

Demand-led e-learning and the elusive total solution

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Abstract

Demand-led learning offers resources to learners when they want them; total solution learning takes the learner from induction to final accreditation through a seamless process. The University of Southampton attempted to deliver basic information technology skills through the support of these processes. Steps in the seamless process were designed, developed and implemented. Face-to-face intervention was eliminated, apart from initial learner induction and online-test invigilation. Feedback loops were planned so that success (eg, in completing the accreditation) might encourage further success through collaborative and competitive peer learning. Critical dependency issues arose whilst implementing the solution. When learning delivery was disrupted by systems failure, the indirect effects on learner motivation and resourcefulness proved as damaging as system breaks themselves. This made the institutionalisation of the learning elusive, but key areas have been identified for further investigation.

Introduction

In the 1960s, programmed learning promised the 'total solution'. Through a step-by-step process delivered by machine or by paper, not only were the high costs of face-to-face teaching were to be eliminated but learner-centric, demand-led learning was also to take place (Skinner, 1954, 1958). The learners were to be in charge, with teaching (ie, the programme) available at their convenience and not the other way around.

The reality never quite matched the vision. There was, first of all, overoptimism with the model of human learning (McKeachie, 1974). Secondly, there was a lack of infrastructure, with paper-based administration clumsy and a machine base (of computers, networking, directory services, etc) non-existent. There was no way that economies of scale could be achieved.

With the rise of the global e-infrastructure—in particular, of the Internet—the picture changed. A brief look at <http://www.google.co.uk> indicates over 4 billion web pages searched, and with a lot more in existence, one can be assured of an Internet-ready workstation base in the millions. Through e-business, e-entertainment, e-government and many other initiatives, the e-infrastructure is now a given so that investment made for other purposes has introduced spare capacity that can be easily turned to learning purposes at no apparent cost. Today's total solution, therefore, consists of an Internet portal, with courseware and other components built in. From behaviouristic models of individual learning, theory has shifted towards models of large-scale Internet-mediated communal learning, backed up by notions of community of practice (Stacey, Smith & Barty, 2004; Wenger, 1998), organisational learning (Remedios & Boreham, 2004) and peer-directed teaching and learning activities (Biggs, 2003).

For the purposes of this paper, courseware and testware refer to specific, commercially available packages for learning and testing respectively, delivered and monitored through commercial portals. 'Testing' refers to candidate testing for each learning module, occasionally referred to as 'real testing' to distinguish it from practice (mock) testing. It should not be confused with 'system testing', which means investigation of a computer system.

This paper offers a case study of how basic information technology (IT) computer skills learning resources were delivered in an integrated modularised, flexible, demand-led e-learning programme for staff (and a few students) within a large UK higher education institution. It offers, first, the optimistic plan for large-scale learning, testing, administration and accreditation—the total solution. It then explains failings of implementation, suggesting that in a multicomponent system, the business-process chain that contains human learners as well as computing machinery must remain unbroken. Isolated technical faults and difficulties can compound not only technically but also in terms of enthusiasm, motivation and resourcefulness of learners as well.

Background to the project

The subject of this case study is a programme of staff training at the University of Southampton, an institution of about 35 000 staff and students on the south coast of England. The topic of the training was e-literacy, accredited through the European Computer Driving Licence (ECDL). This is a modularised accreditation consisting of seven modules of study: basic concepts, file handling, word processing, spreadsheets, databases, presentations and the Internet. It is also flexible, in that modules can be tackled in any order and at any convenient time within a 3-year period. The ECDL (<http://www.ecdl.co.uk>) is controlled in the UK by the British Computer Society (BCS).

The programme at Southampton was additionally demand led, through self-directed 'anywhere, anytime' workstation-based simulation learning and automated web-based testing. Flexible learning methods were allied with a flexible accreditation scheme, with face-to-face sessions essential only for learner induction and invigilated tests.

Practice tests (mock tests) that were equivalent to real tests in both content and presentation were also provided which could be used alongside courseware. These indicated preparedness for tests, in terms of both skills and confidence, and some of our later invigilated test sessions—pedagogically very effective—involved practice, followed by real tests.

