

Information and Communication Technologies: Institutional Strategies Revealed through a Longitudinal Case Study

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Growing pressure is being placed upon educational institutions as students, employers and governments look at the economic, demographic and technological environments of the present, expecting them to have the answers for the future. Many institutions are turning to information and communication technology (ICT) for some of these answers. The focus of this paper is two fold - the use of ICT in teaching and learning by teaching staff within an Australian tertiary institution (Curtin University of Technology) and the mechanisms the University has established in order to realign themselves with the information age. At certain stages these two coincide to provide an insight into the organisational culture and teaching environment of one Australian University. This paper specifically reports on the relationship between the ICT behaviour of University teaching staff and the strategies used to implement the University's ICT strategic planning initiatives. The data revealed that a number of factors emerged which affected the adoption of ICT. These factors included: leadership across the university, attitude toward the use of ICT; the perceived benefits of adopting ICT in teaching and learning; incentives, modeling mechanisms, the provision of adequate support structures; the time factor; training; facilities and resources.

Introduction

Universities are recognised as early adopters of commercial computer applications and the development of Information and Communications Technology (ICT) in Australia. The AARNet was one of the first academic computer networks in the world and its existence and the skills of its technicians enabled Australia to be an early adopter of Internet technologies and applications. Higher education institutions continue to make major commitments to using new information technologies to improve administration, research, teaching and learning despite experiencing severe resource constraints through lack of national funding. It is evident that the rate of ICT adoption is likely to increase over the next few years increasing financial and infrastructure needs.

At the individual level, many teaching staff are just beginning to use ICT in their teaching and learning due to an increase emphasis at a global level of the Web and communication technologies such as the Internet and email. However, there is evidence (DETYA, 2000) that ICT applications have not penetrated university teaching at much more than a superficial level, and that the level of expertise and practice is not yet sufficient to ensure that their wider use is considered viable by all academic staff. Academic staff are using ICT more for

personal tasks than in their teaching and learning (Macchiusi & Trinidad, 2000; Trinidad, 2000).

Universities are facing the challenge of identifying what role ICT will play in the future of higher education and how to implement the appropriate strategies which will meet the needs of the information age learner. One of Australia's key technology oriented Universities, Western Australia's Curtin University of Technology, has demonstrated a high level of commitment to the use and encouragement of ICT in teaching and learning through a number of initiatives implemented in recent years - more specifically, the Professional Development Course Program, Grants, Awards, and the IT Review. This paper attempts to examine the relationship between the ICT behaviour of a University teaching staff and the strategies used by the University to implement the University's ICT plans

This analysis was achieved by a longitudinal research study which identified the University initiatives which were aimed at encouraging and supporting the use of ICT by academic staff. Survey (N=384) as well as interview (N=37) data provided valuable information on the links between the staff and these initiatives, however the key instrument used to monitor these links was an ongoing self-monitoring instrument, the TraclT report. Through the TraclT reports over a 16 month period 32 case study teaching staff were monitored closely to ascertain the extent to which the strategies implemented by the University had filtered through to them.

Innovation uptake

One well known model concerning the diffusion of educational innovations has been based on the work of Rogers (1995). He identifies categories of innovation uptake from high level through to low level - innovators, early adopters, early majority, late majority and laggards. Under this model for significant change to occur, a 'critical mass' of individuals need to have adopted and implemented a given innovation (Green & Gilbert, 1995; Deden, 1998; Rogers, 1995). This 'critical mass' occurs when enough individuals have adopted the innovation so that the innovation's further rate of adoption becomes self sustaining. According to Rogers (1995), the key category is the 'early adopters' cohort as this group can subsequently trigger the movement to a 'critical mass' of adopters. The literature suggests that this can be a slow and in many cases, a painful process (Candiotti & Clarke, 1998).

In addition to these 'critical mass' factors, the pedagogical forces that have driven the push for universities to adopt and incorporate information and communication technologies include:

- Information access: The World Wide Web has made it possible for all people to access primary sources of information. Mastery of this tool has become essential in order to gain access to an ever growing body of recent and up to date knowledge available to us electronically.
- New communication skills: Employers are expecting graduates to be familiar with email etiquette and associated communication tools.
- Asynchronous learning: This initiative has enabled institutions to cater for a variety of students by removing the barriers of time and distance. Students who are normally geographically disadvantaged have access to a variety of resources not usually at their disposal (Deden & Carter, 1996).

