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E-learning for project management

This paper examines the reasons for the apparent reluctance of civil engineers and other construction professionals to use computer-aided learning on distance-learning programmes and reports on the evaluation of a project-management CD-ROM. It concludes that 'e-learning' can be as effective as traditional distance learning and face-to-face teaching, but is best suited to the development of 'hard', technically oriented, project management skills than 'soft' interpersonal skills.

A decade ago 'multimedia' was the buzz word in the computing world. At the time, academics were predicting that such technology would revolutionise teaching, releasing the tutor from the lecture theatre.¹ The vast majority of courses were largely unaffected by such 'technological wizardry' due, primarily, to the high costs associated with computer-aided learning development. Today, however, there is an abundance of authoring packages² and many affordable off-the-shelf educational multimedia products³ from which to choose. Moreover the internet, once the preserve of researchers, has become mainstream, finding applications in many walks of life.

A review of project management education literature suggests that there is an increasing interest in 'outreach' or physically remote training and education programmes aimed at satisfying the needs of the lifelong learner. Examples of novel delivery methods abound as academics follow current trends in higher education towards resource-based learning, either in distance learning or supported self-study mode.⁴ Yet there remains doubt as to the extent of computer-aided learning devel-

opment.⁵ Are such initiatives small-scale and isolated examples created by enthusiasts or far-reaching approaches that are common to many programmes throughout the UK?

UK postgraduate course delivery

Recommendations that project management education should primarily be delivered at postgraduate level⁶ prompted a survey of UK-based built-environment masters programmes to establish the nature and extent of course delivery.

The responses of 129 academics (representing the views of approximately 60% of the built-environment courses identified in the *Independent's* postgraduate listings),⁷ demonstrate that the availability of distance learning is small (Fig. 1). Only 14% of courses in the sample were available in distance-learning mode, of which about half used some form of computer-aided learning. The cost of development together with the maintenance and administration of distance-learning programmes were cited as being key issues. But the principal reasons for opposing such development were the perceived

teaching limitations inherent in all forms of distance learning.

The view of one respondent was typical

‘Peer group learning and discussion is vital for the development of understanding and the testing of hypotheses in our field whereas distance learning students learn alone or in partnership with just a tutor. Our students learn from one another face-to-face.’

The implication was that distance learning promoted a bureaucratic mentality that was inappropriate in courses that were intentionally discursive. This study attempts to test this view by examining the experiences of students and practitioners studying project management at a postgraduate level.

Methods and materials

A well-established postgraduate module delivered in part-time mode was compared with a multiple-media distance-learning resource and a new distance-learning project management educational software application (DIME^{PM}) to establish the effectiveness of distributed interactive multimedia (Fig. 2).

Traditional part-time delivery was characterised by seven three-hour taught sessions, which relied heavily on classroom-based, hands-on activities. The multiple-media distance-learning equivalent comprised a one-day induction event where students were introduced to key topic areas and issued with a range of learning resources: printed guides, ‘readers’, videos, audio-tapes and spreadsheet applications. The software package integrated the variety of media on a single CD-ROM and also provided links to a virtual learning environment with on-line learning resources.

Both the outcomes and content in each delivery mode were identical, the distance-learning material having been written by academics and practitioners who contributed to the part-time delivery of the module. In essence the twelve-credit module reviewed key project management tools and techniques—that is, value management, risk management and critical path analysis—and also emphasised the importance of interpersonal skills. Over a

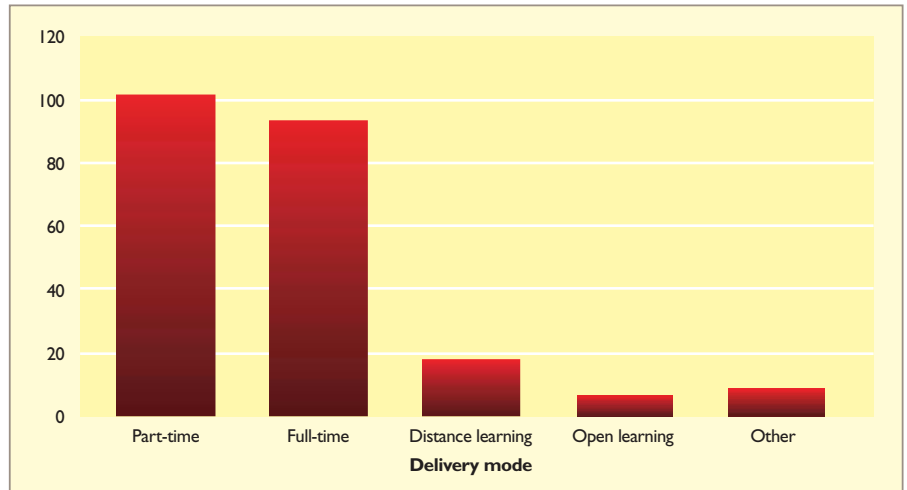


Fig. 1. Responses from 129 UK academics show that distance-learning accounts for only a small proportion of postgraduate course delivery in the built environment



Fig. 2. Project management learning resources: (a) part-time; (b) multiple-media; and (c) distributed interactive multimedia

period of two years the three students undertook the module in different study modes and their experiences and performance were monitored.