The aim of the programme was to take 500 university staff through the ECDL over an 18-month period, in particular targeting manual and non-office-based staff. The ECDL (or a suitable similar alternative) was potentially to become a baseline for e-literacy for all staff and students across the institution.

As with other literacy campaigns, a number of peer effects (Biggs, 2003) were sought. There might be collaborative candidates who would learn together, and competitive candidates who would seek success before others. Feedback, at the individual, group and university level, was planned to encourage peer effects and to promote communal learning. Managers could also receive feedback and become part of the overall communal learning process.

E-infrastructure in the form of institution-wide data networking, public workstations and directory services was to play a key role through the following functions:

- Internet-ready, web-based delivery of learning resources, testing and administration;
- personal computer (PC) workstation access through centrally provided 'public' workstations;
- security control through central authentication servers (enabling single username/password to all services, not just ECDL applications);
- database links to central staff/student records for progress reporting and evaluation

The planned total solution

The notion of total solution (or 'complete solution') has been touted by ECDL product suppliers for some years. Originally, it meant collaboration between separate courseware and testware (assessment software) suppliers. Subsequently, companies that supplied both courseware and testware arose, as a result of the concept.

The concept was extended at the University of Southampton to include administrative components (eg, learner monitoring) and complete web delivery (of courseware, testware and administration). Additionally, authentication was built into the system so that learners and test candidates could use standard university usernames and passwords (through Lightweight Directory Access Protocol). An automated upload of test

results was built in so that paper administration of tests was eliminated (save for the accreditation certificate itself).

The major components of the system are described below.

Pricing agreement negotiated through Eduserv

The project launch was preceded by a pricing negotiation that was carried out through Eduserv (<http://www.eduserv.ac.uk>), a charity that negotiates educational pricing deals. The deal, with the British Computer Society and product suppliers, was not only about pricing but also about taking advantage of university infrastructures. The features included 'paperless' logbooks, with module test results recorded online instead of on paper and testware supplied on a site licence rather than on a per-test basis.

Recruitment and publicity

A colleague from the University's Human Resources Department promoted the ECDL as part of ongoing staff development work. Seminars were run for the staff and their managers. Bulletin articles were released, and a website was set up (that was both publicised and linked to learning resources.)

Accreditation—the ECDL

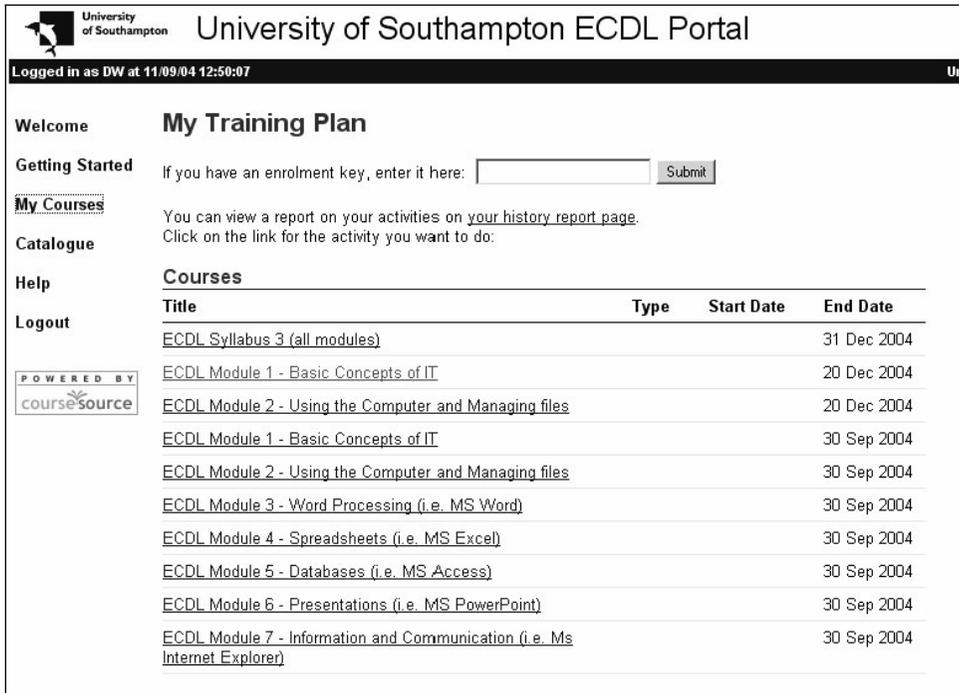
The ECDL was conceived by the Finnish Computer Society and launched in the UK by the British Computer Society in May 1998. It is an international accreditation, run by the ECDL Foundation in Ireland that has to date established over 3 million registrations not just in Europe but on other continents as well through the International Computer Driving Licence. International recognition was a key factor for an international institution like the University of Southampton.

