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Managing Technological Change and University Teaching

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Abstract

Current economic and political climates, together with the need to provide more flexible learning opportunities for students, has resulted in unprecedented pressure on education to use information and communications technologies (CIT) as a way of coping with these pressures, without decreasing the quality of offerings.

This chapter reviews the introduction of technology in teaching and learning in higher education from the theoretical perspective of the MIT90s framework developed in Yetton et al (1997), drawing upon case studies of the introduction of technology in teaching and learning in two institutions, and a study of the outcomes of a national initiative to improve the quality of teaching and learning in Australia.

The framework for this chapter draws upon a study conducted in 1996/7 in which the universities of Wollongong, New South Wales and Melbourne collaborated on a report for the Australian Government titled "Managing the Introduction of Technology in the Delivery and Administration of Higher Education" Yetton et al (1997). Their research on twenty Australian universities (ie half of them) charts a substantial shift in the importance of CIT in teaching and administration, and in how universities therefore position themselves strategically in the market.

The report highlights five factors in which organisations must exhibit a 'tight fit' for the introduction of technology to be successful: strategy, structure, management processes, roles and skills, and technology. This chapter refers to each of these factors, but places an emphasis on roles and skills.

In a separate study funded by the Committee for the Advancement of University Teaching (CAUT) a project team reviewed the processes and outcomes of 104 information technology (IT) projects for university learning from 33 universities across Australia (Alexander & McKenzie, 1998). The major finding of this study was that the use of information technology of itself, does not improve learning. Rather, a range of issues were identified which contribute to the success or otherwise of learning and teaching with technology. Each of these issues is discussed within the framework identified above.

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Managing the introduction of technology in teaching and learning

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Introduction
Current economic and political climates, together with the need to provide more flexible learning opportunities for students, has resulted in unprecedented pressure on education to use information and communications technologies (CIT) as a way of coping with these pressures, without decreasing the quality of offerings.

This chapter reviews the introduction of technology in teaching and learning in higher education from the theoretical perspective of the MIT90s framework developed in Yetton et al (1997), drawing upon case studies of the introduction of technology in teaching and learning in two institutions, and a study of the outcomes of a national initiative to improve the quality of teaching and learning in Australia.

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Strategy
Strategies were defined in (Wills & Yetton, 1997) as "how one university competes or cooperates with another in order to improve its performance relative to other universities in the higher education sector".

The interviews with the senior management of the twenty universities in the study revealed five main imperatives for reviewing universities' CIT strategies as a basis for competition through differentiation in the 'market place':

- the need to improve the quality of teaching;
- the need to reduce costs;
- the need to service new but small multiple campuses;
- the competition for students; and
- the changing profile of the student base.

In their study, Alexander and McKenzie (1998:34) asked the project leaders of the 104 IT projects surveyed about the outcomes they had intended for students, staff, departments and institutions at the start of the project. Each of the imperatives listed above was also reflected in the responses. Case percentages may total more than 100 percent, because respondents have given more than one answer to a question.

Table 1   Summary of intended outcomes of the project

Intended Outcome for	Students % of cases	Staff % of cases	Department % of cases	Institution % of cases
Improved quality of learning/teaching	87.0	34.4	21.3	29.1
Increased productivity/ efficiency and access	39.0	39.8	38.6	30.4
Improve attitudes to learning/motivation	16.0	-	-	-
Professional/staff development	-	29.0	17.8	24.1
Increased profile/ recognition	-	2.2	13.9	31.6

Improved quality of learning was highlighted in both studies as a reason for using Information Technologies, and the intention to increase productivity, efficiency and access to learning noted in Alexander and McKenzie is referred to in Yetton et al as cost reduction, servicing small campuses and changing profile of the student base. The increased departmental and institutional recognition noted in Alexander and McKenzie is again noted in Yetton et al as competition for students.

