

Toward Supporting E-learning and Providing E-teaching Services for E-world

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Abstract. We are entering the e-World. One special part of it is an e-University that supports e-Learning and provides e-Teaching services. Graduates must be well prepared for working in, with and through the e-World. e-Learning and e-Teaching services are necessary to support modern students learning and help academics to provide excellent teaching. This document reports on the School of Information Technology' initiatives, projects, courses and systems that lead toward e-Learning and e-Teaching in preparation of graduates for the e-World. The major lesson of our work toward supporting e-Learning and providing e-Teaching services is that the School's (the authors believe higher education) greatest asset is intellectual capital (human capital), not intellectual property.

1 Introduction

The influence of Information Technology on business, industry and the whole society is growing. Traditional ways of doing business, carrying out production processes are being changed as the result of introducing both computers and computer networks; and information technology based methodologies, techniques and procedures. A computer has become an integral part of work environments. Companies do business via the Internet. Many businesses employ people and allow them to work at homes that have a connection to the Internet. General public has started doing banking, shopping and communicating with institutions and their friends via the Internet. The world has been made smaller – the world is becoming the e-World.

Many universities in their wisdom are preparing students for the e-World; they are choosing to support students who cannot come to their campuses because of work, distance or family requirements; their decision to be competitive or being forced by financial factors have intensified their effort to support student learning processes and provide teaching services using resources, tools and methods of information technology. These universities have embarked on the development path of e-Learning and e-Teaching – the use of Internet technologies in learning and teaching. This path is complex as there is a need to not only provide basic lecture materials on the Web but also to develop new methodologies and teaching methods, which have a computer and a network in their core. Furthermore, there is a need to create a study environment for students who wish to acquire knowledge and skills far away from university campuses, when studying at home or work environment, as well as to provide support for those students who wish to come to campuses – full and flexible delivery of

courses should be provided to both groups of students. One of the problems that e-Learning and e-Teaching should solve in pursuing flexible offering of course, where there is no border between on- and off-campus study, is to create an environment of sharing a spirit of a university and being within, and working in groups, which on-campus student either appreciate or take for granted. This could only be achieved if multimedia services via broadband networks are commonly used.

University students must be well prepared and constantly enriched to take advantage of e-Teaching and participate in e-Learning and graduates must be made ready for working in, with and through the e-World.

The School of Information Technology has been one of the major creators and builders of systems leading toward e-Learning and e-Teaching, and offering through them services to prepare graduates for the e-World. This paper reports on the School's initiatives, projects, courses and systems in this area. In this document some references are made to the Deakin University wide projects leading toward some information technology infrastructure and services, as they form a basic for the School's work.

This document addresses the following issues. Firstly, it shows a relationship between e-Learning and e-Teaching; and modes of study from the School's point of view. Secondly, it presents opportunities to learn to use computing technologies that allow Deakin students to take advantage of e-Teaching and participate in e-Learning; on-campus access to hardware and software, and access to email and the Internet. Thirdly, it briefly characterizes basic tools (systems) that support students in their learning activities and teaching services of the School of Information Technology. Fourthly, it demonstrates how information and communications technologies are used in core educational processes in the School of Information Technology in support for students from disciplines other than information technology. Fifthly, it reports on opportunities for students to learn about information and communications technologies in the School's computing areas of specialization. Finally, it stresses the costs of the development and offering of e-Teaching, participating in e-Learning services and preparing Information Technology students for the e-World.

2 E-learning and E-teaching vs. Study Mode

There are two very important questions to be asked: Is it necessary to distinguish between off-campus (distant) students and on-campus (traditional) students? Which group of students is e-Learning and e-Teaching for?

Some economy and education rationalists argue that it is possible to save a lot of money having all students who study in off-campus mode, who are supported by ordinary tutors and use some study materials (learningware) developed in house (by a small group of academics, who never see students even to test their study materials) or bought somewhere. There is no need for lecture theaters, seminar rooms, laboratories and offices.

The pure off-campus model

- may be well suited to some entry level training whereas learning and hands-on laboratories still best work in a classroom setting;
- requires self discipline by the learner as a computer (PC) provides many distractions (e.g., games);

- is educationally unsound as academics who developed study materials could not test their educational features; and
- is not welcome by many students as they continue to need and want support from an academic.