Its modularity and flexibility was well suited for a total solution but brought other precedents with it as well. Most importantly, it has established a commercial marketplace in its courseware and testware and more recently, in candidate administration products as well. Many of the systems features sought for Southampton were already in existence.

The accreditation is not product specific. In recent years, however, the market predominance of Microsoft (MS) products has meant that MS Windows, Office, Explorer and Outlook (including Express) have become de facto content standards within commercial courseware and testware. The Southampton University was an MS customer so this was not a problem.

The learning portal

The Southampton solution used a learning portal developed by Course-Source Ltd delivering courseware developed by Advance Learning Ltd and practice tests developed by NCC Education. It offered learning through a single web portal personalised by standard university authentication. Login enables access to personal progress records, as well as learning material (Figure 1).



University of Southampton ECDL Portal

Logged in as DW at 11/09/04 12:50:07

Welcome **My Training Plan**

Getting Started If you have an enrolment key, enter it here:

My Courses You can view a report on your activities on [your history report page](#).
Click on the link for the activity you want to do:

Catalogue

Help

Logout

POWERED BY courseSource

Title	Type	Start Date	End Date
ECDL Syllabus 3 (all modules)			31 Dec 2004
ECDL Module 1 - Basic Concepts of IT			20 Dec 2004
ECDL Module 2 - Using the Computer and Managing files			20 Dec 2004
ECDL Module 1 - Basic Concepts of IT			30 Sep 2004
ECDL Module 2 - Using the Computer and Managing files			30 Sep 2004
ECDL Module 3 - Word Processing (i.e. MS Word)			30 Sep 2004
ECDL Module 4 - Spreadsheets (i.e. MS Excel)			30 Sep 2004
ECDL Module 5 - Databases (i.e. MS Access)			30 Sep 2004
ECDL Module 6 - Presentations (i.e. MS PowerPoint)			30 Sep 2004
ECDL Module 7 - Information and Communication (i.e. Ms Internet Explorer)			30 Sep 2004

Figure 1: The learning portal after login

Access was restricted to enrolled learners, but any member of the University with a valid username and password could log in to see a courseware demonstrator. Learner enrolment involved a tutor-led, face-to-face induction session in which enrolment codes were issued. An estimated 80 hours of work is required with courseware to achieve the ECDL, but this figure would go up or down, according to prior experience.

The administration portal

Administrators could log in to a portal with special usernames and passwords. This portal allowed access to individual learner records (Figure 2). It also generated group reports.

The testing portal

Another portal delivered testware developed by NCC Education that chose the question stream, recorded candidate response, marked the response and recorded results. The portal was protected by special invigilator usernames and passwords, with login to identify the candidate (Figure 3). Like the learning portal, the testing portal delivered on demand but could only be used with an invigilator present.

Show exam history for group Enrolled [Enrolled]

[Click here](#) to download this report as a csv file.