With such obvious pedagogical benefits the question must be asked: Why haven't these new and powerful technologies permeated to a greater extent? The literature reveals a variety of

factors that have contributed to the lack of adoption and effective use of ICT at the tertiary level by teaching staff:

- *Leadership.* According to Dolence & Norris (1996), many educational leaders are inexperienced in conceiving growth oriented learning opportunities in the Information Age. For example, Gilbert (1996) points to fragmented institutional planning where institutions fail to match the technology investment with an investment in people (i.e. adequate training, appropriate incentives) (Ehrmann, 1994; Lan, 1997; Williams, 1997; Alexander, 1998). In other institutions, plans tend to be driven by the information technology itself and not necessarily by a pedagogical rationale and focus (Deden & Carter, 1996; Gilbert, 1996; Brown, Burg & Dominick, 1998). The lack of models for integrating ICT into the curriculum (Schofield, 1995; Gilbert, 1996; Northrup, 1997) also contribute to a lack of effective institutional planning.
- *Technology infrastructure and cost.* Lack of uniformity in computer hardware and software systems (Brown, Burg & Dominick, 1998) within the one organisation is another factor noted as hindering the adoption of ICT. There also appears to be an assumption that technology will automatically reduce operating costs and increase productivity (Green & Gilbert, 1995).
- *Innovation and change.* As with many other kinds of innovations, even when technology has been well established, its greatest potential is rarely achieved (Candiotti & Clarke, 1998; Lan, 1997). It should be noted that one of the major factors contributing to the lack of adoption of any innovation, not just ICT, is the entrenched attitudes of the teaching staff along with an associated reluctance to change (Fullan & Stiegelbauer, 1991; Candiotti & Clarke, 1998).
- *Resources.* One of the major concerns for most institutions is a lack of resources and funding. People resources are stretched to the limit and teaching staff are not only asked to do more, but they are expected to do it differently (Gilbert, 1996; Northrup & Little, 1996).

University Initiatives

Curtin University of Technology has demonstrated its commitment to the use and encouragement of ICT in teaching and learning through a number of initiatives:

- Major University Restructuring - The establishment of the Office of Teaching & Learning - a parallel division to the Research and Development Division.
- New Professional Development Courses - Surviving IT, Computer Literacy for Academics, WebCT, Teaching & Learning @ Curtin.
- Extensive New Awards System - The Innovative Teaching Practice Award (ITP) program at Curtin University was initiated by the Office of Teaching & Learning to provide recognition and reward for exemplary teaching by individuals, teams and schools.
- Innovative Teaching Grants - The Learning Effectiveness Alliance Program (LEAP) is one of the major strategies implemented by Curtin University of Technology in response to the key strategic priority "Introduce reward mechanisms for good teaching" (Curtin University of Technology, 2000).
- Initiation of an External Infrastructure Review - Curtin University employed an outside contractor to conduct a review of the IT&T service delivery (the IT Review) at Curtin University. In June 1999 a final report was delivered with a total of 53

recommendations. Since this time Curtin has spent a considerable amount of resources attempting to initiate many of the recommendations.

- New Approach to Policy & Planning - Curtin University appears to have adopted a more 'entrepreneurial' approach to Strategic Planning and hence management of the University (Strategic Plan 2000 - 2005).
- The establishment and implementation of a new University-wide electronic student records and management system.

Research Methods

The data collection for this study involved four distinct phases. The outline of each phase provides an account of the process and approach the researcher applied to the specific task.

The Survey

Phase one, involved the design, development and validation of an instrument, the Curtin University Information Technology Survey (CUIT survey) - an instrument specifically designed to establish baseline data about teaching staff at Curtin University with regards to the use of ICT in their teaching and learning. Table 1 outlines the survey dimensions.

