Chapter 3
Impacts on teaching and learning

This chapter explores how institutions perceive the pedagogic impact of e-learning and how they are trying to enhance it. The "learning object" model, perhaps the most prominent revolutionary pedagogic approach of e-learning to date, is given a special focus.

The pedagogic impact of e-learning is one of the key topics interesting researchers, practitioners and institutional managers. What do we know about it? This chapter explores how institutions perceive this and how they are trying to enhance it. What are the perceptions of the pedagogic impacts of e-learning? Do institutions offer students special assistance to enhance the possible impact of e-learning? Is pedagogy developed and delivered centrally or locally? The first part of the chapter addresses these questions (3.1-3.3). The chapter then focuses on one of the emblematic features of e-learning, which could potentially revolutionise teaching and learning: "learning objects". Learning objects are electronic tools that can be used and re-used in different contexts, for different purposes and by different academics (3.4). The survey reveals that institutions pay much attention to learning objects, although they still consider them as immature tools. Some of the challenges of the further advancement of the "learning object economy" are also highlighted, especially intellectual property issues (3.5).

3.1. Pedagogic impact (Questions 4.1 and 4.5)

All the 19 institutions participating in the OECD/CERI survey reported "positive" impacts of greater use of e-learning on teaching and learning while five institutions also addressed some concerns. The Observatory survey asked respondents to express an opinion on how online learning will enhance on-campus learning over the next five years. The overall average return was 1.8 (only six institutions disagreed), suggesting a generally positive view of the pedagogic potential of e-learning over time, at least on-

campus. More generally, there are various examples of tools and criteria used to evaluate the pedagogic effectiveness of e-learning provision.[1]

Few OECD/CERI respondents were able to offer detailed evidence of the positive pedagogic impact. Different respondents answered this question in different ways. Some referred only to the findings of formal research into the pedagogic impact of e-learning (or its absence to date), while others cited anecdotal/indirect evidence and impressions (*e.g.* invigoration of teaching and learning strategies, rates of student and faculty satisfaction, greater flexibility in learning delivery, better communication, and comparable retention rates and grades between face-to-face student and online students).

This analysis is first and foremost an account of the answers respondents gave to the question, and situations pertaining at their respective institutions. The task is then to compare this account with other literature.

Positive pedagogic impacts from e-learning

It would be misleading to imagine that only the institutions listed below under each sub-heading held the views expressed. Far more likely is that certain perceived pedagogic benefits of e-learning (*e.g.* flexibility of access, enhancing the value of face-to-face delivery) are commonly held within institutions worldwide. The comments below largely reflect varying interpretations of the question (*e.g.* formal versus informal evidence) and the nature/experience of e-learning at the institution concerned.

Respondents reported a range of positive pedagogic impacts from e-learning.

Specific techniques

It is fair to say that almost all respondents to the OECD/CERI survey made at least some reference to learner-centred pedagogy, using terms such as non-didactic, constructivist, story-based, problem-based, etc. However, few institutions commented in detail on the ways in which teaching and learning techniques/impact had changed by means of e-learning.

1. "Online Course Development Guidelines and Rubric" produced by the Michigan Community College Virtual Learning Collaborative (*www.mccvlc.org/~staff/Course-Guidelines-Rubric-v1.2.html*); University of Maryland's "Peer Course Review for Online Teaching Rubric" (*www.University of Maryland University College.edu/ide/wit/*); "Quality on the Line: Benchmarks for Success in Internet-based Distance Education" prepared by the Institute for Higher Education Policy (*www.ihep.com/Pubs/PDF/Quality.pdf*).

Box 3.1. Carnegie Mellon West and the Story-Centred Curriculum

Carnegie Mellon West, founded in 2001, is the new branch campus of Carnegie Mellon University, based in Pittsburgh, United States. The institution is located in California, and at present is restricted to graduate studies and continuing education. The main subjects taught include software engineering and business studies, with various multidisciplinary programmes (*e.g.* legal education for technical professionals). Carnegie Mellon University programmes have been "engineered from the ground up to provide [the student] with a new and better educational experience focused on learning by doing instead of lectures, collaboration instead of competition, and one-on-one mentoring". The institution draws on decades of research at the parent institution into cognitive science and its application to learning.

The Carnegie Mellon West experience is based on a "Story-Centred Curriculum" approach to learning, said to be a "dramatic departure" from the mainstream master's curriculum. The idea behind the Story-Centred Curriculum (SCC) is that a good curriculum should consist of a story in which students play a key role (for example, manager of e-business technology or of software engineering). These roles are selected to be ones that the graduate of such a programme might actually do in real life or might need to know about (because he or she will manage or collaborate with someone who performs that role). Students, working in groups, are given detailed information about the simulated company they are working for together with detailed and authentic projects. Supporting materials and resources are available as well as faculty and online mentors, to answer questions and point students in the right direction on an as-needed basis.

The effect of the SCC model is that as students work through the story to achieve the missions the story puts forth, they learn the critical skills required to successfully accomplish their tasks. The SCC implements true learning-by-doing across an entire curriculum, not just within the scope of a single course. In fact, the SCC is about the elimination of courses in favour of a curriculum that tells a meaningful story – a story in which the student plays roles that he or she is likely to play in the real world after graduation.

The project website can be found at: *http://west.cmu.edu/index.htm*

One exception was Carnegie Mellon University which cited enhanced student learning using particular e-learning techniques compared to traditional model ("lectures alone"). For example, StatTutor (developed by psychologist Martha Lovett at the University) is an "intelligent tutoring system designed to help students learn to solve data-analysis problems by giving immediate feedback flexibly, offering hints when students have difficulty, and reiterating a general set of statistical problem-solving steps. Each of these different kinds of "scaffolding" can be reduced depending on

the student's changing needs".[2] For an overview of Carnegie Mellon University's "Open Learning Initiative" (a foundation-funded effort to develop and make available research-led online programmes), see Box 3.2. Another example from Carnegie Mellon University is a curriculum, namely "Story-Centred Curriculum". This curriculum is specific to Carnegie Mellon West where e-learning lies at the heart of its teaching/learning. The "Story-Centred Curriculum" allows students to learn through the simulated work environment and learn to work collaboratively in virtual groups on authentic projects, with the assistance from faculties and online tutors (see Box 3.1).

For campus-based institutions, a question is often raised if blended learning is the way forward. The Sloan Foundation has established the Sloan Consortium (Sloan-C) (*www.sloan-c.org/index.asp*) with an aim to help learning organisations continually improve the quality, scale, and breadth of their online programme. The Sloan-C launched an online research workshop in summer 2004. One of the research topics includes "blended environments" to specifically examine the impact of the ALN (asynchronous learning networks) on teaching and learning (Hartman *et al.*, 2004; Harwood and Miller, 2004; Laster, 2004). In addition, for learning effectiveness, the importance of scaffolding is highlighted with respect to issues of interface, teaching presence and learner characteristics (Swan, 2004).