Select users per screen:

The following is the group's exam history:

showing results 1 to 25 of 396 [Next 25](#)

UserID	Course Title	Start Date	Last Accessed	Attempts	Max Score
ecd1 (ecd1)					
	Database (using Access 2000)	25 Jun 2004	30 Jun 2004	14	100 %
	Using the Computer and Managing Files	28 May 2004	28 May 2004	1	13 %
	Word Processing (using Word 2000)	23 Jun 2004	10 Aug 2004	2	0 %
as1303 (Abid Sabir)					
	Presentation (using Powerpoint 2000)	10 Feb 2004	10 Feb 2004	1	100 %
	Basic Concepts of Information Technology (IT)	22 Oct 2003	22 Oct 2003	1	100 %
	Information and Communication	22 Oct 2003	28 Oct 2003	3	100 %
	Word Processing (using Word 2000)	21 Oct 2003	21 Oct 2003	3	90 %
	Spreadsheets (using Excel 2000)	21 Oct 2003	21 Oct 2003	3	100 %
agc (Adam Corres)					
alh1 (Adam Hill)					
	Spreadsheets (using Excel 2000)	3 Dec 2003	3 Dec 2003	2	80 %
	Word Processing (using Word 2000)	18 Nov 2003	2 Dec 2003	2	70 %
	Information and Communication	5 Dec 2003	9 Dec 2003	3	73 %
	Using the Computer and Managing Files	24 Nov 2003	2 Dec 2003	3	13 %
	Basic Concepts of Information Technology (IT)	12 Nov 2003	10 Dec 2003	43	100 %
ac13 (Adelle Chapman)					
	Word Processing (using Word 2000)	19 Apr 2004	22 Apr 2004	4	90 %
	Information and Communication	31 Mar 2004	7 Apr 2004	4	93 %
	Using the Computer and Managing Files	31 Mar 2004	7 Apr 2004	2	87 %
	Basic Concepts of Information Technology (IT)	28 Apr 2004	28 Apr 2004	1	75 %

Figure 2: The administration portal, viewing practice-exercise progress data

Learner registration on the learning portal automatically transferred to the testing portal. An administration section within the testing portal allowed administrators to view and adjust records (Figure 4). About 40 minutes is offered for each module test.

Data networking across the campus and beyond

The University connects through a high-speed campus network protected by a university firewall to the Joint Academic Network, which in turn connects to the commercial Internet. These networks are nowadays often taken for granted, but they nevertheless represent a cost—both in opportunity and overhead—in particular when reliable, accurate delivery must be assured, as it is when tests and accreditation are involved.

Staff learning from home used either dial-up networking or asymmetric digital subscriber line (ADSL) broadband privately. Cost reimbursement to learners was considered but not implemented, as the staff did not complain about costs.

The screenshot displays the 'NCC Testing Portal' interface. At the top, the title 'NCC Testing Portal' is centered. Below it, a dark grey bar shows the date and time '11/09/04 12:51:33'. The main heading is 'Test Selection and Launch'. Underneath, the text 'To launch a test' is followed by a numbered list of four steps: 1. Select the Test to be taken, 2. Enter the Invigilator's User ID and Password, 3. Enter the Candidate's password, and 4. Click Start Test. A central box contains the candidate's details: 'Candidate Name' is Denis Wong, 'Log Book' is XX99990000001, and 'Syllabus' is a dropdown menu set to 'Syllabus 3'. Below this, the 'Module' section lists seven options with radio buttons: 'Basic Concepts of IT', 'Use PC and manage files', 'Microsoft Word 2000', 'Microsoft Excel 2000', 'Microsoft Access 2000', 'Microsoft Powerpoint 2000', and 'Information and Communication'. At the bottom, a dark grey bar contains 'Invigilator Logout' on the left and 'Invigilator: Denis Wong' on the right.

Figure 3: The testing portal, test choice

Access through university public workstations and office workstations

Southampton, like many other universities, maintains PC public workstations, some available 24 hours a day. Southampton has about 1600 distributed around its campuses and in locations up to 30 miles away. Provision, through standard university usernames and passwords, is aimed mainly at the students, but members of the staff also have access. These played a role in offering portal access to learners who did not have their own machines at home or in the office. They also had a role as a baseline machine on which product testing and maintenance could take place.

The latter was of particular concern for testware, where locally installed support files were needed by the product. Bugs and incompatibilities in these files needed to be corrected.