Kirkpatrick’s⁸ work provided a useful model for the evaluation of each delivery mode, both from an academic and an industry perspective. The model comprises four levels, namely reaction, learning, application and results. Results encompassed user feedback, learning gain, workplace performance and organisational improvement, and in this evaluation, relied upon a combination of data capture methods to collect the necessary data (Table 1).

In common with other evaluations, however, it became increasingly difficult to collect data in the latter stages of Kirkpatrick’s model and the fourth level was excluded from the evaluation.

Instead an illuminative case study was undertaken so as to collect the views of

The software package integrated the variety of media on a single CD-ROM

Table 1. Data capture methods

Level of evaluation	Data capture method
Reaction	Interest and involvement charts ⁹
Learning	Pre-test, post-test
Application	Self-efficacy
Results	Industry-sponsored case study

practitioners on the organisational impact—that is, results—of computer-aided learning in the workplace. Whereas this might be construed as a break in the cause-and-effect chain,¹⁰ the ethical and logistical problems encountered in determining the extent to which the organisational improvement had occurred were prohibitive.

Findings over two-year period

Reaction

Over the two-year period, 126 students took part in the evaluation of the three delivery modes. Personal interest and involvement was recorded throughout the module via interest and involvement charts

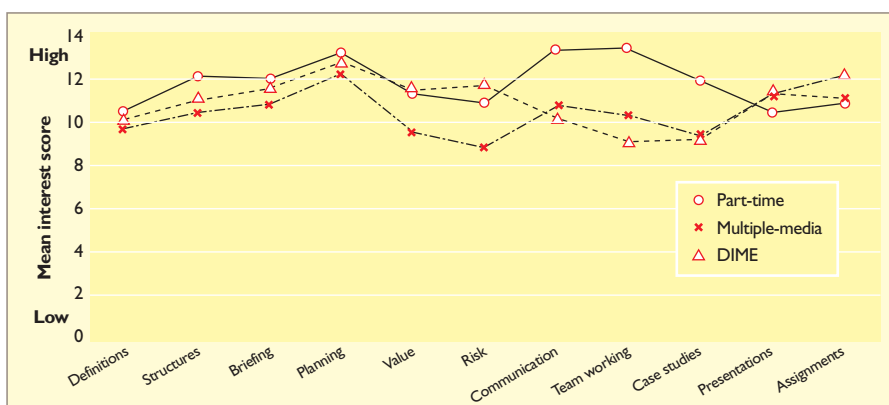


Fig. 3. Interest and involvement chart—technically oriented skills lent themselves to computer-aided learning whereas interpersonal skills were best learnt in part-time classes

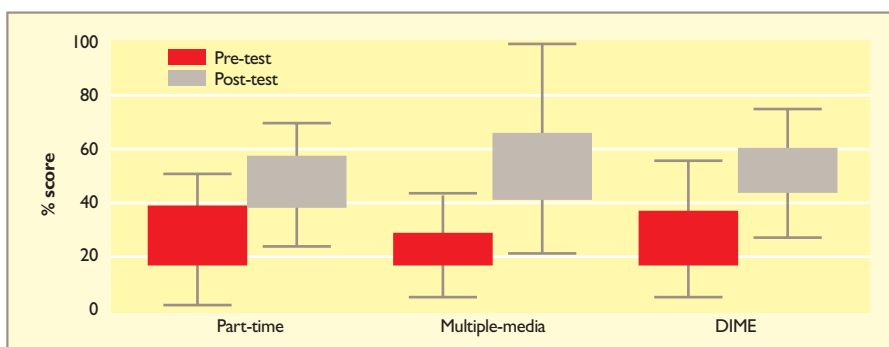


Fig. 4. Learning gain box-plots show little difference between the learning methods