Flexible access to materials and other resources

This was cited as particularly valuable for students wishing to revise a particular aspect of a class, or for students with a relatively weak grasp of the language of instruction (Aoyama Gakuin University). Others mentioned general access flexibility for part-time students (Aoyama Gakuin University, Monash University); and remote access to library materials (Monash University).

Enhancement of face-to-face sessions

Availability of archived lectures online frees up faculty time to focus on difficult points and application. This was said to add value to face-to-face sessions (Asian Institute of Technology, Aoyama Gakuin University). The introduction of e-learning was said to have started a general debate about pedagogy, including in the traditional classroom (Zurich University).

2. Learning and Problem Solving Laboratory (2005), "Description of StatTutor", available at: *www.psy.cmu.edu/LAPS/stattutor_new.html*

Communication

There is "some evidence" that e-learning eases faculty/student communication – *e.g.* reducing cultural/personal student shyness (Asian Institute of Technology), quicker faculty responses to student queries (Monash University) and enhanced peer learning (Monash University). Faculty from other countries can deliver online lectures and joint classes with remote non-local students (Aoyama Gakuin University).

Retention and attainment

A number of respondents offered evidence under this heading. The Open University Catalunya simply cited its nine years experience as a wholly online institution – with over 4 000 degree completions. UCLA Extension and the University of Maryland University College cited the results of large-scale and regular student/alumni satisfaction surveys that revealed high levels of satisfaction with the quality/academic rigour of online provision compared to face-to-face/other distance delivery, plus appreciation of enhanced flexibility of access. The University of Sao Paulo reported on an evaluation of a large mixed mode teacher education programme – under 10% dropout and high demand for similar programmes. The University of British Columbia respondents cited evaluation of some fully online courses that revealed 10-15% better attainment compared to the traditional print version. The improved performance was thought to be due to need (in the online course) for a common cohort to enable discussions and testing. The print version gave students more flexibility over start and finish dates, but meant that some students fell behind. The University of British Columbia also reported that at undergraduate level, fully online courses produced similar grades to face-to-face equivalents, but 5-10% lower completion rates overall. The respondent did not offer an explanation, but one can speculate that the nature of online provision (*e.g.* requiring more independent learning than face-to-face provision at undergraduate level) and cohort characteristics (*e.g.* part-time versus full-time) may play a role. The Open Polytechnic New Zealand said there was evidence that wholly online programmes ("Open Mind Online") were attracting more learners than traditional distance learning provision (normalised annual growth of 30-40% compared to single digits). Some institutions pointed to high levels of re-enrolment in other online programmes – *i.e.* students who completed one programme chose to enrol in another (Open University Catalunya, Virtual University of Tec de Monterrey, UCLA Extension). UCLA Extension reported a steady increase in student satisfaction in line with the introduction of on-campus e-learning. However, it was not possible to demonstrate cause and effect. The growth of e-learning occurred alongside a general drive to improve the student experience.

Employer interest

Employers seem to be interested by graduates of a wholly virtual institution – due to their "persistence, knowledge of IT, consistency, and hard work" (Open University Catalunya).

Student satisfaction

The UK Open University respondent argued that student satisfaction with e-learning, or any other learning activity, was correlated with whether a particular activity was mandatory. This implied that students were less likely to engage with an activity if it was not required for assessment purposes. This is not to say that making an activity mandatory will necessarily raise rates of satisfaction, but rather that a requirement will "force" students to more fully engage with a particular activity and thus gain a more rounded appreciation of its strengths and weaknesses. In reverse, a student may rate a voluntary activity more negatively due to lack of experience as much as informed critique.

There is growing literature surrounding student satisfaction with respect to e-learning. A study in the United States found a correlation between greater student use of an LMS and more positive assessment of its benefits (Borrenson Caruso, 2004, p. 3). The Sloan-C places "student satisfaction" as one of the core pillars, and investigates what affects students' satisfaction. It was reported that high levels of students' satisfaction result from access, quality of programme, students' support and opportunities for personal interaction (Benke *et al.*, 2004); the role adjustment of students from a more didactic traditional teacher-centred face-to-face learning environment to self-directed learning is critical in students satisfaction and success (Garrison and Cleveland-Innes, 2004); and teaching presence is important and, thus, the faculty development plays the pivotal role in students satisfaction (Shea, Pickett and Pelz, 2004).

Quality assurance processes

One pedagogic-related characteristic of e-learning not mentioned by respondents is what Slater (2005) refers to as "QA-ability". This refers to the fact that e-learning course development necessitates much greater specification of materials and activities, making e-learning more amenable to quality assurance processes. As well as offering programme leaders/faculties/institutions better oversight of provision, forms of e-learning also have the potential to provide the student with fuller information on process and content. To facilitate the quality assurance processes in e-learning, some countries have started to work in the area at the governmental level (see Chapter 8).

Negative pedagogic impacts from e-learning

Some respondents also pointed to negative impacts, or phenomena said to undermine effective e-learning pedagogy.

Inconsistency

This concerned inconsistent course/materials terminology; non-uniform faculty/student access to technology; clumsiness of some interfaces (Carnegie Mellon University); system reliability, and lack of integration between online and print materials (Monash University).

Loss of face-to-face contact

The University of British Columbia cited a study in one field (agricultural sciences) that found that while students were generally satisfied with e-learning, there was a strong sense that it should complement, not replace face-to-face time. Zurich University stated that the introduction of e-learning had elicited a general concern from faculty about potential loss of classroom teaching. A strong theme in the literature is a correlation between "social affordances" (*i.e.* forms of social interaction supportive of student learning) and the quality of student participation in online provision (particularly distance online programmes) (Volet and Wosnitza, 2004).

Inexperience

The response from Carnegie Mellon University highlighted the common disparity between adoption of administrative aspects of ICT (*e.g.* the management functions of an LMS) and substantive impact on pedagogy. While 70% of faculty surveyed in 2001 used an LMS to "manage their course", only 22% thought that their LMS use would have a positive impact on student learning. Only 13% had redesigned the course to suit the LMS. This reinforces the argument in Chapter 4 that many faculty use an LMS (the most common e-learning tool) first and foremost for administrative purposes. Consideration of the pedagogic advantages of LMS use tends to take longer to conceive and apply. Carnegie Mellon University is planning a follow-up to its 2001 LMS survey, and it will be interesting to see whether perceptions of positive pedagogic impact and rates of redesign have improved over time as faculty gain more e-learning experience.