Clearly, the rationale for the use of information technologies in education has changed. Five years ago, CIT was viewed by university management as experimental seeding on the edge of mainstream teaching, and as an expensive if necessary administrative resource. Now, the Vice-Chancellor of a major university talks about "mainstreaming the digital revolution" (Alan Gilbert, Vice-Chancellor, The University of Melbourne).

For CIT to become mainstream however, universities will need to put significant resources into staff development to equip staff to undertake the new roles required. The next section discusses this development.

Developing new roles and skills
It is incumbent on those institutions increasingly relying on Information Technologies in the 'mainstream' of education to recognise the need for new roles for both academic and non-academic staff, and to provide staff development opportunities for those staff which will maximise their investment in CIT.

The majority of universities appear to be lagging behind in this area according to Alexander and McKenzie (1998) who noted a range of issues which prevented staff involved in an IT project from completing a project, or which prevented the project from being as successful as it otherwise may have been.

Analysis of the experiences of academics and students in the Alexander and McKenzie study indicates that the most important qualities of academics who develop information technology projects are no different to those of good teachers. The qualities listed below, from Ramsden et al. (1995:24), are qualities that researchers "generally agree are essential to good teaching at all levels". They provide the critically important underpinnings in developing CIT projects.

- Good teachers display enthusiasm for their subject, and a desire to share it with their students.
- Good teachers encourage deep learning approaches, rather than surface approaches, and are concerned with developing their students' critical thinking skills, problem-solving skills, and problem-approach behaviours.
- Good teachers recognise the importance of context, and adapt their teaching accordingly; they know how to modify their teaching strategies according to the particular students, subject matter, and learning environment.
- Good teachers demonstrate an ability to transform and extend knowledge, rather than merely transmit it; they draw on their knowledge of their subject, their knowledge of their learners, and their general pedagogical knowledge to transform the concepts of the discipline into terms that are understandable to their students.
- Good teachers are also good learners; for example, they learn through their own reading, by participating in a variety of professional development activities, by listening to their students, by sharing ideas with their colleagues, and by reflecting on classroom interactions and students' achievements.
- Good teachers set clear goals, use valid and appropriate assessment methods, and provide high quality feedback to their students.
- Good teachers show respect for their students; they are interested in both their professional and their personal growth, encourage their independence, and sustain high expectations of them.

In recognition of the critical importance of good practice in teaching in the use of CIT in teaching, the Alexander and McKenzie (1998:257) report recommends that 'Staff development opportunities be provided in good practice in teaching'.

The second issue relates to projects that require significant software development and the skills required for successful completion of these. Perusal of the papers from numerous CIT and education conferences indicate the extent to which academics sometimes see their role in development projects as the graphic designer/ programmer/ media developer.

However, Alexander and McKenzie's report notes that very few projects which required significant software development were successfully carried through by the lone academic assuming a range of roles from educator, to graphic designer, to programmer, to media producer. The vast majority of these projects, despite being carried out with the best of intentions and enthusiasm, commonly failed because the particular academic simply did not have the time, or the expertise to carry out every role.

Where the introduction of CIT in teaching includes a significant software development, a further set of qualities in addition to those noted above is required:
- recognition of new roles (project manager, technical director, teacher);
- understanding of individual roles within a team and team dynamics; and
- skills in software development.

Many of the issues/problems highlighted above could have been avoided with adequate project management of software development projects by a skilled project manager. This person would not only ensure that adequate planning and scoping of the project occurred, but would also keep the team working together as a group, while steering it through the planning, development, evaluation and implementation cycles, ensuring that each of these activities is carried out in a professional manner, and recognising and drawing upon appropriate expertise as required.

A further recommendation of Alexander and McKenzie (1998:257) relates specifically to these issues: 'Staff development opportunities be provided in the areas of project management, working effectively in teams, evaluation of IT projects, and legal issues related to IT development, for current and potential project leaders'.