Table 1: CUIT Survey Dimensions

Scale	Attributes
<i>DEMOGRAPHICS</i>	<ul style="list-style-type: none"> • Name (optional) • Age • Gender • School/Department • Current Position • Main Teaching Subjects • Years at the University • Employment Status • Modes of Teaching Used
<i>TECHNOLOGY ACCESS</i>	<ul style="list-style-type: none"> • Computer Use • Internet Access/Use • Email Access/Use
<i>TRAINING</i>	<ul style="list-style-type: none"> • IT Training • Awareness of Curtin professional development Courses
<i>IT IN TEACHING & LEARNING</i>	<ul style="list-style-type: none"> • Level of IT Use • Software Used

	<ul style="list-style-type: none"> • (teaching preparation/ • during teaching sessions/students) • Attitude Scales - IT Issues
<i>POLICY FRAMEWORK</i>	<ul style="list-style-type: none"> • Curtin University IT Strategic Plan • School/Department IT Plan
<i>IT GOALS</i>	<ul style="list-style-type: none"> • Personal Goals • How can Curtin University Help?
<i>FOLLOW-UP INTERVIEW</i>	<ul style="list-style-type: none"> • Yes/No

The CUIT survey was administered to all full-time academic teaching staff at Curtin University of Technology (N=715) during the period of March - May 1999 with a return rate of 54%. As the researcher aimed to measure change over a period of time, it was important that existing practice and related benchmarks be identified. The survey was therefore designed to identify individual and group profiles of information and communication technology attitude, awareness and uptake.

The following two phases (Phase Two - Case Study Participants and Phase Three -Curtin University Initiatives) were linked and occurred concurrently.

Case Study Participants

Included in the CUIT survey was a question asking respondents if they would be interested in a follow up interview. Over one third of the survey sample agreed to participate in a follow up interview. A separate database was created with this group of respondents.

A process of stratified sampling was applied generating a subsample representative of the whole population in terms of certain criteria. The specific criteria used involved stratification based on: Division, School/Department and the Level of ICT Integration Rating. This final criteria is linked to the theoretical framework of Rogers' (1995) innovation uptake model. This was determined mainly by examination of the responses to question 16 of the CUIT survey.

Ten people were selected from each of the Divisions of Humanities, Health, School of Business and Science & Engineering. The ten represented two people from each level of the five ICT ratings (very low - very high). Proportional representation dictated that only five were selected from the School of Mines (Kalgoorlie) and Muresk campuses, with one representative from each ICT uptake levels. The total number of participants selected for this phase of the study was 50.

A semi structured interview schedule was designed to allow the researcher to gain a deeper awareness of the ICT culture of each participant. The interview schedule was carefully linked to the individual responses from the survey database which allowed the researcher to

personalise each individual interview. This enabled the researcher to clarify and consolidate certain survey responses made by the respondent. The following key issues were addressed in the interview:

- ICT use in teaching & learning;
- ICT use (personal/professional/students);
- training;
- attitude toward ICT use;
- ICT facilities (personal/professional/students);
- ICT concerns; and
- personal ICT goals.

Due to a variety of reasons (long service/study leave, other commitments) a total of 37 out of the 50 were interviewed. The interviews were conducted by the researcher over a period of five weeks and ranged from 30 - 45 minutes.

At the end of each interview the interviewee was informed of the next stage of the research. Each interviewee was then asked whether they would be prepared to participate in the following stage which involved monitoring individual ICT changes which occurred over a 12 month period, on a monthly basis. For this purpose a special electronic tracking proforma was designed to record responses on their ICT use. This proforma, called the TracIT report, was presented to the interviewees and explained with examples. Thirty two of the 37 participants agreed to be part of the longitudinal study.

Tracking Change - Case Study Participants

The TracIT report was used as a guide to help the case study participants focus on specific ICT issues. Table 2 (found on the following page) provides an example of the TracIT report proforma. This data collection process involved the researcher sending an email message at the end of each month to each case study participant which they in turn returned with their message reflecting any ICT changes that had occurred over the past month. For those respondents who did not have any changes to report they simply returned the email message to the researcher.