Pedagogic evaluation

As seen above, the overall impression given by respondents as to the pedagogic impact of e-learning was a positive one. That said, in most institutions, evidence was either informal or derived from more general

pedagogic evaluation (*e.g.* user satisfaction surveys or attainment data). Systematic, multi-dimensional research into the pedagogic impact of e-learning was conspicuous by its absence. Fifty per cent of respondents to the Observatory survey answered "yes" when asked whether their institution conducted "formal evaluations of the impact of online learning on the student/faculty experience". However, this relatively high figure may mask a diversity of practice, and, unlike the OECD/CERI survey, it did not ask for specific details.

In the OECD/CERI sample, the main examples of systematic research were evaluation associated with Carnegie Mellon University "Open Learning Initiative" (an attempt to develop cutting-edge open access e-learning materials – fundamentally informed by cognitive science and the experience of key individuals/programmes at the institution).

Other examples are associated with longstanding detailed satisfaction surveys/focus groups utilised by the UK Open University, the University of California, Irvine, the University of Maryland University College and UCLA Extension. UCLA Extension stated that in order to "invite greater institutional comparative oversight into student experience and attitudes", quarterly reports are prepared on student evaluations of online programmes. At the University of California, Irvine, the Student Focus Group[3] for the "Electronic Educational Environment", prepared an evaluation report, which evidences the increasing use of the "Electronic Educational Environment" tools among students and faculty. The University of British Columbia cited its local-led initiatives and reported some discipline-specific results: *e.g.* the mixed mode project in an introductory English course reported a positive experience; the survey in Agricultural Sciences proved positive on online course resources while learning should be complementary but not replace face-to-face time; the Faculty of Education finds that the use of e-learning has created a stronger culture of more student-centred teaching and learning, etc. Zurich University reported the instigation of a dedicated evaluation model for e-learning programmes. What was described as an "e-learning enhanced course" must be evaluated after the first semester, and must take into account both faculty and student views. The University's e-learning Centre has developed a standardised evaluation form to facilitate this. The system was implemented in 2003, with the intention that evaluations would be repeated annually. The findings are submitted to the institution's Executive Board.

3. An on-going cross-divisional collaboration between the Division of Undergraduate Education, Network and Academic Computing Services, the Registrar's Office and University CI Libraries to enhance the online learning environment.

A number of institutions pointed to plans to evaluate e-learning more systematically (*e.g.* Monash University and the University of South Australia). The University of British Columbia cited evaluation work concerning specific courses, and indicated plans for systematic institution-wide evaluation through its new Office of Learning Technology. FernUniversität Hagen and Multimedia Kontor Hamburg also pointed to initiatives to expand the scope and sophistication of evaluation (*e.g.* LMS user tracking and video conferencing to hear the views of remote students). This sort of LMS user tracking was already employed at the Open Polytechnic New Zealand (by means of automated data collection by the LMS itself). The University of Paris Nanterre pointed to its role in HEAL (Higher Education E-learning Courses Assessment and Labelling – a project funded by the European Commission across five European countries to develop online delivery in the European credit framework) as a source of future evaluation data in this area (see Box 1.1). The Greater Mekong Sub-region Virtual University, of which the Asian Institute of Technology is a member, was said to have pedagogic evaluation of e-learning built in from the start (see Box 2.2).

Most negative comments concerned sub-optimal facilities and user inexperience, rather than direct criticism of the pedagogic reality or potential of e-learning. The point about loss of face-to-face contact is anxiety about the positioning of e-learning in relation to face-to-face provision, not a specific criticism of the former. Data from the Carnegie Mellon University survey reinforce the point that e-learning in all its forms remains a recent phenomenon in most tertiary institutions and thus pedagogic impact in terms of both conception and evaluation is necessarily in its infancy. A recent study in the United States concluded that "the longer faculty work with the web, the more likely they are to pursue and derive pedagogic benefits from the technologies, but this process may take longer and require more collaboration than anticipated" (Wingard, 2004, p. 34).

The literature on the impact of ICTs, or other non-traditional modes of delivery, on teaching and learning is ambiguous. Many studies report either positive or negative effects, and many others report no significant difference. A Canadian website lists hundreds of studies across all sides of the argument (see *http://teleeducation.nb.ca/significantdifference/*). It is simplistic to imagine that there will ever be a "magic bullet" study that shows that e-learning *ipso facto* is beneficial in tertiary education. E-learning is not a "treatment" but a large and very diverse category of treatments, and effectiveness in teaching and learning is not a single outcome but a large, varied and even contradictory array of criteria for judging effectiveness. The context of application and the variants of specific situations (*e.g.* students, faculty, materials, experience, technology,

discipline, level, setting, etc.) may have a significant effect on pedagogy and pedagogic outcomes (Sener, 2004). This is not an argument for not seeking to address research questions about the benefits of e-learning versus face-to-face learning; but that such a research project and the research methodologies applied would have to be contextualised. The key underlying question concerns the isolation of those variables that contribute to learning, whether online or face-to-face.

In fact, teaching and learning specialists in tertiary education are in broad agreement about what constitutes an effective student learning experience. This reflects a wholesale shift from behaviourist/cognitivist to constructivist theories of learning, emphasising the role of the learner in "making sense" of received material, and the significance of peer and student-faculty interaction. Key elements include: student motivation to learn; clear expectations – with some student input; opportunities to learn by doing; use of a range of activities (reading, writing, discussion, experimentation, hands-on); the value of peer learning; balance between tutor-led, group and independent learning; recognition that individual students prefer to learn in different ways; learning strengths and weaknesses (and for tutors to both accommodate and stretch students); the value of regular and constructive feedback; the opportunity to "make sense" of what has been learned through personal or professional application; and some form of official recognition of achievement.