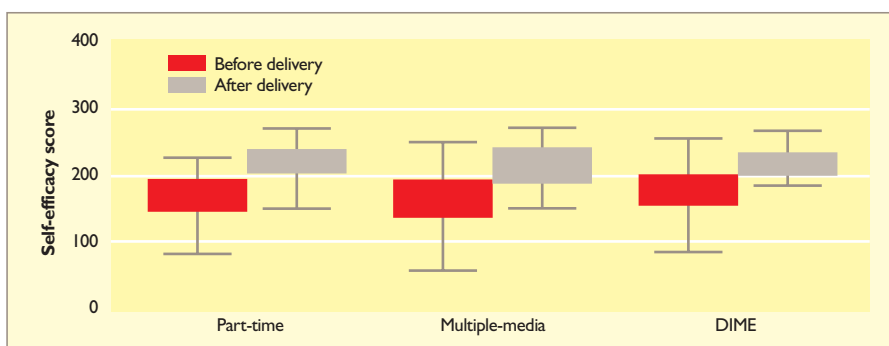


Fig. 5. Self-efficacy box-plots again show learning methods are comparable

which were summarised so as to create a profile of the interest generated by each topic and subsequent assessment (Fig. 3).

The profile suggests that topics related to technically oriented skills lent themselves well to computer-aided learning whereas the softer interpersonal skills were best dealt with in face-to-face class sessions. These observations were reinforced by the comments of students. For example

‘The CPM [critical path method] exercises were really helpful but I question whether communication skills can be developed/improved as part of a distance-learning course.’

Learning

The relative academic performance of students in different delivery modes produced inconclusive results. Fig. 4 indicates the range of pre- and post-module test scores. Although the median performance in the post-test exceeded that of the pre-test for all delivery modes, an analysis of covariance on post-test scores, using the pre-test as the covariate, found there to be no statistical significance in the differential learning gain across the three groups (Fig. 4).¹¹

Application

Self-efficacy, that is the conviction that one can successfully execute the behaviour required to produce outcomes¹²—was used as a quasi-measure of performance (or application). The 34-item scale, derived from the Association for Project Management Body of Knowledge¹³ produced similar results to those obtained for learning gain (Fig. 5). Confidence increased but a Kruskal-Wallis test (i.e. the non-parametric equivalent of an analysis of variance) showed there to be no statistical significance between the groups in the extent of increase in self-efficacy median scores after the module was delivered.

Results (industry case study)

The objective here was to gauge the potential organisational impact of computer-aided learning but, unlike the previous stages of the evaluation model, a quantitative approach was not considered suitable. Hence a qualitative approach was adopted to explore the likely effectiveness of computer-aided learning in an

industry setting. A series of in-depth interviews were held with a small but representative sample of practitioners working for a leading international engineering and project management consultancy listed in the top ten *NCE 2001 Consultants File* 'top firms in building'. The company's management services division, responsible for the management of major construction and infrastructure projects, was keen to take part in the evaluation as a recent staff development programme had prioritised the need to develop similar competencies to those stated in the module specification.

Six participants received copies of the distance-learning software and were allocated four weeks to work through the detailed content and reflect on the assessment tasks contained on the CD-ROM and complementary internet site.¹⁴ On completion of the evaluation period, one-hour semi-structured interviews were held with each participant and transcripts of the interviews were analysed using NVivo data management software.¹⁵ Responses were coded for meaning (Fig. 6), indicating the themes and sub-themes that emerged from the data collected.

Practitioners suggest that the effectiveness of computer-aided learning is dependent upon four key issues

- organisational behaviour
- the individual
- instructional design
- software functionality.

Not surprisingly, the key factors affecting workplace learning are attributed to commercial pressure and the culture within the organisation. Client demands took priority over learning. The opportunity to set time aside, while theoretically possible, seldom occurred due to fluctuations in workload. Therefore, the often-cited strengths of computer-aided learning—access and flexibility—are in practice likely to contribute to its downfall. With no strict timetable to adhere to, learning could and normally would assume second place in day-to-day activity. Moreover, use of the CD-ROM during working hours relied upon the organisation's information technology infrastructure and was affected by internet access policy. One practitioner states

'Unless you're extremely well disciplined and you say 'right, nothing between three and five is going to get in my way of this task in terms of training', then I think it's very difficult to concentrate when you are in the workplace.'

Practitioners suggest that successful e-learning relies heavily on individual discipline, commitment and motivation. It has less to do with innate ability. Previous educational experiences and the perceived relevance of the learning material also influenced their responses.

Design of software is crucial

However, the instructional design of educational software is crucial. Responsibility for motivation does not rest solely with the student. The CD-ROM must be lively, have an appropriate mix of activities, provide feedback and contain relevant assessment tasks in an integrated resource.

What is clear from practitioners' comments is that interactive multimedia can offer these attributes, and that users expect computer software to excite them. Interactivity is vital, for without it CD-ROM technology provides little more than a textbook. Feedback is essential, irrespective of the delivery mode, as another practitioner observes

'If you are reading text, you can read it through and you can think

you've understood it. The only way you will know if you've understood it is when someone questions you on it. Therefore the points of learning that you might get out of it on first reading are what you assume them to be.'