Table 2: Sample TracIT Report Headings

<i>August 1999 - Change in ICT Use</i>				
Teaching	Students	Training	ICT Support	ICT Facilities

As time progressed the case study participants ventured outside these boundaries and used the headings simply as a reminder or focal point. It is important to note that individual profiles (reflecting ICT use, access, attitude and views of ICT in teaching and learning) of the case study participants had previously been established through the survey and the

interview data, however the TraclT report was used to identify changes which occurred over the subsequent 12 month period. This longitudinal data collection period allowed the researcher to note changes in the behaviour and attitudes of specific individuals and most importantly, to explore the origins of these changes.

Curtin University Initiatives

This phase involved the identification of the strategies implemented by Curtin University of Technology which claimed to support and encourage the use of ICT by academic staff in their teaching and learning. For example, strategies such as the professional development of staff, incentives for staff to adopt ICT, support structures, and ICT infrastructure. These initiatives were identified by the following methods:

1. Extensive examination (content analysis) of relevant Curtin University policy documents.
2. Regular monitoring of Curtin University's electronic information dissemination systems, Curtin Web Page, Enews, Learning Matters, staff academic E-mail list.
3. Contact with key Curtin University personnel involved in ICT initiatives (i.e. Information Management Services, Centre of Educational Advancement, Office of Teaching & Learning).

As mentioned earlier, phases two and three occurred virtually simultaneously. The case study participants were monitored closely via the monthly TraclT reports to ascertain the extent to which the strategies implemented by Curtin University had filtered through to the teaching staff.

Key Findings from the Longitudinal Study

A number of themes emerged from the various data sets collected over the course of the study which in turn generated a number of assertions (generated from a synthesis of the research findings) about teaching at the tertiary level within an ICT environment in an Australian university. The assertions are specifically based on the data collected in this study concerning current teaching practices and existing working environments of the teaching staff at Curtin University of Technology.

Assertion # 1: Major cultural change across an entire university needs to occur if there is to be any significant change to the University's teaching practices.

Data strongly suggest that Curtin University of Technology has already undergone a major cultural transformation at both an individual and organisational level regarding the integration of ICT in teaching and learning. The change which had the most profound affect on teaching and learning was the establishment of the Office of Teaching and Learning - a parallel structure to the powerful Office of Research and Development Office. Such a move was a timely indication to all the stakeholders that the University valued teaching and research equally.

The restructuring at Curtin University also saw the establishment of the Centre for Educational Advancement (CEA) - a key branch within the Office of Teaching and Learning. The chosen division of labor within this Centre - staff development, educational media support, distance education - signaled a further commitment to the quality of teaching and to the integration of ICT in teaching and learning. This strategy also meant that the University

has made a clear distinction between the educational media support and the already well established technical support.

The Office of Teaching & Learning also instigated a number of initiatives to reward and encourage good teaching - The Innovative Teaching Practice (ITP) Awards and the Learning Effectiveness Alliance Program (LEAP). The focus of both of these initiatives has been on teaching and learning practice, however by publicly identifying and rewarding certain individuals, teams, Departments/Schools and projects, the University is clearly acknowledging those practices the University wishes to encourage and emulate. Importantly, over the past few years the use of ICT has been a feature of the winners of these awards and grants. Such an initiative has a revitalising effect on the whole University as it rewards the practice of good teaching as well as encouraging the practice of good teaching through modelling. Providing an effective means of disseminating is essential, as the research literature has identified that effective modelling of the appropriate use of ICT in teaching and learning is seriously lacking in most tertiary institutions.

Another key initiative which caused major structural and subsequent cultural change was the instigation of the IT Review and the implementation of its recommendations which occurred at significant cost to the University. It is recognised that changing the structures within an organisation does not necessarily equate to changing the culture of an organisation, however the evidence is that the particular structural changes resulting from the review were brought about by the commitment from the University to changing the culture of teaching and learning at the University. Within Curtin University these structural changes were crucial if real change in the existing culture was to occur. As Fullan (1998) tells us - it is the people who place pressure on existing structures, which in turn force them to change.