Twigg (2002) and others have attempted to explicitly utilise ICT to support learning design in accordance with the above list of learning elements. The methodology holds that tertiary education programmes (particularly large-scale, introductory undergraduate provision) can achieve student learning gains, increased student numbers and reduced costs through specific redesign principles partly facilitated through use of ICT. The effect is to move away from the conjecture that use of ICT as such has a major and inevitable learning impact. Instead the assertion is that certain pedagogical approaches have the biggest impact on learning, and that use of ICT can facilitate such approaches if used in particular ways. The Pew Charitable Trusts, a major US funding body, sponsored a four-year trial of the methodology at 30 US institutions between 1999 and 2003, with encouraging outcomes.[4] Moreover, because Pew-funded institutions were required to implement a relatively standardised set of pedagogic and administrative practices, the variation that typically hinders straightforward assessment of impact was reduced. It is this normative approach that opens up new possibilities in causation attribution. The Twigg rationale is to move

4. See the website of the Centre for Academic Transformation, Programme in Course Redesign. Available at: *www.center.rpi.edu/PewGrant.html*

beyond current uncertainty about the cost, access and pedagogic impact of greater use of ICT in higher education, and address concerns about rising costs, access pressures and teaching innovation. In addition, the aim is to assist academics, institutional managers and national policy makers with the complex task of integrating ICT into mainstream strategy, realising the benefits of past bottom-up/experimental approaches and enhancing understanding of, and options for, organisational change. The cross-institutional and cross-subject evidence from the Pew Grant Programme in Course Redesign is also important. (For an overview of this approach, see Twigg, 2002.) Twigg is now leading a follow-up initiative (Roadmap 2 Redesign) designed to disseminate redesign practice more widely and to overcome the need for special funding to kick-start the process at an institution (*www.center.rpi.edu/R2R/R2R.html*). Twigg and associates have now formed a non-profit organisation to disseminate the methodology – the National Centre for Academic Transformation.

In conclusion, it is difficult to assess the pedagogic impact of e-learning. There is certainly no compelling evidence of its positive or negative impacts. However, most institutions believe that it has improved the student's learning experience. The pedagogic impacts on teaching and learning are not exclusively related with ICT use but also with other elements such as student support and new pedagogies.

3.2. Who decides on e-learning pedagogy (Question 4.3)

The OECD/CERI study tried to determine who controlled the delivery of e-learning as far as pedagogy is concerned. Institutions were specifically asked about the balance of power between centre-led initiatives, faculty/departmental guidance and the preferences of individual faculty members.

In general, the pattern was for e-learning to begin as discrete enthusiast-led initiatives and externally-funded projects. This is e-learning development as faculty research interest, and particular initiatives may struggle when an individual's research agenda moves elsewhere and/or when special funding runs out. The next stage saw the engagement of larger groups, moving to joint ventures by one or two departments/faculties, perhaps alongside the creation of an institutional e-learning unit (or similar) that starts to develop the outlines of a central approach. After that, the next stage was for the institution as a corporate entity to formulate some kind of e-learning strategy, and to make decisions about the extent to which branches of the institution will conform to a single blueprint. The Open Polytechnic New Zealand described an interesting "e-learning unit" arrangement. An "e-learning Office" was set up in March 2003 and is

scheduled to be dissolved in March 2005. The Office was established to shift e-learning from project status to core business. "The fixed term of the e-learning Office allows the office to operate more freely than other business units", and assume "higher risk exposure than permanent offices". It will be notable to see whether the Office is actually dissolved or becomes a permanent support unit.

While many institutions have developed a central strategy on teaching and learning (*e.g.* asserting the value of student-centred, problem-based, interactive approaches, etc.), there were virtually no cases where such a strategy directly and in detail impinged on the day-to-day pedagogic decision-making of faculty members. This probably reflects the importance of faculty autonomy and academic freedom in tertiary education.

At one extreme, the central position at Carnegie Mellon University is to facilitate maximum decentralised decision-making about adoption/nature of e-learning (as above, Carnegie Mellon West is different in this respect, adopting – initially at least – a centralised approach to pedagogy – see Box 3.1). At many other large, established universities, the balance of power was also with the academics. Alongside any central imposition of particular technologies as institution-wide standards, respondents reported that individual faculty members retained significant control over the details of mode of delivery, and whether and how to make use of available ICT. Multimedia Kontor Hamburg pointed to the fact that pedagogy as the right of the individual professor was enshrined in the German constitution. Curricula were determined through consensus across the programme or department, or in Multimedia Kontor Hamburg's case, the consortium. At the University of South Australia, a broad policy statement had been issued to the effect that all students "will experience some part of their programme online". What this might mean for a particular course, or whether a particular course will have any online elements, remains a matter for the individual academic.

Many campus-based universities presented a model where a central committee or committees undertook an approval role for new programmes, but where pedagogic details were largely left to individuals. Matters such as tool selection (which may have a significant effect on pedagogic possibilities) was said to be decided locally, but increasingly centrally, as institutions saw value in standardising on particular platforms (although in most cases departments/individuals were free to continue with local preferences; see Chapter 4 for more details). Many respondents reported forms of central "e-learning unit" tasked to spur innovation and share good practice, but in a context of individual academic autonomy. Use of such a unit to develop particular e-learning programmes may impose elements of commonality. At the University of British Columbia, this limited

centralisation is under review, following faculty concerns that project-based funding allocated by the unit inhibited faculty-led development. The respondent from this institution suggested that in future these funds might be allocated directly to faculties to spend as they saw fit rather than being only available by means of formal bidding to the centre. In this scenario, the central e-learning unit (called the "Distance Education and Technology Unit" at the University of British Columbia) would retain its role as disseminator of good practice, but would not be in a position to steer faculty through administration of dedicated funding. At Zurich University, alongside a general commitment to academic autonomy, all substantive e-learning development must – unless utilising free tools or paid for from non-university funds – be undertaken through the equivalent central e-learning unit. It has been argued by Slater (2005) that the traditional "final" course approval model (by committee) was ill-suited to e-learning, insofar as it did not offer earlier and more frequent quality assurance interventions appropriate for more complex, experimental and potentially costly course development.

At the other extreme was the more centralised approach traditionally taken at the Open Polytechnic New Zealand. In both the pre-e-learning era and more recently, the institution's "Learning Materials Design Group" played a major "gate keeping" role in the design and development of learning materials. Faculty members served on development groups, and may initiative course development/re-development, but the "Learning Design Group holds control over content". Almost all pedagogic aspects of a programme (*e.g.* use of a discussion tool) are pre-built at the design stage, rather than being something faculty could decide to introduce once a programme was underway. Similarly, "faculty do not have the ability to dynamically post supplementary materials". The rationale for this centralised approach was to ensure consistent quality, and indeed this was viewed as a competitive advantage for the Open Polytechnic New Zealand. However, the flexibility and dynamism of e-learning materials (compared to say, print) forced a re-think. Final arrangements are not yet clear, but the thrust of reform was to decentralise course development to department level, and to allow faculty members (in line with certain protocols, and not affecting stated learning objectives or assessment methods) to make substantive pedagogic interventions throughout the lifecycle of a course. The advent of Moodle was said to have greatly facilitated this proposed change. It would appear that the Design Group function will retreat to a model more akin to "e-learning units" in other institutions, with a support and best practice remit – although reforms may remain at the pilot stage.