Inadequacies in any of the above qualities commonly resulted in a project's failure to reach completion, or failure to achieve the intended outcomes, and were reflected in projects which:
- were overly ambitious in terms of desired outcomes for the budget and time available (roles and skills);
- commenced software development without adequate planning (roles and skills);
- did not have access to adequate technical advice, expertise and support (skills);
- acted on technical advice provided by people lacking in the necessary knowledge and skills to provide such advice, especially in relation to the selection of hardware and software (skills);
- did not change the assessment of learning to reflect changed learning outcomes (roles and skills);
- did not have access to adequate relevant expertise where projects involved significant software or multimedia development (roles and skills);
- had academic team members who felt they could perform all the technical functions, such as programming, graphic design etc, but were not able to do so (roles and skills);
- had staff on the project team who did not value the different skills required and available for the successful project completion (teamwork and skills);
- had project teams which were unable to resolve differing opinions (teamwork);

- had a project development team which did not include a member with responsibility for project management, and which did not foresee the need for project planning and/or documentation (roles);
- did not adequately prepare students for participation in learning experiences which they had not encountered before, such as working in groups (roles);
- over-estimated students' willingness to engage in higher level learning activities, especially when they were not related to assessment (roles);
- developed a project which was operational on the development computer only, and could not be run on the implementation computers because of inadequate memory, disk space etc, or because of non-existent CD-ROM drives (skills);
- conducted evaluation (if at all) only when the project was complete, and discovered that changes were required for which funds were no longer available (roles and skills);
- conducted limited or poor evaluation of the project because of lack of time and/or budget and/or evaluation expertise (roles and skills);
- did not evaluate the project in the anticipated context of use, prior to implementing it (roles and skills).

Case Study 1: The University of Wollongong
Examples of the implementation of staff development are seen at The University of Wollongong where the Academic Staff Development Committee established a working party to prepare a report on staff development for flexible delivery (Wills, 1997). Although flexible delivery does not necessarily entail the use of information technology, many of the modern techniques do assume a degree of technological literacy. The working party recognised that staff do not all have the same needs. The following grid was developed as a thinking tool to map the varying needs of staff involved in flexible delivery at varying levels.

The first column indicates staff level of use of the innovation (Flexible Delivery). The grid is based on the understanding that staff progress through four main levels of use of the innovation, from *Level 1 Beginners* through *Level 2 Getting Started* to *Level 3 On-the-job* to *Level 4 Advanced.* The need for provision of staff development resources for each area is indicated by the shaded cells.

Table 2 Staff development for flexible delivery

LEVEL OF USE OF INNOVATION	Finding Out About Flexible Delivery	Planning for Flexible Delivery	Designing a Flexible Subject	Teaching Flexibly	Managing and Evaluating Flexible Delivery	Supporting Flexible Delivery
BEGINNERS: aware of innovation but little involvement						
GETTING STARTED: taking the first steps						
ON THE JOB: implementing the innovation in their work						
ADVANCED: improving the innovation, demonstrating to others, and being rewarded						

The working party recognised that:

> …staff development is not only about provision of workshops and seminars but also about provision of information, resources and rewards. Flexible delivery may provide longer term rewards in terms of reducing the burden of time pressures, but it is important that academics who free up that time via innovations in their teaching, do not lose that time by having to take on other teaching commitments. Departments may need to review the way they calculate 'teaching contact hours'. Staff who innovate with alternative modes of delivery should also be rewarded with time release, encouragement to attend flexible delivery conferences and by publicity or other forms of recognition of their achievements in this area. Promotions procedures need to openly take more account of teaching innovations and academics need assistance in preparing Teaching Portfolios which demonstrate their achievements in this area.

It also recognised that most staff development must be well-integrated with departmental plans rather than operating in isolation from the funding and support of the innovation. [1]

Project LEAD
An example of a staff development strategy that goes past the traditional workshop strategy is Project LEAD. Funded in 1998 by a government grant, the University of Wollongong is implementing staff development in the team-based processes that underpin successful introduction of flexible delivery. The need for skills in management, leadership and team building has been highlighted above. Titled Project LEAD (for Leading & Evaluating Advancements in Delivery), it is an example of Action Learning as a staff development strategy. A further example in this chapter is the FLAG project at UTS, described in Case Study 2 below.