Hence it becomes difficult to disentangle the problems associated with computer-aided learning from those of distance-learning delivery. Distance learning, the same practitioner continues

'allows you to reflect after the event but not to ask questions as easily. The disadvantage is that when you're going through distance learning and doing it by yourself ... at the time there is only you to adjudicate whether or not the points that you are picking up are the points that you will be expected to understand from the information presented.'

Moreover, the functionality offered by electronic communication could not, as is so often cited, overcome these problems. Practitioners preferred to discuss issues face to face. Whereas one must be wary of generalising from a limited number of in-depth interviews, a reluctance to use asynchronous and synchronous web-based communication facilities was noted. Perhaps this should come as little surprise, however, where no clearly definable cohort or group exists with whom to communicate. Certainly tutors must facilitate such

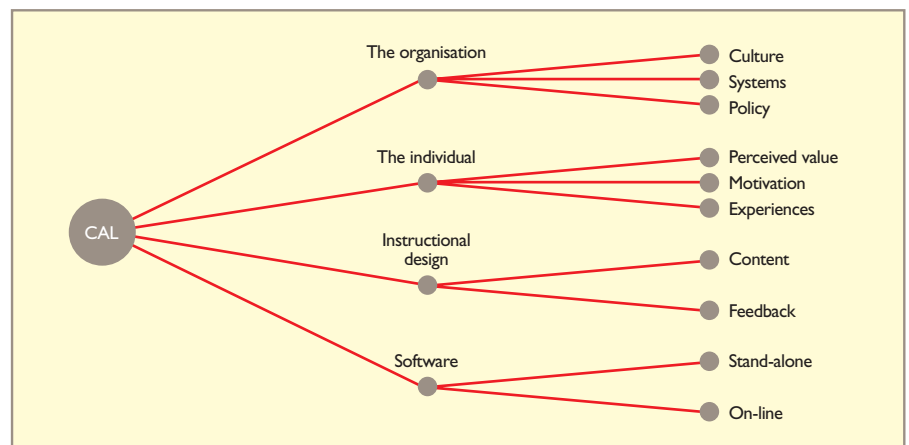


Fig. 6. Themes that emerged from analysis of practitioners' responses

communication and ensure that all those who are taking part in the training programme have previously met.

In essence what is being advocated is a combination of delivery methods, and in subsequent discussions with the company's management it was agreed that, in order to deliver project management training, a variety of delivery formats should be utilised. Less emphasis should be placed on electronic communication and the design of such programmes should be encapsulated within an overarching training strategy that is owned by all participants.

Conclusion

The longitudinal evaluation found that there was no statistical difference in the performance and confidence of students in the computer-aided learning, multiple-media and part-time groups. Not unexpectedly, student learning and application increased in all delivery modes on completion of the module. Furthermore, the reaction of students to novel technology-based educational software mirrored the sentiments of practitioners working in industry.

Project management is a challenging subject to deliver, not least because of the wide variety of skills and knowledge it embraces. Therefore, it seems quite natural that an equally diverse range of delivery techniques should be employed. Distance learning in either a multiple-media or computer-aided learning format cannot alone overcome the difficulties of isolation and lack of motivation.

Contrary to the conventional view that computer-aided techniques enhance learning, by offering increased access¹⁶ and flexible study, the findings of the evaluation suggest that these so-called benefits may in fact allow users to prioritise other commitments at the expense of study. Distance learning, whether in multiple-media or computer-aided learning format, requires a high level of self-discipline and to be successful must be underpinned by readily available tutor support. Based on the experiences of the practitioners in this evaluation, if web-based conferencing facilities are to overcome these problems, it is essential that a readily identifiable cohort, or set of students, must exist and that such dia-

logue forms an integral part of the learning programme. Users must appreciate the benefit of entering into discussion and tutors, accordingly, must create tasks that encourage debate among peers.

The success of computer-aided learning also relies on its ability to interact with the user. It is insufficient merely to enhance text-based material with flashy graphics and coloured backgrounds. True interaction relies on creative and often complex programming routines that are inevitably resource intensive. There is a real danger that academics and trainers, looking to CD-ROM technology and the internet for solutions to their delivery problems, will have insufficient time or funding to do little more than convert existing resources into dull and ineffective web-based learning materials.

Part-time study, distance learning and computer-aided learning should not be viewed as mutually exclusive delivery modes. Each mode has its strengths, be it the currency of internet-based information or the interaction between participants in face-to-face discussion. The mix adopted on any project management course or training programme must, therefore, accommodate the needs of both the organisation and the individual, and be closely aligned with the outcomes of the study programme.

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