A number of dedicated virtual/distance institutions (notably the Open University Catalunya) exhibited some form of centralised pedagogic vision

and development process. The UK Open University reported that to date individual academics/departments/faculties had majority control over how e-learning pedagogy was developed, but indicated that the intention was to establish a "more centralised approach in future … to implement 'course models' which will be more prescriptive in terms of the design of courses". UCLA Extension described a faculty-dominated pedagogic/course development model, but the respondent reflected that this "tends to foster incremental, sustainable and low risk-initiatives, but may stifle boldness". This issue was to be addressed in the institution's next strategic planning round.

3.3. Guidance for students about e-learning (Question 4.4)

The availability of guidance and support for students regarding e-learning was unevenly distributed across the case study institutions.

General IT/information literacy programmes were commonplace – and were beginning to feature e-learning elements (*e.g.* use of an LMS) – as were ICT/e-learning support services for students enrolled in e-learning provision. The latter were designed to deal with technical functionality, as well as subject-based problems. The majority of respondents did not offer centralised special assistance/guidance to students about e-learning specifically (*i.e.* how to learn using various forms of ICT), although particular departments/programmes did. The Monash University respondent commented that the institution had yet to "systematically address these learning skills for off-campus or on-campus students".

Not surprisingly, guidance or students support for e-learning is provided at institutions with a more developed online presence and sufficient experience of providing e-learning. A number of institutions (*e.g.* UK Open University, Open University Catalunya) pointed to the use of a generic "introduction to learning online" course, course-based online assistance of various kinds, and the availability of academic/other staff to answer student questions throughout their experience. The Open Polytechnic New Zealand described online assistance as standard across all relevant programmes. "The online support provided is designed to guide learners through the full cycle of the study year, from getting started to successfully completing assessments, to final exams." The institution also offered online FAQs and study tips, "how to" pages and so on. The Open University Catalunya respondent emphasised the role of the academic tutor, responsible for academic and pedagogical matters. At the University of South Australia, all students had access to the "Learning Connection" website, a resource for student learning; and all new students were given a copy of a CD-Rom

"Online at University South Australia", a reproduction of some University South Australia online courses for offline access.

At UCLA Extension all students were strongly encouraged to take an LMS orientation course prior to commencing an e-learning programme, and each programme was assigned a "Course Manager", trained to handle service, policy and technical matters. The aim was to ensure that all non-learning/content difficulties were dealt with swiftly and smoothly to allow "students to concentrate on the learning process, and not anxiety over technology". The University of Maryland University College has made its LMS and online library introduction courses mandatory, and made technical support and library services available 24/7. At Carnegie Mellon West, mentors were employed to guide students through the e-learning process, and shadow virtual work teams (reflecting the story/team/problem-based pedagogic approach followed at that institution: see Box 3.1). In some cases, the central "e-learning unit" (or equivalent) ran some form of "introduction to e-learning/distance learning". The University of British Columbia emphasised that a point of good practice in instructional design was to ensure that a new user could make full use of an online course with minimal introduction and experience.

A recent study of over 4 000 students at 13 higher education institutions in the United States recommended greater attention be paid to student IT literacy more generally. It was found that in general students "know just enough technology functionality to accomplish their work … they do not have in-depth application knowledge or problem-solving skills" (Borrenson Caruso, 2004, p. 1). Sixteen per cent of faculty surveyed said they had decreased LMS use because students found the technology difficult to use (Kvavik *et al.*, 2004, p. 83-84). The report notes that "few studies elaborate effective practices in this area", and debates the merits of institution-wide threshold standards on entry, required courses for credits, peer learning and the balance between generic and discipline-specific foci.

In conclusion, students appear to have a limited IT literacy: availability of guidance and tutorship is generally provided at institutions with a developed online presence.

3.4. Material and learning objects (Questions 4.8 and 6.6)

Learning objects are viewed as a promising way forward for e-learning as they can potentially cut costs and revolutionise pedagogy. The OECD/CERI survey asked whether institutions had a strategy to support the development of learning objects and the rational and challenges. While it is commonplace for faculty to utilise a third party textbook, or for some institutions to obtain rights to use/re-purpose third party materials, the

notion of a "learning object economy" goes further. "Learning objects" has become a widely used term to describe a model of materials development that manipulates and combines/re-combines discrete "chunks" of material designed to be re-used and re-purposed for different needs. There is no fixed definition of what constitutes a learning object, and an object may range from a single chart or diagram to an entire course. Various tools are available and various initiatives underway to tag/specify objects in a consistent manner to ensure maximum flexibility of use and re-use, and interoperability between platforms. The "learning object" model is widely seen as offering a potentially efficient approach to e-learning materials development (*i.e.* reduced faculty time, lower cost, higher quality materials, more faculty time for teaching), and an enhanced student experience in terms of pedagogic impact (Roy, 2004). The latter stems from the customisation and media-rich potential of the learning object model.

The "learning object" model raises many issues, like *e.g.* copyright, the range of actors in and "location" of the creative process, creation versus adoption. Learning objects foreshadow a model of materials/course development that departs from the craft-model where the individual academic is responsible for majority of the work (and where courses are generally created whole, rather than compiled from pre-existing materials), and is rather one where the individual assembles a course largely or entirely from third-party materials, or even adopts an entire third party course. Aside from private institutional collections, there are various public learning object repositories that individuals may draw upon (*e.g.* MERLOT – *www.merlot.org*; e-teaching – *www.e-teaching.org*).

Production and adoption of learning materials

A number of institutions are grappling with different approaches to the production of learning materials. Many learning management systems offer authoring functionality and "coursepack/e-pack" creation, empowering individual faculty members; and institutional "e-learning units" (or equivalent), often backed by central funding/strategy are building a range of development and support functions. In some cases (*e.g.* FernUniversität Hagen), a central unit administers a competitive development fund that faculties/individuals may bid for. No sample institution reported major use of learning objects, although many expressed interest and cited early plans/trials. Across respondents, there was a common sense that the learning object model had potential but was untested. The University of South Australia said it had adopted a "wait and see" policy. One of the most active institutions was the University of British Columbia. Through a competitive central fund, the University has invested over CAD 300 000 in a range of learning object projects, and has appointed a co-ordinator to support and link

them. The University of British Columbia has adopted the CAREO repository developed at the University of Calgary, and funded by the national Canarie ICT fund; and has experimented with MIT's D-Space system (D-Space is an online searchable archive of institutional documentation, with research papers as the main focus. The system is available for use by other institutions).

