
Replacement of traditional lectures

with computer-based tutorials: a case study

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A set of computer-based tutorial files were produced in-house and used to replace two traditional lectures. Students submitted feedback on their use of the CAL material. The ease of production and delivery, and the positive responses from the students, have provided justification for further development of in-house CAL material. Further insights are given into the integration of CAL into a curriculum.

Introduction

This paper reports on a pilot project with a group of 60 second-year undergraduates studying the use of standard forms of contract in the construction industry. The project entailed the replacement of two of a series of nine scheduled lectures with a computer-based tutorial. The two main aims of the project were to test the viability of converting existing lecture material into computer-based material on an in-house production basis, and to obtain feedback from the student cohort on their behavioural response to the change in media. The effect on student performance was not measured at this stage of development.

Description of the courseware

Windows Help Author was used to create a set of tutorial files on the subject of payment under standard forms of contract in the construction industry. The files were created in hypertext style to allow the students to navigate through the material as they wished, although a suggested route was provided which mirrored the approach taken in a normal lecture. The computer-based material deliberately replicated that which would have been available via the two normal lectures in order not to distort the comparison between the two modes of delivery, although some of the group interactions in normal lectures were postponed until a subsequent seminar. A total of 22 windows were produced, an example of which is shown in Figure 1. Blue or red hot words were used to guide students to further windows or pop-ups respectively, taking account of published screen design principles (Clarke, 1992).

Advantages to the lecturer in using Help Author included the negligible expense of the

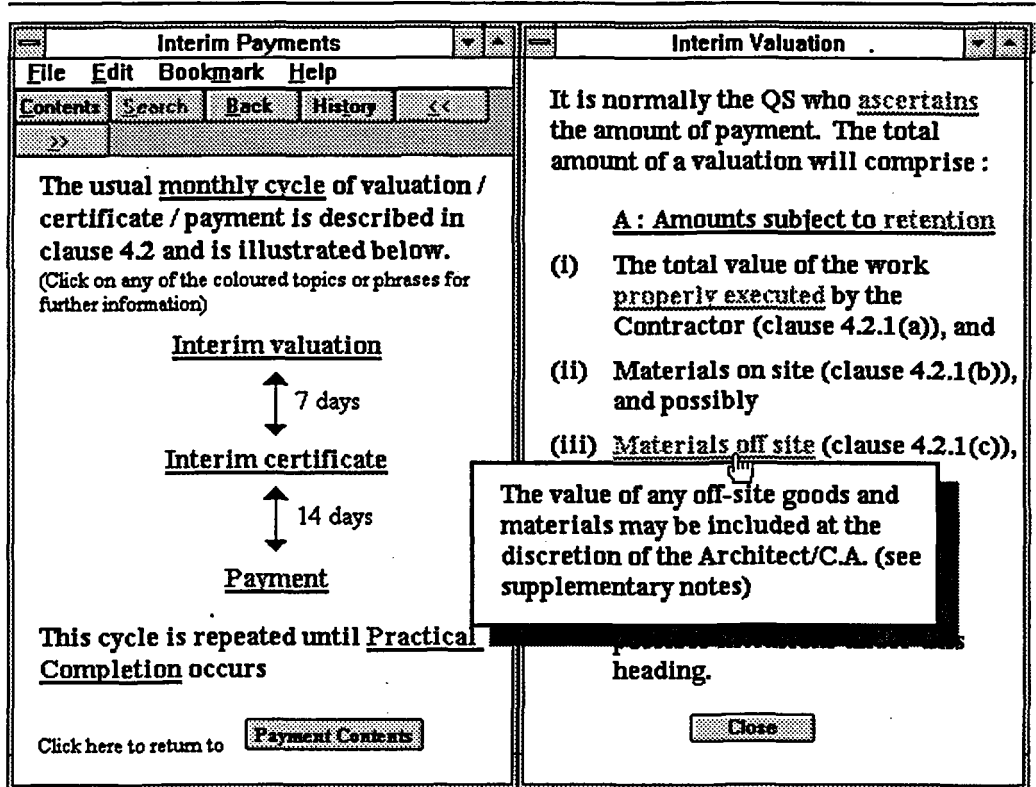


Figure 1: Example of the courseware screen display

package, its ability to dovetail with Microsoft Word where most of the subject matter already resided, and its ease of use for authoring once the initial techniques had been mastered. A further advantage in the delivery of the material was that the resultant set of files required only Windows 3.1 to be available, thus enabling study to be conducted on any departmental computer, networked or otherwise. Sixty students undertook the computer-based study and 38 (63%) voluntarily completed a feedback questionnaire on the following points of interest.

