagogic effectiveness' category. There are also 'hidden' costs such as the cost of having computers available in an institution. Recent data from our own university put the cost of ownership of a computer as about £1,000 per year. This includes the desktop hardware, networking infrastructure and core software provision. We have not chosen to include this in the CAA cost as there is no way of apportioning this cost. However, if the introduction of CAA requires an increase in computer provision, this extra cost should be included.

Activities for costing

In their review, Pollock et al (2000) looked at three key activities of academic staff in assessment. These were setting time, invigilation time, and marking time. We have tried to give a more detailed breakdown which includes the administration of the process. Table 2 below shows the activities we think important to include in costs.

Table 2. Assessment activities for costing and suggested staff time involved

Activity	Staff time
1. Writing, reviewing, and testing questions	20 mins per question
2. Creating assessment	15 mins per test
3. Setting up user names/passwords and test arrangements	30 mins per test
4. Checking test is running and dealing with students who 'can't get into test'.	30 mins per test
5. Collating Data	1 hour per test

The suggested times will clearly depend on staff expertise, and casual users of CAA will undoubtedly take longer than this as they will need to re-learn the process each time. One issue for academic staff is the need to learn how to use the CAA system. The activities that they would usually undertake in a paper-based system might only be a sub-set of those in Table 2. They may be reluctant to take on increased overheads when converting to CAA.

Table 1: Items to consider when assessing the cost and benefits of introducing CAA systems.

Costs to University	**Costs to staff**	**Costs to students**
Hardware (server etc) for CAA Software for CAA Support staff for maintenance of server and software upgrades Provide staff development Additional load on IT infrastructure	Time to learn the system	
Benefits to University	**Benefits to staff**	**Benefits to students**
Can compensate for lack of staff resources (time) Less paper and printing Better retention of students Increased cross-departmental working	No marking Easy recording of marks Additional mode in assessment strategy May improve staff-student contact Better information on students Better information on assessments	More formative assessment (currently limited by staff resources) Fast feedback Repeatability Clarity of assessment criteria Flexibility in place Flexibility in time Apparent fairness May improve staff-student contact

The effect of changing staff roles

One of the effects of introducing CAA at institutional level is that some of the activities which might be undertaken by academic staff if the assessment system was locally managed are now undertaken centrally. For example, activity 3 in Table 2 is 'Setting up user names/passwords and test arrangements'. Now that our CAA system is integrated with our Managed Learning Environment, this registration of students happens automatically and is updated daily from our student record system. This is no longer an activity which academic staff undertake. Table 3 below looks at which members of staff might be expected to undertake particular activities. This is a more detailed version of Table 2, and might be preferred for activity-based costing.

Table 3. Activities and staff involved in CAA: (+) means primary responsibility, (?) means possible responsibility

Task	Academic	Graduate teaching assistant	Computing support	Admin / secretarial
Question design	+	?		
Question entry	?	?	?	?
Question testing	+	?		
Session creation and publishing	?	?	?	?
Scheduling sessions	?	?	?	?
Registering students as participants			+	
Dealing with student with special needs	?		?	?
Extracting marks	+	?		?
Support of client software			+	
Support of server software			+	
Student support	+		+	
Staff training			+	

Discussion

The higher education sector in the UK is increasingly driven by 'value for money' concerns. While many of the processes in higher education can be relatively easily costed, the processes involved in assessment receive little analysis. We believe that it is possible to produce costings for assessment, and for CAA in particular. However, existing management information systems do not seem to contain any useful data on assessment. The recent 'transparency review' could have provided some information, but was a lost opportunity.

One question which needs further consideration is whether the move from paper-based to computer-based assessment leads to shorter assessments. Thus, is it possible to replace a 2-hour written examination with a 1-hour computer-based objective test? If such changes to assessment practice do take place then this could lead to substantial savings. Tracking such changes in practice is not easy.

Finally, we suggest that higher education needs to consider the costs of assessment in much more detail. Only if good data is available for existing systems will it be clear whether computer aided assessment provides real cost benefits.

References

Bacsich, P, Ash, C, Boniwell, K, Kaplan, L, Mardell, J and Caven-Atack, A. (1999), *The Costs of Networked Learning, Report 2.* Sheffield, Sheffield Hallam University. http://www.shu.ac.uk/cnl/report2.html

Brown, S, Race, P and Bull, J. (eds). (1999) "*Computer Assisted Assessment in Higher Education*". Kogan Page, London. ISBN 0 7494 3035 4

Bull, J (1994) *Computer based assessment: some issues for consideration. In "Computer Assisted Assessment*" edited by J Darby & J Martin. Active Learning, 1. CTISS Publications, Oxford. ISSN 1357-1125.

Pollock, M J, Whittington, C D & Doughty, G F. (2000) in Danson, M & Eabry,C (eds.) *Proceedings of the Fourth International Computer Assisted Assessment Conference*. Loughborough, Loughborough University.