Local information

Login identified individuals uniquely, hence linking the individual to university data records. This enabled a personalised welcome to both learning and testing materials.

Menu Item	Description
Help	Use this option to access the online administration manual
Users	Find/Add/Edit/Delete Users
Tests	Find/Add/View Test Results
Test Centres	Find/Add/Edit/Delete Test Centres and locations
Reports	View/export reports

Figure 4: Test-portal administration

Additional personalised information was required, and this was gathered through locally produced authenticated web forms. These included a precourse questionnaire (to investigate prior experience), a learning contract (to indicate current learning goals), a postmodule questionnaire and a postcourse questionnaire. Data were gathered and stored locally, and downloads from the central portals enabled querying across tables (eg, to offer progress data by department).

Test booking was also carried out with a web form, offering a choice of preset invigilated sessions (Figure 5).

Local support

Whilst young children may be able to pick up IT skills and self-teach through ‘minimally invasive education’ (Mitra, 2003), this ability was not assumed for the adults learners whom we were dealing with. A tutor-led pre-ECDL course was designed for learners who lacked confidence. The building of resourcefulness (or gumption—see below) was a key part of this course, so that learners could then independently learn (or failing that, learn with peer support).

Other support was aimed at handling specific learning issues but also at engendering peer effects (Biggs, 2003). Hence, motivation was to be generated through organisational learning (Remedios & Boreham, 2004). An online community of learning was encouraged to sit alongside existing communities of practice (Stacey *et al.*, 2004; Wenger, 1998). Within an office environment, for example, where a local MS Office might exist *anyway*, more formal and/or extensive arrangements of swapping hints and tips could arise. Hence, volunteer ‘departmental training advisors’ (DTA’s) were

ISS - Test Booking System - Microsoft Internet Explorer provided by University of Southampton

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Print Mail News RSS Feeds

Address <http://www.iss.soton.ac.uk/landt/skills/ecdl/testbooking.php> Go Links

information systems services

Webmail I-Zone Subscribe Help

Search for

Advice & Support

Your Account

Computing

Corporate Services

Media & Design

Telephones

Facilities

About ISS

Staff Only

Click to change fonts/colours

ISS - ECDL Test Booking System

Welcome Denis Wong

The form below will allow you to select from a number of tests. If no tests are visible in the list, then there are no spaces remaining in any scheduled tests. Note that test sessions are one hour in duration and so only one test can be taken in each session.

Please only select a test for the version of Office (either Office 2000 or Office XP) that you have been using during your study of the courseware and practice tests.

Please select the test you wish to book for:

Username:

Confirm your test booking by clicking Submit.

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Figure 5: Test-booking form

appointed to receive group progress reports and report back on issues. The voluntary nature led to difficulties (of even appointing in the first place), but the concept worked well in at least one department.

The 'phone around' was a regular call to each enrolled learner by central support that was an affirmation of an individual's progress but also (by implication) a reminder that others were moving forward, and that we were taking the individual's needs into account. It was recognised that complex interactions took place amongst e-learners (such as those described by Boddy & Tickner, 1999), and individual learning styles (Holt, Oliver & McAvinia, 2003) needed to be taken into account.

Further communal effects were intended through an institution-wide publication of results. The first successful ECDL candidate was reported in the University bulletin.

Accreditation

The test results were automatically uploaded from the testing portal to the British Computer Society (BCS) candidates' database. Certificates were automatically posted by

the BCS. Apart from this and the occasional audit, no manual intervention was required.

Results

Recruitment

Three hundred forty-one learners enrolled, a figure achieved largely through one recruitment drive (University bulletin, Human Resource Department promotion, email and web publicity) with a few targeted departments (Library, School of Nursing and Midwifery, and Business Services) approached through management. The cascade effect was quite strong, both within departments and across the university, with early adopters persuading others to join.

Each learner was asked to fill in a web-based precourse questionnaire indicating that 240 were full time, and 101 were part-time. Staff grading, self-assessment of prior skill level and personal objectives are reported in Tables 1–3 below.