According to McClenney (1998), innovation is transformative only if institutions can find ways of employing examples of success which can lead to new forms, new structures and new cultures. This is certainly the case with the ITP Awards as well as the LEAP Grants. Curtin University appears to be working toward the common features identified by Clark (1998): 'a strengthened steering core' - identified in the new Strategic Plan; 'a diversified funding base' - developing fully online units, stimulating offshore market development; 'a stimulated heartland' - teaching staff are adopting ICT in their daily teaching practices; an 'integrated entrepreneurial culture' that embraces change - reflected in the approach and language of the Strategic Plan as well as the changes in structure to support these changes.

Assertion #2: The adoption of ICT into the working environment of a university teacher significantly increases the workload of individual staff.

Information and communication technologies have enabled people all over the world to work anywhere and anytime, allowing a much more flexible working environment. ICTs not only allow us to be more flexible regarding where we work, when we work and with whom we work, but it has the potential of increasing the working day. Such a flexible working environment which has no boundaries has great potential but also has 'unintended consequences' (Fox, 2001). The references to the heavy work load (teaching, research & committees) and the lack of time to complete all of their assigned tasks was evident throughout the data collected over the 16 month time period.

One of the factors which appeared to contribute to the increased work load was that individuals perceived they were receiving less administration help than they had previously been accustomed. However, the matter is not one which was clearly decided by the data collected. Another contributing factor to the perceived increased work load was the fact that teaching staff were having to constantly deal with a great deal of information. Information overload was certainly felt by the majority of the case study sample. The dramatic increase

in electronic communication with students, via email or discussion groups in a structured web-based environment such as WebCT, was identified as the main contributor to this information overload. This rapid escalation in electronic communication with students also required the need to re-examine unit management policies and include in course outlines the appropriate procedures and protocols for electronic communication with students.

The data also indicated there has been an increase in work load for those staff who have adopted Web-based materials for their teaching and learning. Creating Web-based resources was not the only concern - the issue of constant maintenance was certainly identified in the TracIT reports. Although creating Web-based material has become easier, it is still a time consuming task. There appeared to be a cycle where integrating ICT in teaching and learning caused the work load of teaching staff to increase, and yet on the other hand some teaching staff claim to have been unable to increase their use of ICT due to their heavy work load.

There were many examples throughout the TracIT reports relating to stressful situations which were derived from having to do more tasks with less help and less time and with unfamiliar tools. Certainly the introduction of ICT in higher education has enabled teaching staff the means to complete certain tasks with efficiency, and affords them the luxury of flexibility and the ability to explore new ways of teaching. Furthermore, it appears to have become embedded in the working culture of the University to the extent that it is now difficult to function without the technology.

Assertion #3: A necessary condition for the effective implementation of an ICT policy for a university is the university's basic commitment to providing appropriate resources.

Time appears to be the most sought after resource by teaching staff at Curtin University and more than likely for academic staff working within other higher education institutions. This lack of time was the single strongest resourcing issue raised by the survey sample. The issue of time was also carried through with the case study sample where there was constant reference to the lack of time in their monthly TracIT reports. Overall, the comments reflected the teaching staff's lack of time to complete tasks due to their heavy work load, as well as the lack of time to learn and practise new ICT skills. Another critical element identified by the study was the need for specialist/expertise help for those who were not the 'ordinary user'. This group, as one would expect were the innovators, who required very specific high level help with more complex problems. It is clear that the morale and productivity of staff are profoundly affected by their environment. Constantly having to battle with inadequate facilities certainly affects the way an individual chooses to work, their attitude toward their work and the effectiveness of their work.

As identified earlier, the introduction of ICT in tertiary education has enabled a greater flexibility in the working environment for teaching staff. However, this change has also placed, and will continue to place, more pressure on a university's remote access facilities and policies. Certainly it is clear from this study, that if a university wishes to encourage the use of ICT in teaching and learning and embrace the notion of working anywhere at anytime, the university must provide appropriate levels of support mechanisms for this to occur.

These issues of inadequate resourcing are certainly not restricted to Curtin University, being a major issue affecting many tertiary institutions nationally and internationally. As seen from the data collected at Curtin University of Technology, there are a variety of support mechanisms which need to be put in place to form this human infrastructure. These key mechanisms are related to: incentives, reward structures, recognition, training and effective leadership.

Assertion #4: The existence of transformational leadership across all levels of the university is a major factor in the promotion and adoption of ICT and ultimately in the development of a truly professional learning community.