Location and timing of study

The departmental computer laboratory was booked for the timetable periods corresponding to the cancelled lectures. The computer-based material was made available to the students to copy to their own disks such that they could choose when and where to carry out the study, whether during the booked laboratory periods or at another time elsewhere. A major advantage to the students was that the resultant files were quite small in terms of the disk space required (80 Kbytes) and in only requiring Windows 3.1 to be available, they could be used on a wide variety of machines both inside and outside the university.

The students were asked whether they used the computer tutorial at the university in the booked laboratory period, at the university at another time, or at home/elsewhere. Eight students chose more than one place of use and the responses are shown in Table 1.

Table 1: Location and timing of study of the computer tutorial

Place of Use	Number of students
University in booked time	17
University at other times	11
Home / Elsewhere	18

A significant number of students took advantage of the opportunity to study either 'out of hours' and/or outside the university. It was apparent that the more computer-literate students who liked to work from home were very enthusiastic about the exercise. However, a significant number of the student group took advantage of the booked laboratory time, and they commented that the success of such an exercise depended on their gaining access to a university computer and that, in their experience, casual access was often not available. The implications of a more widespread use of this method of delivery on the demand for university computers would need careful consideration.

Ease of use of the computer-based material

The responses to a question regarding the ease of use of the tutorial are shown in Table 2. The majority of students experienced little or no difficulty in using the tutorial which was gratifying for the author of this paper in his first attempt at using the authorware. Of those few who experienced difficulty, it was clear that a small number of students were 'anti-computers' regardless of this exercise. Gilleard (1995), in the field of building services engineering, found a similarly positive response to CAL tutorial work, especially where CAL design and presentation promoted ease of understanding.

Table 2: Ease of use of the computer tutorial

Ease of Use	Number of students
Very easy	12
Easy	22
Difficult	4
Very difficult	0

I noted several distractions during the laboratory periods with regard to noise from other users (vacant machines were available for other students), demands of other work (including the temptation to use the computer time to word-process outstanding assignments) and technical problems (usually with regard to the students' own disks). All these factors were disruptive, and mitigated against effective study. Some form of controlled environment, as on 'silence' floors in a library, may be necessary if this form of delivery were to become more prevalent.

Lecture vs. computer-based study

The students were asked whether they preferred study of this subject by traditional lecture, computer tutorial or a mixture of the two. Their responses are shown in Table 3.

Preference of study	Number of students
Lecture only	7
Computer tutorial only	4
Mixture of lecture /CBT	24
No preference	3

Table 3: Preference for form of study

The responses to this question are particularly interesting. Despite a very positive overall reaction to the use of the computer to assist their study, a notable majority of the student group still favoured retention of the traditional lecture in some form. A mixture of the two types of study was the strongly preferred option. This overall response is matched by the experiences of others. Cordell (1991), studying learning styles and CAL in the field of health care, recommends that educators should continue to use a variety of instructional methods including CAL to facilitate learning. Edward (1995) concludes that an effective computer-based laboratory simulation will enhance but not replace traditional techniques. The experiences of Howard *et al* (1995) in the field of construction technology, suggest that while being positive about the adoption of new teaching technologies, students still value human interaction with lecturers and that an effective integration of technology into existing teaching and learning strategies is required.

However, alternative opinions have also been offered. Garrud *et al* (1993) in the field of medicine, conclude, with reservations, that CAL can effectively substitute for traditional didactic teaching. Stokes (1994) describes a project whereby lectures and seminars were replaced with CAL material. The use of commercial CAL material proved problematic, but the subsequent development of in-house CAL material is proving to be a success.

The issue of replacing versus enhancing traditional teaching with computer-based instruction is a delicate one. It is evident that truly effective CAL does not bolt on to existing lectures and seminars, but rather causes the focus of them to alter. Contact time may be more suitably used to offer support and feedback rather than the traditional emphasis on provision of information. There is considerable value in a human expert setting the scene, establishing expectations and being available for consultation as a course of study progresses. Experience to date would suggest that, once good quality CAL is available, a judicious balance of teaching modes is required to allow for effective integration of CAL into a curriculum.