While workshops are only one staff development strategy, they are effective in raising awareness and motivation. One-off withdrawal workshops in general do not lead to sustainable change in teaching practices or management practices. Effective staff development programs are collegial, problem-centred and outcomes-based, supported by the organisation, and evaluated (Zuber-Skerritt, 1993; Elliot, 1991; Kemmis & McTaggert, 1988). Action learning programs have these characteristics and make fertile ground for the proliferation of the learning community (Senge, 1990) within the University. Action learning groups link practice to research, setting new goals for collaborative research and learning (UQ, 1996). A community of reflective practitioners (Schon, 1987) encourages effective and ongoing personal and professional development. The University's staff development units in Project LEAD adopt a facilitator and coordinator role rather than a direct training role, a move from staff development to professional development.

The Project LEAD Coordinator has provided teams with tools and processes for:
- brief clarification and team cohesion (purposes, outcomes, roles, responsibilities),
- stakeholder analysis (interests, issues, benefits and risks),
- critical reflection for establishing the meaning and value of current practices,
- baseline measures of current practices and measures of change over time,
- information capture and information sharing,
- conceptual mapping,
- systems mapping,
- flowcharting,
- strategic use of communication strategies for team building,
- network-building strategies,
- debriefing and collaborative, strategic reporting as a leverage strategy for systems change.

Four LEAD teams formed themselves to focus on real problems that require real solutions:
Faculty of Arts: South Coast Curriculum Developers

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[1] Full report at http://cedir.uow.edu.au/CEDIR/flexible/staffdev.html

CEDIR Educational Development Team
Engineering Physics Curriculum Developers
and the Information Management Team: Flexible Delivery

The latter team, the first to be formed, was a multi-functional group representing information management processes that constitute the design, development, production and delivery infrastructure for flexible learning environments. This team included representatives from the Library, Interactive Media Production, Educational Development, Academic Registrar, Secretariat, Print and Distribution, Desktop Publishing, Administrative Information Services and Client Services and Infrastructure and they achieved their initial goal 'development of a system for information capture and information sharing' within the very short span of 4 months. One of the factors critical to the success of this team is now seen to be the evolving role of Team Facilitator taken on by one of the team members under the guidance of the Project LEAD Coordinator in order to ensure planning was taken forward into actionable steps which could then be evaluated and if necessary reshaped.

Comments from members of this team include:

"In hindsight I would admit that I had always been a supporter of the cross-functional team model to open up dialogue and implement change, but until Project LEAD, I had never had the opportunity to develop the necessary new skills and experience the cycle of personal development required to bring these goals to fruition. The staff development opportunity and experience for me was one which I doubt will ever be repeated in such an effective and satisfying manner and one which I will draw upon for a long time to come." (Curtis, 1998b, Appendix 16)

"We are not a committee – we get things done!" (Curtis, 1998a, p.6)

"If someone had asked me what we had achieved, I'd have said not much. But looking at the change in weightings, I can see that there has been an enormous change. We have re-positioned ourselves in light of not having clear direction and created our own." (Curtis, 1998a, p.6)

"This team has been redefining the way the university will work in the future – the model is spreading because people don't have time to waste." (Curtis, 1998b, p.4)

The Project LEAD Coordinator in her Interim Report (Curtis, 1998a) says "there have been a range of benefits to the University from the work of this team that go beyond their impact on more effective systems, structures and processes for information management. Amongst these has been the building of strong and productive boundary-spanning networks, the development of satisfying and mutually beneficial social relations both within and across function areas and the building of intangible assets. While these assets will not appear in any institutional profit and loss balance sheets, they are the very assets that the university requires to assure its location in a higher education market-place which demands high quality and flexible teaching/learning environments." (p.11)

Pathways
As noted above, academics developing educational multimedia and subjects on-line are usually not experienced project managers and lack understanding of the overall development process. Impart, a government funded Cooperative Multimedia Centre in which the University of Wollongong is a shareholder, has collaborated with Griffith University, Central Queensland University and New Media Corporation to produce a development methodology, parts of which are freely available on the web as a staff development resource[2].