As developed below in Chapter 4, the Observatory survey found low-level adoption of content management systems (*i.e.* software that coordinates the creation and use of learning objects of various kinds). Overall, the rate of institution-wide adoption climbed slightly from 4% in 2002 to 6.6% in 2004. However, this functionality was widely cited as a matter for future development. The bulk of institutions (61% – down from 64% in 2002) reported implementation of a content management system as a strategic priority on a one- to five-year horizon. A good example of a university – or rather a state university system – that has addressed the learning object model head-on is the University System of Georgia in the United States. Dissatisfied with a website that simply brought together all online first and second year undergraduate courses, the University System of Georgia's "Advanced Learning Technologies Unit" set about disaggregating the courses into learning objects and grouping objects by subject/topic/learning objective (the Sharable Content Object Reference Model [SCORM] compliant to aid re-use – see below). The objects were stored in a mainstream commercial LMS. The aim is to reduce the time and cost of course development for first and second year undergraduate provision – although formal return-on-investment data have yet to be generated (for more information, see Lasseter and Rogers, 2004).

Interoperability standards

Question 4.8 also asked about use of international interoperability standards. Such standards are seen as critical to ensuring the smooth flow of data between diverse applications, and enabling more detailed and consistent data mining within content repositories. SCORM (Shareable Content Object Reference Model) and IMS (Instructional Management Standards) have emerged as the world's two leading initiatives in the learning sphere. SCORM was developed by the US Department of Defence as a way to connect the disparate systems and materials generated by third parties in support of the organisation's "Advanced Distributed Learning" initiative – an in-house training and development push. The "reference model" part of SCORM refers to the bringing together of various specifications or standards (or parts of these) that describe the totality of the creation, deployment and behaviour of learning objects in an LMS (*i.e.* how the various discrete specifications work together) (*www.adlnet.org/index.cfm?fuseaction=scormabt*). The IMS Global Learning Consortium was founded in 1997, bringing together a range of technical standards bodies, vendors, governments and education

institutions/agencies to collaborate on the development of standards for the interoperability of learning resources. An example of an IMS specification is IMS Enterprise, a specification for transferring data from one application to another (*e.g.* student records from a learning management system into a central student records system). Generally speaking, SCORM and IMS are complementary, and both utilise "core" metadata (notably "Learning Object Metadata" from the Institute of Electrical and Electronics Engineers – IEEE). Various updates of SCORM have featured in particular IMS specifications. The newly announced model by the Advanced Distributed Learning Initiative is the Content Object Repository Discovery and Resolution Architecture (CORDRA), in which Carnegie Mellon Learning Systems Architecture Lab participates. The CORDRA is designed to bridge the worlds of learning content management and delivery, and content repositories and digital libraries.

Respondents to the OECD/CERI survey offered little detail in this area. Most acknowledged the existence of SCORM and IMS, and some indicated that their LMS was compliant in some sense. Only one (UK Open University) said that it was an active contributor to the process (IMS). There was no sense that lack of appropriate standards was the problem, rather that rationales and processes for systematic compliance (*i.e.* how and why to embrace an object economy) were rarely clear across the board. Multimedia Kontor Hamburg said that the intention, as part of its efforts to improve the quality of learning materials, was to make international standards mandatory for all e-learning development. As noted in Chapter 4, the Observatory survey found low-level adoption of SCORM/IMS.

Issues around learning objects

A number of OECD/CERI respondents pointed to concerns and issues that had inhibited or might inhibit the widespread adoption of learning object economies in tertiary education. Some were critical of the "building-block" analogy of learning objects as the future of learning materials. A key pedagogical challenge was to reconcile the notion of the decontextualised learning object with the context of a specific learning encounter. To quote the Carnegie Mellon University respondent: "Effective courses are often facilitated by having a 'theme' that runs throughout the course. Themes give students the 'big picture' of the subject matter, *e.g.* a physics instructor may choose to use conversation principles as a thread that ties together all the parts of an electricity and magnetism course. Themes can also follow from single examples that are treated with greater precision and complexity as students develop more knowledge of a subject. This need for a thread to tie a course together militates against breaking the course into learning objects." The UK Open University respondent made the same point. The argument here is that the pedagogical value of discrete learning objects may be over-

rated. The Open Learning Initiative at Carnegie Mellon University, an attempt to develop online courses for use by individual learners not enrolled in formal education, retains a learning object conceptualisation, but those involved hold the view that a lot more work needs to be done to ensure the pedagogical effectiveness of the object model.

Another important issue was faculty motivation. Is this attempt to standardise content between institutions a matter of simple efficiency, or a "dumbing down" of tertiary education and a brake on academic autonomy? Is a learning object model in conflict with prevailing reward/career structures? The University of British Columbia respondent commented: "It is a challenge to convince instructors that reusable resources exist that may be of use in their practice." As noted above, the traditional "craft-model" of materials development generally pulls against adoption of third party materials, or making materials available for use by others. The Monash University respondent commented that it is often cheaper and less complicated for faculty to develop their own materials than attempt to gain copyright clearance for those of third parties. While a growing number of copyright cleared materials repositories are in operation (*e.g.* XanEdu in the United States), many charge a fee, and in all cases material that a particular academic wishes to include may not be in the repository. Another respondent commented that only when development of learning objects met a specific departmental need (*e.g.* cost reduction) was faculty buy-in sufficient.

The counter-argument to this is that such a perspective takes an overly content-centric view of teaching, and over-plays the contribution of the individual. Slater has argued that content is "slowly acquiring a prominence more aligned with its perceived worth" (Slater, 2005, p. 16). By this is meant a realisation that content by itself plays only a relatively minor part in the student experience. The Massachusetts Institute of Technology's (MIT) decision to gradually place all course content online for free is an indication of the relative value of place, faculty, face-to-face interaction, assessment, accreditation, research environment, etc., which MIT students are willing to pay such a high premium for. Particularly at undergraduate level, in most subjects, content is broadly comparable between institutions, at least within the same country. Moreover, few institutions would claim to be at the leading edge in every subject taught within their "walls". A reduced focus on content creation shifts the emphasis onto facilitation of learning, guiding students with the assistance of materials. One vision is for most institutions to rely on world-class materials developed by third parties (*e.g.* the handful of leading universities in each subject), and only invest in content creation where an individual/department has something genuinely unique to contribute. Carnegie Mellon University's Open Learning Initiative might be

viewed as an example of this approach (see Box 3.2). The aim of the Open Learning Initiative is to develop high-quality materials (based on the subject and pedagogic expertise at Carnegie Mellon University) and make these available (either free or for a fee) to third parties. The question is how other institutions might adopt such materials (on a whole course basis, or in smaller chunks), whether faculty members/departments will in practice agree to take on standardised content from elsewhere, and how much local customisation will be deemed to be necessary (possibly undermining the entire model). The US leads the way in this initiative. In addition to the case study institution, Carnegie Mellon University's Open Learning Initiative, others include the MIT's Open courseware, Rice University's Connexions, Utah State University's Open Learning Support, Footfill-De Anza Community College District's Sofia Open Content Initiative and Eastern Oregon University's Eduresources Portal.