Flexibility of study

The computer tutorial was designed to offer flexibility in timing and pace of study. The responses of the students as to whether this was a good or bad idea are shown in Table 4. The computer tutorial was designed to offer the opportunity to review material as required. The responses of the students as to whether or not the material worked in this respect are shown in Table 5.

Not unexpectedly, there was a very positive response to the opportunity to break free from the constraints of fixed timing and pace of delivery associated with traditional lectures. The responses may seem to be obvious, but this was a novice group with regard to CAL, so their

Table 4: Ability to control the timing and pace of study

Flexibility of timing and pace of study considered to be a:	Number of students
Good idea	29
Bad idea	5
Not concerned	4

Table 5: Ability to review the computer-based material

Ability to review the material considered to be:	Number of students
Beneficial	30
Not beneficial	3
Not concerned	5

initial reactions are particularly noteworthy. It was noticeable that some students, having been directed into the material, took the opportunity to engage in more intensive study than would normally be expected in following up a traditional lecture. Striking a more negative tone, some students did not enter into such 'deep' learning and felt the need for the clear and strict direction obtainable in a lecture, despite supplementary notes being available to them. Isaacs (1990) concludes that tutorial CAL has a definite role in assisting students to learn freely, that is to learn what they will and when they will. However, he also highlights the range of study skills which students require before gaining maximum benefit from tutorial CAL.

Further computer-based study

Students were asked if they would like to see more of this type of study on their course. Their responses are shown in Table 6.

Table 6: Preference for further computer-based study

Would you like further study of this type on your course?	Number of students
Yes	20
No	6
Not concerned	12

In considering this exercise as a pilot study, the overall positive response acts as a suitable encouragement for further development of the computer-based material. A sizeable number of students replied that they did not mind whether there was more computer-based study or not, implying that they are indifferent to the medium adopted and are content to leave such choices to the academics concerned.

Use of staff time

It is difficult to be totally unequivocal about the efficiency of staff time when engaged in such work. There is obviously a front-end investment of time required in converting and updating materials to be suitable for use in electronic mode. However, if carried out wisely, this should result in many hours of student learning time being provided, hopefully with only minimum effort required in future updating of the material, this clearly being dependent on the subject under consideration.

Garrud *et al* (1993) were very clear that good quality CAL requires substantial resources and high-calibre staff to develop and maintain it. Stokes (1994) reported a lower than average requirement of development hours for in-house production of CAL, indicating that efficiency gains can result from good management and adequate resourcing. The courseware supporting the project described in this paper was developed totally in-house with the help of suitable authorware. Built Environment does not have access as yet to much subject-specific material in the public domain, and we are now actively considering a strategy for in-house CAL development.

Learning outcomes

All of the results reported above are with regard to the behavioural response of the students to the change in media. The effect on academic performance is usually considered as the main criterion for evaluation in this type of study. However, it has not been possible in this pilot study to measure discrete effects on performance. The assessment of the subject was integrated in such a way that it was difficult to identify the results in the topics delivered by computer separately from those delivered traditionally. The study did not extend to altering the basis of assessment at this stage. In further development of this material, it may be possible to use self-assessment to provide more definite feedback on learning outcomes as well as to improve the learning process.

Academic performance may not be totally independent of behavioural response. My own earlier work (Lavelle, 1992) demonstrated how a systematic use of appropriate IT facilities helped to promote the development of cognitive skills and the adoption of new techniques. It is possible that the generally positive response of the students to their use of the computer-based material may demonstrate sufficient motivation towards a higher level of performance. However, the range of marks in the subject revealed nothing unusual when compared with other subjects, nor with previous student cohorts. On this basis, one could infer that there was no significant effect on performance either way, but the evidence is not conclusive because of the number of interdependent variables affecting performance at this level.

Conclusion

With reference to the aims of this pilot study, the conversion of existing lecture material into computer-based material on an in-house production basis is proving viable, and shows promise for further development. The positive feedback from the student cohort on their use of the pilot CAL material also gives encouragement for further development.

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