Virtual teacher training
If there is to be a paradigm shift in the way educational institutions deliver education, there will need to be a paradigm shift in staff development - not just personal but also organisational. Delivery should be anywhere, anytime. Staff should be able to put themselves into the learner's shoes and actively experience the learning environments that are advocated for their students. In order to mainstream these experiences for students, they need to be mainstreamed for staff professional development. Only when staff are comfortable with using a variety of delivery methods will they be able to incorporate them successfully in their own teaching.

Virtual resources: *Teaching at a Distance*
For example, in 1995 the government provided to the PAGE consortium of Distance Education universities funds for workshops for academic and general staff about designing and delivering education at a distance. PAGE is a consortium of eight universities in Australia and New Zealand collaborating to deliver Professional And Graduate Education (PAGE), at a distance. Originally using television, video and print as the main delivery vehicles, PAGE providers are increasingly moving to the internet and CD-ROM. It was recognised that the future success of the consortium in bringing distance subjects to the market, was largely dependent on quality training for university staff who in the main have had little experience of distance education for their students' learning, nor for their own learning. Funds were also provided to build resources so that staff could learn at their 'own time and their own place'. Impart CMC, University of Wollongong, and Central Queensland University collaborated on the development.

The team decided to construct a hybrid CD: the resources were compiled in web format [3] and pressed onto CD-ROM.   The advantages include:
• multiplatform delivery
• speed of video and audio as the resources are being accessed from CD-ROM rather than across the internet
• capability to easily update and expand the information by providing external links from the CDROM to real web sites
• a familiar navigation interface ie the web browser (Wills et al, 1997).

In addition to standard web navigation and frames, the team designed a graphical user interface to humanise the interaction with the resources. Beginning with a typical

[2] http://www.impart.com.au/pathindex.html)

[3] http://cedir.uow.edu.au/programs/TAAD

scenario in the Dean's Office (the mission assigned), the academic finds out what they need to know about distance education by setting up meetings with the:
• Education Consultant
• Librarian
• Enrolments & Enquiries Officer
• PAGE Liaison person
• Media Services Manager
as well as chatting with a colleague in the Staff Club.

Virtual conferences
For example, universities in NCODE, the National Council on Open and Distance Education, recently collaborated to develop a web site about Resource Based Learning[4], a project which was funded by the Committee for University Teaching and Staff Development. Like the PAGE collaboration described in the section above, its first objective is the provision of information. However it has a second objective (in Stage 2) to provide opportunities for academics (the 'learners') to communicate and discuss at a distance the issues raised by the information in the web site. A series of Virtual Staff Development Workshops are being run nationally to enable academics to experience distance learning at first hand using computer-mediated communication and collaboration, with the web site as the focus. The first online workshop was aimed at staff developers themselves adopting a train-the-trainers approach. It was a combined onsite and virtual workshop – around 15 staff developers attending a national meeting in Darwin plus another 18 participating from their desktops around Australia – working as one virtual class. The themes were negotiated asynchronously online in the week leading up to the synchronous 3 hour event. Nine people indicated they had never participated in an online discussion forum before. Some support was provided to these people but the evaluation of the event indicated that more needed to be done in this respect.