The majority group in Table 1 possibly reflects self-selection and cascading. Clerical staff, whose work involves frequent communication, may have good social networks. The academic category includes academic-related staff, including many from the Library. ‘Other’ includes a group of premedical students.

Table 1: Recruitment by grade

Academic	79
Clerical	181
Manual	22
Technical	19
Other	40

Table 2: ‘Roughly, how would you describe your computer skills?’

Excellent	41
Good	133
Room for improvement	156
None	11

Table 3: Personal learning objectives (mentioned in free text comments)

Qualification	87
Skill	114
Knowledge	45
Work	19

Table 2 shows that for many learners, it was a case of supplementing and/or affirming existing skills. The learning topic, e-literacy, was offering a unique opportunity with many learners sufficiently skilled to take advantage of e-learning but appreciating the incompleteness of the learning that they already have.

Table 3 supports the above interpretation, showing that the qualification was important. The achievement of skills, however, was the main aim and indicates some expectation that structured online learning was better than unstructured learning on the job.

Courseware

Over 9000 hours of courseware usage had been recorded towards the end of the project, averaging about 27 hours per learner. Three thousand three hundred fifty-four practice tests had been run, averaging about 10 tests per learner. These figures do not necessarily correlate to learning, not least because machines could have been inadvertently left logged on, and practice tests could be aborted immediately after start. There is little evidence of the former but some evidence of the latter (in low completion rates).

Testware

NCC Education supplies ECDL in-application testing, which means that skills testing takes place within the real package (eg, MS Word) rather than within a simulated environment. It therefore not only delivers and monitors through the standard operating system; it does so through the package as well. The key advantage of this is validity; the test environment is real, not an artificial simulation. The disadvantages are sensitivity to locally installed (or not installed) components and difficulties in acceptance testing.

These led to a number of 'false starts' with testing roll out, as problems were traced back from the remote server through the network to the locally installed components. The major implication of these false starts was a 'stop-start' scenario, with the effect of each 'stop' described below.

A comparison of how testware performed is in formally recorded problem reports to the information systems helpdesk, the ServiceLine. Out of 145 problems marked as ECDL related between July 22, 2003 and July 31, 2004, 56 were related to testing (out of over 16 500 recorded for all services, for example, including email). This compares to nine problems related to courseware. Testware (including practice test) problems were also more long-standing, and the human cost of a failed test (eg, a technical failure to record a result) was far greater than the cost of failed courseware (see below).

By the end of the project, 807 tests were successfully passed, with a further 189 failed, out of an intended figure of $500 \times 7 = 3500$ successful tests. However, 208 of these tests (166 pass, 42 fail) were successfully delivered within a 2-week period towards the end of the project to demonstrate that, by extrapolation, the original target was feasible.

Importantly, delivering those tests involved not just technical fixes but also support of learners. A phone around (see above) was required to motivate learners to come forward for testing.

Administration

Progress data were gathered, and both local and remote reporting tools were used to summarise data. This was used for direct feedback (eg, in the phone around) and for DTA feedback. It was also intended for wide publicity, to promote peer effects (see above), but testware problems led to time constraint and insufficient numbers.

Postmodule evaluation

After each successful module test, the candidates were asked to fill in a web-based postmodule form (Table 4).

The skew towards the positive may be expected, because these were successful candidates. Some positive comments were

- ‘Some excellent practice exams’
- ‘The course material was very good, but it would not have been as easy without the help of the support team’
- ‘Course material laid out well. Difficulty in accessing (practice) tests at home or office, but spoke to (support staff) and know what to do’.

However, many comments, in particular those who indicated ‘poor’ were telling. For example,

- ‘I found following this module particularly difficult, and it did not help that the practice test was not working properly’.
- ‘The first time I took this test it did not calculate my score. This was very demoralising and did not leave me with much confidence and so I got very nervous before this test’.
- ‘ECDL on the whole has been very disappointing. The course instructions are not relevant to the tests, I have not been able to access the practice tests, the exam questions are poorly written and unclear’.