The study reveals that leaders at Curtin University have adopted an entrepreneurial approach to the formation of the current University Strategic Plan. Kaplan and Norton's (1996) Balanced Scorecard method was adopted where specific goals and initiatives could be assessed rather than relying simply on financial indicators. The overall planning process revolved around productive partnerships in terms of the staff and organisational culture, clients, core activities and financial security.

Within the context of ICT uptake, the evidence is that the leaders within the University have attempted to provide a balance of pressure and support. It has been identified through the data collected in this study that there has been significant pressure to adopt ICT in teaching and learning, in particular online development of courses. It appears that at various times the balance of pressure and support was uneven. The IT Review was a major initiative which attempted to correct this imbalance. The establishment of the Office of Teaching and Learning was another major leadership initiative which clearly helped to reshape teaching and learning across the University.

Leithwood (1992) noted that the goals of transformational leaders were to encourage people to develop and foster a collaborative and professional culture, to encourage and stimulate staff development, and to promote the use of collective problem solving. The initiatives at Curtin University have been instigated for exactly these purposes. Transforming the culture of an organisation into a professional learning community requires individual staff to take on leadership roles within the various levels of the organisation - and more importantly in the 'academic heartland'. The innovators identified in this study were the leaders in adopting ICT but also the leaders in initiating and implementing real change in their Department/Schools.

Assertion #5: In order to assist a University to become a truly professional learning community, strategies involving targeted staff development and reflective practice need to be built into the working regime of all teaching schools and departments.

Green (1998) in the USA found that assisting staff to integrate technology into their teaching was the 'single most important information technology issue confronting their organisation'. Nearly 60% of the CUIT survey sample indicated that integrating ICT into teaching and learning was the most important issue currently confronting them at work - with a similar response from those who indicated they would use technology to a greater extent if they had more information on the best usage of ICT in their teaching area.

This information highlights the structure of the University's professional development initiatives in light of the data collected and addresses the need to focus on developing teaching professionals not so much on professional development. A variety of issues surfaced regarding the University's professional development needs, the most common concern being the issue of time to attend training sessions. It is a persuasive argument that the time to undergo professional development needs to be recognised as part of the total academic workload. This is a crucial element if there is to be a culture where life-long learning is to be valued and practised. It is important to also recognise that professional development is not simply an add-on - it needs to be part of the working calendar. Time needs to be allocated to encourage reflective practice which enables individuals to identify their own needs and design a course of action to meet these needs. If such time was allocated, then staff would be responsible for their own participation in ongoing professional development. This could quite easily be monitored, included in portfolios and formally documented through yearly reviews. Even though the data revealed that some teaching staff

at Curtin University were reflective about their personal ICT goals and their adoption of technology, it is still important that more avenues are provided for individuals to continually reflect and modify teaching practices according to these analyses.

Assertion #6: The integration of ICT into teaching and learning practices is more likely to occur if teaching staff are in the position to identify significant benefits for not only their students, but also for themselves.

There is strong support from the general change literature indicating that an innovation will not be successfully adopted if the individual does not perceive any real value in making any changes. What appears to be clear from the data in this study is that examining the issue in terms of measurable benefits is no longer appropriate to groups of high end users - they see that the adoption of ICT in their teaching and learning as a natural response to the changing university environment.

This assertion is embedded in the data derived in particular from the low end users who could not identify any real benefits for integrating ICT for themselves. They noted that utilising ICT, especially in the initial stages, was difficult and time consuming and added to their already high work load and therefore they saw no real benefits for themselves. In other words, it was not productive for them to utilise ICT. An important finding was that the TracIT reports identified that the first group who had moved beyond identifying ICT as a benefit (part of their very culture) continued to use and experiment with ICT in their teaching and learning, while the pattern of ICT use did not alter over the 12 month period for the other group. It seems that those who cannot identify any benefits for themselves are less likely to attempt to adopt ICT into their own teaching and learning.

Assertion # 7: The use of a planned diffusion model such as Rogers' (1995) diffusion of innovation theory in the implementation, monitoring and evaluation of ICT adoption, can be an important tool in implementing change within a university environment.