What else was learnt from this experience? It was not completely satisfying for all the participants. Many commented that it was valuable "to be put in their students shoes as participants of the forum" (Gilbert, p.2) however onsite participants became more interested in talking with each other and left the offsite participants hanging in virtual space waiting for some sign of activity. And not all offsite participants who had registered in the week leading up to the event actually participated on the day – something else more urgent took over their desktop. We do not have the discipline yet to set aside the time for our own professional development. It is a contradiction but we still seem to find it easier to pack our bags, endure long flights, risky foreign food, and unfamiliar beds for days away in order to attend an event face to face rather than discipline ourselves to keep our computer desktop free for an afternoon to participate at a distance in a virtual event. It was recommended that in future "The two aspects of the workshop could be viewed as supporting each other with the virtual taking place either prior to and after the face-to-face workshop. The two groups could 'meet' online for a shorter period (1 hour) of synchronous communication on the specified day.' (Gilbert, p.2)

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[4] http://cedir.uow.edu.au/NCODE

A similar story emerged at Teleteaching 96 an international conference attracting about 100 delegates to Canberra plus 100 online via videoconference or the internet, depending on the event. Onsite participants in particular were very uncomfortable with the format. In the interests of practising what is preached as teleteachers, the traditional conference format of papers delivered in half hour parallel sessions was discarded, and seven half day interactive events were held in an Internet Café set up at the Convention Centre. To accommodate the participation of Australian teachers after school and international sites across numerous time zones, the videoconferences were held in the evenings, however onsite delegates chose not to attend because understandably they preferred to go out to dinner and socialise. And in reverse, the virtual conference's social event failed to get onsite delegates rocking and dancing because it was held at 10am in the morning and served coffee rather than the alcohol which normally helps make social events swing (Lefoe et al, 1996).

Everything in the Land Downunder was turned upside down and participants had no familiar formula to fall back on. We have a lot to learn yet about how to make virtual spaces effective. That's not to say all physical spaces are always effective – the traditional mode of delivery in universities and conferences is not very effective yet we stick with it because its familiar and everyone's role is well defined over centuries of use. Virtual spaces need the same sort of refining and polishing and we as teachers must certainly put OURSELVES in the learner's shoes BEFORE we inflict these new developments on our students.

Case Study 2: The University of Technology, Sydney

Flexible Learning Action Groups
At the University of Technology, Sydney 'Flexible Learning' was nominated as a strategic initiative. A decision was made to provide resources to six cross-university action groups, each of which was required to use the resources in a way which would benefit the university as a whole rather than benefit individual projects.

One of the six groups (comprised of academics from across the University) was asked to focus on the role of the Internet in flexible learning and the members (about 20 initially but now around 60) selected three projects: an investigation of the feasibility of and selection of, one Computer-Mediated Communication (CMC) tool for use across the university; the feasibility of conducting on-line assessment; and 3 pilot projects in each of these areas.

Members of the group took a keen interest in the first pilot project, and were kept informed of the successes and areas for improvement in the design of online learning in general, and the use of TopClass in particular.

The critical outcomes of this group have been in the areas of contributions to policy, and the rapid uptake of CMC in teaching across the University. In the area of policy, the recommendations of the group in the selection of a particular tool, the need for centralised hardware, software and support were accepted and put in place. The use of CMC as an integral part of teaching has risen from ~5 subjects in 1996 to over 180 subjects in 1999.

A recent external evaluation of the group's activities (Moran, 1998) confirmed the important role the FLAG Group had played in: raising awareness about the potential of online learning amongst academics across the university; promoting dissemination of good practice in the design of online learning; fostering inter-disciplinary collaboration and links within the University; and as a critical peer-support group for the 'early adopters'.

Alongside the range of strategies for the use of CIT in universities, and the development of new roles and skills are the all important structures which support the development and use of CIT in teaching and learning. Two examples of structures are highlighted in the next section.

Structure
As identified by Alexander and McKenzie, academics need access to adequate technical expertise, access to resources, as well as learning, teaching and evaluation expertise. This section reviews the structures established within universities to respond to these needs.