Some traditionalists argue that real learning takes place in a classroom environment in the presence of and with support provided by academics. Although the pure on-campus mode may support student learning very well,

- learning is completely replaced by teaching – i.e., the student is an empty vessel waiting to be filled;
- it is expensive; and
- it does not suit all students, as some cannot come to a campus because of work or family commitments.

Our study and experience have led us to the following conclusion:

- both modes of study can exist if Internet support is offered and academics provide efficient support;
- both modes should be mixed to save resources and to suit all groups of students, and offer flexibility throughout life-long learning of students.

Thus, e-Learning and e-Teaching should be a natural approach to support both on-campus and off-campus students in order to offer courses in a flexible manner.

3 Opportunities for Students to Access Information and Communications Technologies

All Deakin students have the opportunity to acquire Information Technology knowledge and skills at two different levels. Basic introductory level training is provided to all students during the Orientation week. Some students may still not have been exposed to Information Technology at all previously. This training is defined by Information Technology Division and addresses use of the Deakin computer network and basic productivity skills such as using email and accessing the Internet. The training is provided by the best second and third year Computing students. In providing this training, the second and third students are given the opportunity to acquire some basic teaching skills, improve their communication skills, which are of prime importance to provide good professional services.

The second level, also offered to all Deakin students, is based on the study materials developed and tested by staff of the School of Information Technology. Through first year teaching programs students have an opportunity to gain essential information technology knowledge and computer literacy skills including use of email, accessing and using online services, word-processing, using and building spreadsheets, using and developing database management systems as well as preparing effective presentations using PowerPoint software. These computer literacy skills are becoming as necessary as reading, writing and arithmetic!

All Deakin students, in particular, off-campus students, receive a CD that contains basic software that allows them to learn about the University, IT services and access IT services provided by Deakin. Further, all Deakin students (both on- and off-campus) have 24-hour access to Deakin IT servers and laboratories. All computing

laboratories comprise the latest models of PC that run Windows 98, Windows NT, Windows 2000 and Windows XP. The Deakin computers are connected by local and metropolitan networks and are also connected to the Internet.

The laboratories are located in two main types of areas: general access areas on all Deakin campuses and within the Schools of Deakin. The latter are designed to meet specialized needs and comprise specialized hardware and software. Laboratories within the School of Information Technology, which support teaching in Computer Networks, Operating Systems, Distributed Systems and Communication Security, can be disconnected from the University network to avoid any disruptions should any error occur during laboratory classes and to ensure security of the network is maintained.

Computers linked by a network are also provided in student dormitories. Students are able to use any computer in laboratories, dormitories and at home, and all these are provided with e-mail and Internet services.

4 Tools for Administrative Dealings with Students

Information Technology has become a core-enabling tool of the School of Information Technology enriching all aspects of the teaching and learning process. Students can access study guides, lecture notes, class information, assessment methods and results. Assignment tasks are available electronically; assignment solutions are submitted via networks from laboratory or home computers. Assignments are marked and returned electronically. Students communicate among themselves and with lecturers and tutors using on- and off- line computer supported communication facilities such as WebCT, FirstClass, and e-mail systems. Unit evaluations are carried out at the end of each semester via a Web tool developed within the School. The data is processed automatically within the tool and the outcomes can be accessed, using passwords, by students, lecturers and tutors. Communication with on/off campus students is facilitated through email and other specialized teaching and learning tools such as WebCT. Students are not limited by physical locality.

5 Using Information and Communications Technologies in Support of IT Students

This includes access to learning resources by electronic means, and using electronic instructional and assessment media. Note, that providing distance education will not be regarded as an advantage per se. Evaluation of distance education will be as for any other kind of educational work: to what extent are information and communications technologies appropriately provided and used?

Some of the off campus study materials are accessible electronically by both on and off campus students, as are lecture, tutorial and other learning resources (although via restricted sites to protect intellectual property and copyright).

Computing units are delivered electronically. Students in Johannesburg, Broome, Hong Kong, Darwin, and London use the same materials as on-campus students in

Geelong or Melbourne. With two decades experience delivering units electronically, the School of Information Technology provides the same complex advanced information technology laboratory exercises to remote students on their home or work computers as on-campus students experience in laboratory sessions. Electronic meeting places allow off-campus students to mingle with each other and with on-campus students, providing depth to the educational experience that cannot be provided by student-teacher interaction alone. Students obtain rapid feedback from tutors and lecturers via email and electronic newsgroups. Electronic delivery also enhances on-campus students' education, providing twenty-four hour a day access to course materials, rapid remote access to academic staff and access and interaction with a highly diverse student population including practicing professionals from around the world. Automated computer managed learning systems provide instant feedback whenever and wherever students wish to access it.