One of the key theoretical constructs adopted by this study was Rogers' (1995) so called "rate of adoption categorization" and his "critical mass" concept. Being able to identify the rate of adoption of various staff members proved to be a most useful tool and was subsequently applied on numerous occasions throughout the data collection period and analysis, as it enabled the researcher to make some generalisations about the rate of adoption, and whether this had changed over a period of time.

Once the rate of adoption categories were identified for a particular subsample the researcher was able to determine whether critical mass had been reached. For instance from the survey sample, the researcher was able to identify very early in the study that the integration of ICT in teaching and learning had reached the critical mass stage at Curtin University. According to Rogers' theory once a critical mass stage has been reached, then the innovation can be self-sustaining. He also recognised that it was important to target the early adopters group (high level) as they can trigger the larger group to the critical mass stage. As Curtin University was beyond the critical mass stage, this particular study found that the innovators were not only the leaders in adopting the technology, but also the leaders in initiating and implementing change within their own Department/School. It is therefore important for institutions to recognise and strongly support the early adopters and innovators as both are crucial to the diffusion process.

Assertion #8: As the use of ICT becomes institutionalised in the working culture of the University organisation, a set of performance standards or guidelines need to be established for staff (new and existing) if they are to enter into and function effectively within such an environment.

As Education Departments around Australia are developing and have developed competency frameworks and benchmarks for practicing school teachers, it is important for universities to demonstrate their commitment to developing and strengthening professional excellence in teaching and learning, by following a similar path. Establishing a set of guidelines or benchmarks for staff is important so that they are aware of what is expected of them regarding those skills and processes which need to be adopted in their teaching and learning practices. Establishing such benchmarks enables staff to reflect on their professional effectiveness, identify professional development opportunities and encourage life-long learning.

Within this study, the researcher was able to identify a set of performance standards specific to Curtin University staff through the close examination of the individual profiles. Again Rogers' (1995) adoption categories aided in the evolution of certain common attributes. These common attributes identified in each adopter category provided a general overview of how most of the individuals within that particular category had adopted ICT in their teaching and learning. In particular, certain patterns evolved which identified the applications they utilised, their own personal attitude toward ICT and how they actually adopted ICT in their teaching and learning.

When adopting such a process to develop performance standards or guidelines the focus must be on the early majority category (medium level). Specific to Curtin University of Technology teaching staff the following minimum performance standards are suggested in Table 3.

**Table 3: Minimum Performance Standards for
Teaching Staff at Curtin University**

Application	Attitude	Adoption
<p>Staff at Curtin University will be able to utilise the following applications:</p> <ul style="list-style-type: none"> • Wordprocessing • Electronic Communication <p>Work/Home</p> <ul style="list-style-type: none"> • Spreadsheets • Presentation software • Web Browsers • Web-based Development Tools 	<p>Teaching staff at Curtin University will be:</p> <ul style="list-style-type: none"> • able to feel comfortable with the technology itself. • able to identify the benefits of integrating ICT in teaching and learning. • resourceful - able to seek information from a variety of sources. • reflective in the use of ICT. 	<p>Teaching staff at Curtin University will be able to:</p> <ul style="list-style-type: none"> • communicate with students and colleagues electronically. • encourage and promote the use of ICT through developing Web-based material for delivery of resources as well as initiate real learning, and set Web-based

		assessment tasks.
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These are very simple, yet practical guidelines. Too often competencies are written in such a generic way that they are difficult to measure and almost impossible to achieve. It is important for universities to constantly revisit such benchmarks and monitor whether the benchmarks reflect the University's current vision and strategic plan.

Concluding Comments

The study on which this paper is based identified four crucial areas which require attention if ICT is to be effectively integrated into the working and teaching environment of Australian Universities.

Quality Leadership

As outlined in a number of previous sections, leadership is one of the most important elements when attempting to develop a Professional Learning Community that will be able to sustain effective technological change. Leaders need to be aware of the human face of change and critically evaluate the need for certain change. Leaders are also responsible for setting goals and striving for certain standards within predefined time frames and one of the keys to being a good leader is making sure that these expectations are realistic and humanly possible.