Yetton et al (p102) characterise approaches to the organisation and management of CIT activities on a continuum, from a centralised model, to complete decentralisation of control. They report that 'older universities have been shaped by a professional bureaucratic model in which considerable operating autonomy has typically been devolved to faculties, departments and individual academics'. The newer universities, the authors claim, are characterised by more centralised bureaucratic structures. The major difference is said to be in the extent to which decision-making and budgeting is devolved. Further, the authors reported a trend to combine CIT services, library, multimedia production and staff development.

Case Studies
At the University of Technology, Sydney two separate but complementary structures exist to provide the range of expertise required for the successful development of CIT projects. The Institute for Interactive Multimedia (IIM) provides support and advice on pedagogical approaches to teaching with communications and information technology, and the technological and project management expertise required for significant educational software development. Alongside IIM is the Centre for Learning and Teaching (CLT) which provides academic staff development in the areas of learning theories, assessment and evaluation. While this structure would be seen by Yetton et al as an example of a 'bureaucratic' structure, it is important to note that much of the decision making does in fact occur within a framework which is devolved. As noted earlier, the FLAG group on Internet use was the catalyst for the large-scale adoption of a Computer-Mediated Conferencing tool within the institution, and put forward recommendations (which were accepted and implemented) for funding for hardware, software and personnel. The role of IIM then, is essentially to implement the recommendations of this group, rather than determining the policy.

At the University of Wollongong, these two structures, originally separate, are now amalgamated. The Centre for Educational Development and Interactive Resources (CEDIR) assists and develops university teachers to enhance the quality of education for

students. As an amalgamated unit, Flexible Delivery is then positioned as just one of the priority areas for educational development, hopefully avoiding the danger that it will be viewed only as a technology issue and in isolation from educational issues. Should subject flexibility entail development of educational materials, a structure like CEDIR's can provide a close coupling of staff development, needs analysis, design, and evaluation with technical production services. A key to the effective functioning of amalgamated units is the ability of multi-skilled staff to act as an interface between university teachers and technical production staff. CEDIR's educational developers each work closely with one Faculty usually via Faculty Education Committees.

The two case studies presented here, while clearly structured as a centralised model, also contain elements of a more devolved approach to the determination of both policies, and of budget priorities.

Management processes
The final piece in the jigsaw described in this chapter is the range of management processes necessary for managing the introduction of technology in teaching and learning. These include support for staff undertaking projects, time release for those staff, facilitating collaboration in projects, evaluation of project outcomes, and undertaking cost-benefit analyses.

The importance of providing support for staff undertaking CIT projects was noted by Alexander and McKenzie's study in which the lack of support from management was cited by almost 15 percent of cases. The report notes the disappointingly high number of Heads of Department who felt that the project leader would have been better off devoting the time spent on the CIT project, to research. As long as this view prevails, there is little incentive for academics to use CIT in teaching.

Time Release
The second issue of providing adequate time release for academics undertaking CIT projects was also noted in the study:

"Comments about lack of time and teaching release appeared consistently in response to a range of questions …almost half of the project leaders reported time problems as a factor which hindered the project's development, and the most common piece of advice offered to new grantees was to "be realistic about the time commitment and seek adequate teaching release".

Collaboration
While some CIT projects are developed by a single or small group of academics, the majority of successful projects appear to be collaborative. The range of the collaborations highlighted in the report include the following examples.

- Collaboration between academics and private enterprise.
An example of this collaboration was the development of the Japanese language learning project 'Kantaro', in which Fujitsu Australia Limited provided the technical expertise required for completion and extension of the project. This collaboration, as well as providing a boost in funding, allowed the academics involved to focus their involvement in the project on what they do best – determining and providing the content, as well as

advising on particular learning activities which they know will promote high quality learning. Fujitsu Australia Limited managed the technical aspects of the project, handled copyright and intellectual property issues, packaging, as well as the marketing and distribution of the 3 CD-ROMs produced.

- Collaboration between academics at different institutions.