The University of British Columbia respondent suggested that given the challenges of intellectual property and technical complexity related to standards, "the model of faculty-driven contribution of resources appears to be a non-starter", at least by itself. While the flow of materials from faculty was said to be "disappointing", a number of strategies to address this shortfall exist – such as streamlining processes, raising the visibility of available support, and drawing on the resources created by the university's distance education and instructional support units. It is also hoped that engaging the community through workshops that attract attention to well-stocked collections that do exist (such as MERLOT and the National Science Digital Library – NSDL [US]) will demonstrate the teaching and learning value of well-designed shareable learning resources. University of Maryland University College reported active central tagging of e-learning materials in anticipation of potential future needs, to ensure the institution was able to utilise an object economy as and when this was deemed appropriate. This was being done at undergraduate level, where a central instructional design team (heavily involved in the development of undergraduate online provision) had identified and tagged "learning objects" across over 400 courses. By contrast, at graduate level, despite a range of central materials development resources (*e.g.* the Centre for the Virtual University and the Faculty Media Centre – both educational media production units), to date there has been no co-ordinated effort to tag such materials to facilitate re-use across courses.

Other concerns raised about some forms of learning object included cost – cost to the student of use of third party e-packs of materials often available through adoption of a proprietary LMS; and cost to the institution in terms of development of sophisticated multimedia production facilities. It has been argued that smaller institutions may be unable to bear such costs (Paulsen,

2003). Such a scenario points to many institutions adopting a less content-centric, less craft-model approach to materials development, and a greater willingness to adopt third party materials.

Box 3.2. Open Learning Initiative at Carnegie Mellon University

The Open Learning Initiative (OLI) started in the autumn of 2002, funded by a grant from the William and Flora Hewlett Foundation. The Foundation's interests include providing access to high-quality post-secondary education and educational materials to those who otherwise would be excluded due to geographic, economic or time constraints. These aims are in concert with the research and teaching interests of a number of faculty at Carnegie Mellon with considerable experience of producing high-quality online education. The result has been a dual focus for the Open Learning Initiative, incorporating both product delivery in the form of online courses and research on how to make such courses more and more effective in facilitating learning.

The objectives of the OLI project are to:

a) Design online courses and course materials using *best current knowledge* from the cognitive and learning sciences.

b) *Document the methods* of course development and the assumptions underlying the application of results and methods from the cognitive and learning sciences.

c) Establish and implement procedures for *routinely evaluating* the courses and use that formative evaluation for corrections and iterative improvement.

d) Feed information from these evaluations back into the research communities that have postulated the theories on which the designs are based upon.

e) Develop *communities of use* for OLI courses that will not only deliver the courses but also contribute to their continued development and iterative improvement.

f) *Explore economic models* for combining free access to the courses for individual learners with commercial access to the courses for degree-granting institutions.

As of February 2005, there are six subject areas for which there are either full courses or substantial course materials available through the OLI web site (see below): Causal and Statistical Reasoning, Statistics, Economics, Logic, Biology, and Physics. Work is underway to add courses in Calculus, French, Statistics, and Research Methods. Material from these additional courses was planned to appear in the spring of 2005.

The project website can be found at: *www.cmu.edu/oli*

Source: Smith and Thille (2004).

Sharing learning objects

Given that sharing learning objects is so important for the efficiency of the learning object economy, how common is the practice? Question 6.6 asked whether institutions had established any internal mechanisms to share learning materials. The common response concerned general co-ordination work of e-learning units (or equivalent), "show and tell" sessions, special interest groups, and informal contact between faculty members (often at or about the design stage, rather than the finished materials themselves). Only one institution (FernUniversität Hagen) cited the existence of an in-house learning object repository, although a number (*e.g.* Monash University, UK Open University) pointed to developments in that direction. The Virtual University of Tec de Monterrey described a system called "Digital VideoTec", a repository of All Audio-Visual Material Ever Created by the Institution. At the University of British Columbia, learning object project co-ordinators were part of a "Learning Object Steering Committee", and often shared resources and experience. At Zurich University, each faculty has an "e-learning Co-ordinator" tasked to facilitate communication between faculty members. The Open University Catalunya stated that while a learning object model as such was not in place, institutional policy was to make all learning materials available to faculty and staff across the institution.

The most obvious example of a sample institution in membership of a collaborative group for the production of e-learning materials was the University of British Columbia. In fact, the respondent cited several networking initiatives judged to have assisted the university in its development of e-learning materials. The University of British Columbia is a member of edusource, Canada's network of learning object repositories (see Box 3.3). The aim of edusource is to gradually link existing repositories, work towards their common searchability and "provide leadership in the ongoing development of the associated tools, systems, protocols and practices that will support such an infrastructure". The University of British Columbia is also active in the US National Learning Infrastructure Initiative (NLII), part of EDUCAUSE (a leading network concerned with use of ICT in higher education). NLII, an initiative to use ICT to improve teaching and learning in higher education, features as "Learning Object Virtual Community of Practice". Through edusource, the institution is a secondary partner in MERLOT, the US repository. Finally, the respondent cited the University of British Columbia's membership of Universitas 21, the group of research-intensive universities worldwide. Networking opportunities within this group were said to have been "immensely helpful in terms of developing a community of practice among professionals working to develop learning object strategies, and in terms of developing and selecting tools". The University of California, Irvine is also a member of MERLOT. Of course, some repositories, such as MERLOT, admit individual members, as well as institutions; and some

respondents indicated that they were aware of the involvement of faculty members in such activities. Only two institutions specifically indicated that membership of learning materials co-operatives was not a favoured approach. Carnegie Mellon University said that from their perspective a cost/benefit analysis was not favourable, and the University of Maryland University College was committed to in-house production.

In conclusion learning objects are generally seen as immature tools. Although many institutions pay attention to their potential, none of them reported major use. The learning object economy faces several challenges: interoperability, knowledge management issues as well as, possibly, a conflict with traditional academic autonomy and rewarding systems.