University Policies

The study clearly indicated that academic staff face insurmountable challenges if they are expected to simultaneously produce high quality research, innovative teaching and meaningful community service. Institutional policies need to be flexible with respect to academic staff workloads by providing initiatives which encourage and support Department/Schools to allow individual staff to negotiate their teaching, research and community service balance according to their interests, expertise and the specific needs of the School. These duties could be negotiated on employment and continued at annual reviews with the Head of the Department/School. Interestingly, in the case of the University under study, it allows individuals to make such judgements about the balance of their own teaching and research tasks in the work place in its own internal promotional procedures.

As a direct result of this study it is suggested that an equivalent process to the operation of the Research Performance Index (RPI) which tracks and rewards research activities, be introduced across the University for teaching. This process also should include dimensions which directly relate to the use of ICT in teaching and learning. As the adoption of ICT becomes part of the overall working culture of the University, the University's remote access facilities and policies relating to these facilities, need to be continually monitored and adjusted in order to reflect the specific working needs of the teaching staff.

Professional Development

The results of the present study clearly suggest that Universities should integrate regular professional development within the normal working culture of all staff. Further, any model or plan for ICT integration for the University should establish strategies and provide resources

whereby individuals can analyse their own professional development needs and identify the most effective method of meeting these needs. A comprehensive set of University performance standards in this area would aid such a process as well as the introduction of a monitoring system such as the TraCIT reporting system. Initiating such mechanisms would demonstrate that the university valued reflective practice as part of an individual's own professional development progression.

A powerful tool in this specific area of professional development is the modeling of effective use of ICT in teaching and learning. The Innovative Teaching Practice Awards are a useful start in this area, however universities need to tap into as many sources of innovative practice as possible. From evidence drawn from this study, forums which encourage on a regular basis a 'show-casing' and subsequent discussion of effective use of ICT in teaching and learning within School/Departments and across disciplines, are likely to be an effective professional development strategy.

Infrastructure

It has been clearly documented in the literature (McNaught et al., 1999; Green, 1999; Bates, 2000; Jacobsen, 2000) as well as through this study, that for effective use of ICT in teaching and learning, high quality technical support is crucial. More importantly the evidence from this study is that such technical support needs to be sourced within the Department/School and that the people who are providing the service need to adopt a more 'humanistic' approach to those they are helping. The range and varied use of ICT across the university also calls for different levels of ICT support. In other words, those individuals who engage in more sophisticated use (there certainly appear to many of those within the University) than the average user at the university, should be able to contact a more sophisticated help system. It is no longer appropriate to have a 'one size fits all' approach.

There now appears to be a strong need for technical support to encompass and assist in the mechanics of developing and maintaining Web-based environments. If an online environment is to be encouraged it also needs to be technically supported not only for university staff but also for students. As more staff adopt Web-based environments the need to support students will be magnified. Staff engaged in such units should be able to refer students to a specific help line and not have to deal with technical problems students may be faced with.

If ICT is to be seen as an integral part of the teaching and learning process then the University must provide ample computer access and projection facilities in all teaching classrooms. Remote access facilities for staff need to be provided free of charge and Department/Schools should be encouraged to support leasing laptops for staff instead of stand alone computers. This will enable staff to take advantage of the full flexibility of ICT. Such hardware/software should be upgraded on a regular basis by a technical support team.

The research data clearly indicates the need for universities to be flexible when implementing certain hardware and software policies. Standardising equipment is required for all of the obvious reasons, however there needs to be some flexibility where innovators can continue to experiment at the cutting edge. Weigel (2000) warns universities of the need to be aware of falling into the trap of "commoditisation", where products or services become standardised so much to the extent that their attributes are roughly the same. The writer understands the need to economise and that the various disciplines need to provide some consistency for students and staff - however the fear of removing individual autonomy and having every unit within a course resemble every other unit across all disciplines, is clearly what Weigel (2000) refers to as "commoditisation". This is where universities need to be creative and resourceful and perhaps provide a suite of options.

As the University market place is becoming more competitive, with students as the consumer having the option of taking their purchasing power where ever they choose, they will demand and have every right to demand, the highest possible quality teaching and learning environment. In the 21st century this environment must necessarily involve the most effective use of information and communication technologies.

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