Postcourse evaluation

Twenty-four out of 66 returned the postcourse evaluation form, for the candidates who had completed the ECDL. Table 5 indicates how the candidates rated aspects of the course.

The candidates also rated access to learning materials (Table 6).

Table 4: ‘How useful was the content in helping you to pass the test?’

Very good	265
Good	188
Fair	70
Poor	10

Table 5: Rating of aspects of the course

	<i>Very good</i>	<i>Good</i>	<i>Fair</i>	<i>Poor</i>	<i>Very poor</i>
Publicity	4	15	5	0	0
Induction	13	11	0	0	0
Content	9	12	3	0	0
Presentation	12	11	1	0	0

Table 6: Rating of access to learning materials

Very easy	6
Easy	14
Difficult	4
Very difficult	0

Positive comments were about the support staff:

- 'The ECDL staff were wonderful!!!!'
- 'I would like to thank the team for being friendly and patient!'

Online learning did not suit some:

- 'I had difficulties with the Access module and would not have passed without getting some books from the library'.
- 'Coursework needs to be accessible in other media (eg, a book!) as the software was too slow for anyone but a complete beginner. Also it makes it difficult to review a small part without having to go all the way through the module. Most people could actually skim through a module very quickly to see what they already know or need to learn'.

Technical problems were noted:

- 'There were also problems with the marks of some of the tests but on the whole I enjoyed the course and think that I have learned from it'.
- 'Not having access to practice tests from office was not good. It was not that difficult to find a public workstation, but the easier access is the more likely people will complete'.
- 'Sometimes frustrating not being able to always access practice exams, the course material generally good although slightly repetitive eg, how to save and load was repeated in each module although I understand why. Overall I enjoyed doing the course and I would be very interested in the (ECDL) Advanced level'.

The elusive total solution

There was a great deal of technical detail to report, but this paper will instead concentrate on their effects. The total solution was, after all, more than just a technical implementation.

In particular, we concentrate on the idea of ‘flow’, a state under which ‘people become absorbed in their activities’ (Konradt, Regina & Hoffmann, 2003). It is ‘...a state of experience which is characterised by an experience of intense concentration and enjoyment’ and ‘subjects spend three times more time in flow at their work place than during leisure time’.

It is a concept that can be particularised to specific tasks, like browsing the Web. We, on the other hand, generalise it to mean any activity (narrow or broad) that gets severely damaged by an uncontrollable delay or break in the business-process chain.

The interrupted business-process chain

In the case of the total solution, the chain consisted of

- recruitment—involving bulletin articles, email mail outs, talks to management of learners;
- induction—involving a face-to-face tutorial and associated booking and scheduling;
- learning—involving access to courseware and support of learning;
- practice testing—to build up preparedness, including confidence and affirmation;
- test—involving web-based booking and invigilated testing;
- accreditation—involving automated data upload and response from the accrediting body; and
- feedback and motivation—involving publicity about success, through the same media used in recruitment.

The strength of the Southampton total solution was that most of this was web based and available just-in-time, anytime, anywhere. Hence, it was possible to capitalise upon

- enthusiasm to learn (with courseware) after initial registration;
- desire for affirmation (with practice tests) after module learning is complete;
- motivation for testing (with real tests) after affirmation is achieved; and
- desire for reward (through accreditation) after all module testing is complete

until of course, a link in the chain gets broken, and the ‘flow’ is disturbed. Under such circumstances, it is not surprising that comment is polarised between very positive and very negative (see above), especially because peer effects, deliberately nurtured, were now also working in reverse.

Specifically, if practice tests were not working, there was no learning affirmation to learners and therefore, there was low turnout for real testing. If real tests were not working (or learners were not coming forward, because affirmation was missing), then hours of learning was atrophying with each passing day. Added to this were imperfect communication channels, so when products were finally fixed and made to work, the response from learners could not be immediate. It took time for negative peer effects to turn back into positive peer effects.

In traditional face-to-face teaching, we may take for granted and/or fail to notice such effects; most likely, we correct them before they cause damage (consciously or not). We

cannot afford to do this in total-solution e-learning. Technical faults have an obvious immediate effect but also a long-lasting ripple.