Box 3.3. Edusource – Canadian Network of Learning Object Repositories

Edusource is an attempt to link and make interoperable a wide range of learning object repositories from across Canada, and to advance the development of associated tools and mechanisms to facilitate use of learning objects by educators. Primary partners in the project include universities such as Athabasca University (a leading distance learning institution) and University of Waterloo (a research-intensive campus university with a tradition of leadership in learning and technology), as well as provincial consortia such as TeleEducation NB (New Brunswick's distance learning portal and development hub) and Netera (Alberta's information infrastructure corporation, bringing together government, universities and companies). Secondary partners include many other Canadian universities and colleges (including University of British Columbia). Edusource is funded by CANARIE (Canada's Internet development body) and partner institutions.

The project is still under development but goals include the creation of a learning object evaluation system (assisting educators to judge the nature and potential of an object), and the formulation of re-purposing criteria to maximise re-use possibilities. Primary partners have developed or are working on key aspects of the edusource vision. To facilitate interoperability, edusource has adopted CANCORE, a Canadian metadata schema (compatible with emerging international standards, such as IMS).

Mainstream broadband is seen as vital to a vibrant learning object economy, and so edusource is forging links with major national and provincial telecommunications initiatives. The long-term aim is to make the meta-repository available free to all Canadians (although per-object access will be subject to particular licensing criteria, depending on source). A variety of funding models are being assessed including memberships, subscriptions, support and service contracts, licenses and pay-per-use. All material will be available in the two national languages: English and French.

The project website can be found at: *www.edusource.ca/*

3.5. Intellectual property (Question 6.9)

Who owns the learning objects or material collected and used for e-learning? Are institutions addressing this intellectual property issue? The Observatory survey found that 39% of institutions had a "formal policy on intellectual property rights associated with online learning materials and resources", with a further 29% saying that such a policy was under development. Not surprisingly, those institutions more active in e-learning were more likely to have such a policy. For example, the positive response from Asia-Pacific respondents was 76%, compared to 33% for Canada and 36% for the United Kingdom.

The OECD/CERI survey gives a good overview of the disparity of arrangements in this area. In some cases, answers were clear cut – either the institution or the course creator owned such materials, and this was specified in institutional policy and/or national legislation. At some institutions (*e.g.* Monash University, Asian Institute of Technology), this question of ownership was said to be in flux. In the United States, it is commonplace for faculty members to own all teaching and learning materials they create in employment at an institution, while in, for example, New Zealand, the law states that all creative work undertaken while in employment belong to the employer. A number of respondents (*e.g.* University of British Columbia, University of Maryland University College) described a situation where ownership resided with faculty unless "substantial university resources" were deployed in the material's creation. In such cases, a contract was signed setting out the rights of both parties. For example, at the University of British Columbia all courses developed in conjunction with the "Distance Education and Technology Centre" begin with a contract between the Centre, the author and his/her department. In general, the faculty member retained the right to use ideas and content in other formats, and retained ownership of anything created prior to the course being developed. The institution owns the final materials, including websites. The University of British Columbia respondent indicated that this arrangement was controversial, and was subject to legal challenge by the institution's Faculty Association. Since the survey was submitted, the legal challenge was settled in favour of the Faculty Association.

UCLA Extension made a distinction between the curricula (owned by the institution) and the "expression of course content" (*i.e.* any personalised act of instruction, including associated materials) owned by the instructor. While the institution was free to develop the curricula as it sees fit, it could not (without express permission) pass personalised materials to another instructor. This respondent indicated that their institution did not wish to appropriate personalised materials for use by other instructors. It was argued that UCLA

Extension's reputation was partly based on the expertise of individual instructors, and that "canned lectures", that is common materials delivered by multiple instructors, were deliberately avoided on quality grounds. Carnegie Mellon University commented that a faculty ownership policy had caused some complications when the institution wished to use certain materials; and University of California, Irvine made reference to negotiations with particular faculty to clarify rights to certain materials. At the Virtual University of Tec de Monterrey, a dedicated "logistics" department was tasked with negotiating rights from authors at the parent institution.

At Multimedia Kontor Hamburg, the institution owns the rights to materials for two years (with an extension option) – if those materials were created using public funds (*i.e.* including paid employment at a member university). At Zurich University, the institution owns the rights to publicly-funded materials indefinitely. At the Open Polytechnic New Zealand, the UK Open University, the University of South Australia and the University of Paris Nanterre, all materials developed by employees were owned by the institution. The Open University Catalunya preferred to own materials (to enable ease of re-use), but was open to negotiation with authors.

The Carnegie Mellon University respondent raised an important point about collective creation and ownership. Many e-learning materials were created by a team consisting of instructional designers and technologists as well as academics. It was said that many faculty "think" they own materials they have contributed to while in the institution's employment, and may fail to acknowledge the claims of others. The University has developed a policy of clear attribution. This institution also mentioned the appointment of a central "copyright officer" to handle faculty questions about the right to use third party materials. Not least because the University operates in a number of offshore locations with diverse legal positions on such matters, the individual was overwhelmed with work. A revised structure has now been put in place, with a designated copyright officer in each faculty as a "first filter" for queries, allowing both central and devolved support.

In all cases, the ownership of intellectual property of e-learning material appears as important and complex. Finding the right balance between institutions, academics and technologists will be one of the challenges for the further development of e-learning objects and materials.

3.6. Conclusion

The overwhelming view of respondents was that e-learning had a broadly positive pedagogic impact. However, few were able to offer detailed internal research evidence to this effect. Indirect evidence (*e.g.* student satisfaction surveys, retention and attainment data) were widespread. More generally, work

at Carnegie Mellon University and under the auspices of the Centre for Academic Transformation at Renneslaer Polytechnic Institute are leading examples of research-led programme redesign efforts that have produced strong evidence of the positive pedagogic impact of certain forms of e-learning. Indeed, redesign (*e.g.* use of pre-existing software, third party materials, peer/automated feedback, economies of scale) would appear to be crucial in order for e-learning to obtain key pedagogic benefits and cost efficiencies. Crucially, both initiatives are also concerned with dissemination of methodology, offering other institutions valuable sources of expertise.

E-learning opens up the possibilities of redesign, not least through the "learning object" model. Sample institutions expressed considerable interest in the learning object model but were faced with a range of primarily cultural and pedagogical challenges to widespread adoption. These included tensions between the decontextualised object and the contextualised learning encounter/programme, faculty unwillingness to use third party materials and object access, re-use and copyright concerns. A number of institutions pointed to early work to disaggregate in-house materials, with explicit and widespread re-use seen to be some way off.

At present, it is plausible to say that e-learning continues to grow in scale and significance in the absence of an explicit learning object economy. This partly reflects the influence of a "conventional" course development paradigm, but is also indicative of infancy (and thus poor utility) of any such economy. Over time, one might expect cost, faculty time and competitive concerns (alongside an ever-more efficient learning object model) to drive e-learning in a "learning objects" direction.

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