One example of this collaboration is the development of a multimedia "playground" by two academics who were teaching statistics at different institutions: The University of Melbourne and La Trobe University. The project originated when the two academics realised they had surprisingly parallel views about the problems of teaching statistics, and about the ways in which it might be improved. They successfully applied for a series of grants and together developed the project which has become StatPlay. The collaboration was one in which they continually talked through ideas, options and strategies, offering different views but deciding together on a particular course of action. The outcome of this project has been the widespread adoption of the project outcome (StatPlay) at both institutions and more recently, since earlier copyright and intellectual property issues have been resolved, to the wider community.

A second example of collaboration between different institutions is an Internet-based political simulation of Middle-East politics. This project was only made possible through the collaboration of a Political Science academic and a Computer Science academic who, through serendipity, met when they were both working at the same institution (The University of Melbourne). When the Computer Science academic heard about his colleague's attempts to run an international simulation using faxes, he saw the potential of email and the World Wide Web to enhance the simulation. Together they were successful in gaining two grants to develop the software for the project, and despite the fact that they subsequently moved to different institutions in another state, the project continued. The outcome of this collaboration has been the development of a very successful and qualitatively different learning experience for students, one which was made possible by the complementary nature of the input of each academic.

- Collaboration between academic development units at different institutions.

The PAGE CD-ROM described earlier in this chapter is an example of collaboration between staff development units. Central Queensland University, with its long experience as a Distance Education provider, had a number of existing staff development resources in print. The University of Wollongong, coming into distance education in more recent technological times, had a number of existing staff development resources, mainly in video. The two content providers collaborated to convert those resources to a digital medium using the multimedia design and production facilities at the University of Wollongong. Staff development is a task of such magnitude that the need for collaboration on developing resources is important. Mobility of academics means that any university that does expend funds on the development of their staff, loses that investment in the learning curve to other universities, unless the investment is shared via collaboration. The development of student resources for generic skills such as information literacy, statistical literacy, communication, career development etc is a task of similar magnitude and one that is BEST tackled by collaboration, for example the

UniLearning web site under development by the University of Western Sydney, The University of Melbourne, and the University of Wollongong.[5]

Evaluation Studies
Finally, the report highlighted the paucity of evaluation studies to determine the degree to which the original project intentions were realised. While in some cases the absence of evaluation data was reported by project leaders as being due to insufficient time and/or budget to undertake the study, in others project leaders reported a lack of access to evaluation expertise.

Of those who did conduct an evaluation, the study team noted the narrow range of evaluation methods used. There was a heavy reliance on student reaction surveys, and in some cases there is an apparent confusion between student reactions and student learning. While student reaction surveys are a useful component of any evaluation, they should not be the only component.

Evaluation needs to be part of all stages of the development and use of CIT. This evaluation needs to be informed by the rigorous models already developed, for example by Kirkpatrick (1994) and Alexander and Hedberg (1994). It should involve academics in: developing their awareness of what is already known about effective evaluation of innovations; thoughtfully choosing evaluation methods to collect valid evidence at different stages of the project and for different purposes; critically analysing and synthesising the evidence they have collected; using evaluation findings to inform ongoing changes to the innovation; and communicating about the innovation and its effectiveness to the academic community and the broader society.

This section has highlighted the importance of providing adequate time release for academics undertaking CIT projects, the benefits of a range of collaborations and the need to encourage a climate of thorough evaluation of projects. Other important management processes include establishing quality assurance procedures involving peer review of teaching materials, resolving intellectual property issues, and providing meaningful reward & recognition for those undertaking the challenges of introducing technology in university teaching.

Conclusions
The outcomes of a 1998 national survey of academics leading IT based teaching projects reinforce the outcomes of a 1997 national survey of management introducing technology in the delivery of education. Technology in itself does not change or improve teaching and learning. Attention to management processes, strategy, structure, and most importantly roles and skills, are the key to successfully introducing technology in university teaching and learning.

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[5] http://unilearning.net.au

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