Gumption, gumption traps and the learner experience

The notion of 'gumption' may illuminate the ripple effect. The term was used by Pirsig (1974), and he states:

If you're going to repair a motorcycle, an adequate supply of Gumption is the first and most important tool. If you haven't got that you might as well gather up all the other tools and put them away, because they won't do you any good.

Shepherd and Wong (2001) apply the notion in an educational technology context:

There is little doubt that learners' capacity for enthusiastic enquiry is a finite resource. We maintain that many aspects and attributes of learning technologies are Gumption Traps that deplete this resource.

In the context of the project, there were gumption traps clearly tied to specific events. For example, learners may have spent many hours preparing for the test. They may already have been nervous coming to a test (many having come from non-office backgrounds), and to then suffer a technical failure may have been particularly galling, especially if the failure occurred towards the end of the test. No result is recorded, and their effort is lost.

There were also gumption traps less easily monitored but nevertheless discernible. For example, to receive news that a testing module was not working and not be available for several weeks does not inspire confidence. Although there are other modules to do, the chances of a learner taking up that alternative challenge may not be great.

Gumption traps damage flow, affecting both the individual and the group.

Inadequate seamless empathy

According to Goleman (1999), 'Beyond mere survival, empathy is critical for superior performance wherever the job focus is on people', no more so than in a demand-led total-solution e-learning project. This must clearly be the case for frontline support staff; it may also be needed for back-end technical support staff as well.

Problem prioritisation must reflect the learner experience, which exists beyond the delivery of content to any particular screen. Support staff may perceive an event as a minor technical problem, but for a learner, it may be much more. It is the meanings and interpretations *constructed* by the learner—part of the learning flow experienced by the learner—that are disrupted.

Seamless empathy grew as the project progressed, after an on-site visit by the testware supplier's representative. Once a scenario (eg, of panic) is experienced, an individual is able to pass that onto colleagues. Repeat scenarios may then be communicated seam-

lessly from delivery site to support base, by telephone or email. Measures were taken, including the means to shorten the time taken between report and fix, and problems were eventually resolved.

Unfortunately, the project time lost could not be recovered.

Conclusions

Whilst testware was a key point of failure in this project, we should not let it distract from the primary focus, that of whole-system reliability delivering widespread, continuous organisational learning.

Signs of this were brief and isolated but optimistic. For example, amongst a subgroup of 15 non-office-based Business Services Department staff (out of a total of 46), there were 41 module passes, 2 completions and 14 failed attempts. The candidates often turned up to take the same tests together, suggesting that collaborative learning may have taken place.

The situation was not dissimilar to that of the UK e-University whose executive officers complained (House of Commons, 2004a) that the project was curtailed at the very point when success was around the corner. Their view was clearly at variance with project sponsors (House of Commons, 2004b), and although our sympathies might lie with the executive officers, clearly, there are still questions about what, *precisely*, was around the corner. With the Southampton project, for example, although testware problems were eventually resolved, the introduction of a new ECDL syllabus and the University's move from MS Office 2000 to MS Office 2003 brought subsequent problems of courseware supply. The fixing of one key business-process link may not be the end of it, because around the corner, another one might be broken.

Alexander and Hedberg (1994) identify four phases within an integrated e-learning evaluation framework: design, development, implementation and institutionalisation. The final stage—institutionalisation—remains elusive, but this project has identified specific areas to look to in achieving that final stage. We should not, we believe, abandon the total solution. We should look to further work in the areas of

- critical factor analysis—how do we translate hindsight into foresight? How do we anticipate problem areas, so that adequate preparation and resources can be allocated?
- risk management—how do we define, assess and describe the risks, such that these may be shared openly with project sponsors?
- whole-system integration—how do we integrate not just system components but support systems as well, such that, for example, technical-fix priority reflects learner experience?
- courseware and testware accreditation—how can accrediting bodies encourage and ensure the quality that the total solution demands?
- workplace practice—how can managers (and other stakeholders) be encouraged to get further involved in organisational learning and to become part of the total solution?

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