The School's units in information technology are informed by both research and industry practice. The University has recognized the international standing of the School's research by forming a priority area of research on information technology for the information economy. The School's staff actively advises some of the nation's leading companies on the use of information technology in the e-World.

6 Opportunities for Students to Learn about IT&T

This topic includes the use of information and communications technologies as professional tools, but perhaps more importantly it focuses on learning about implications for professional practice. For example, what opportunities do business students have to learn about the 'e-commerce revolution'? Do teacher education students consider how technologies might change the delivery and character of education?

Deakin students are provided with many opportunities to learn about Information and Communications Technologies and their implications in the students' area(s) of specialization. These opportunities include:

- IT&T (computer and network) literacy, which is created in the form of single subjects (units);
- Major study in Computing/e-Systems/Multimedia Technologies;
- Bachelor courses such as the Bachelor of Computing, offered by the School of Information Technology;
- Coursework based postgraduate courses in IT&T, for instance, Graduate Diploma of Computing, Master of Information Technology; offered by the School of Information Technology;
- Research based postgraduate courses in IT&T leading to PhD and DTech (Doctor of Technology) degrees (also offered by the School of Information Technology).

In order to promote the Internet, its role and importance for education, business and industry, the School of Information Technology, as early as 1995, organized a set of workshops that comprised a 40 minute lecture and 1.5 hours laboratory (hands-on-exercises). 200 high school principals and teachers and 40 business and industry specialists attended these workshops. Such workshops are still being organized for elderly citizens, Internet groups, parents and teachers. As a follow-up, some high

schools received Internet access through Deakin University. Academics and postgraduate students assisted schools and businesses to develop their home pages.

Although IT&T literacy units are geared towards teaching elementary IT skills and provide foundational IT knowledge, students from diverse disciplines are provided the opportunity of investigating the role and impact of IT in their own disciplines. This is achieved in two ways. First, by dividing a subject (unit) into two parts, IT&T oriented offerings by the School of Information Technology usually span 9 weeks and the applications and impact of IT&T on a given discipline is offered concurrently by academics from these disciplines. Secondly, it is achieved through open-ended assignments. Students nominate the topic or area they wish to investigate. While they have to meet core competency requirements of the specific unit, the contents of their final submission should reflect their home discipline interests.

Some disciplines require more than just basic knowledge and skills as provided by IT&T introductory units. For instance, health students in the Faculty of Health need knowledge and skills related to databases, engineering students in the Faculty of Science and Technology need programming knowledge and skills as well as an understanding of computer architecture and operating systems. These units are available to them through the School of Information Technology.

Students of other disciplines are encouraged to take a major study in IT&T, which comprises eight (8) units. Students of Engineering, Accounting, Commerce and Education use this approach in particular to enrich their study and be better prepared for the e-world.

Students who are interested in IT&T careers are offered the following courses:

The Bachelor of Computing, with streams in Applied Computing, Computer Science and Software Development, Information Systems and Multimedia Technology, has been re-accredited by the University and the Australian Computer Society (ACS). It satisfies the requirements for professional membership at the highest level. This course is designed to enable students to work in a professional capacity in the computing industry and any area where IT&T is used. It provides a sound foundation and up to date knowledge of computing technology, prepares students for a professional life and, at the same time, fosters continuous learning and development to efficiently address, influence and propose technology changes. The course also aims to help students develop essential workplace skills. These include problem solving skills, management of human resources and physical assets, working in groups and skills enabling students to communicate effectively with clients.

The Bachelor of Computing curriculum has been developed to innovatively and effectively embrace students' existing mastery of the e-World. The School's Introduction to Software Development unit is a typical example of this approach. The current generation of students comes to tertiary study with extensive knowledge and experience of information technology. These students have grown up in the information age. In contrast, much Information Technology education is grounded in traditions developed when computing was a novelty and most students had little knowledge of the technology. Instead of ignoring it, the School's first computer programming unit Information to Software Development leverages student's extensive knowledge of using computers. Instead of starting with the low level details of programming and programming languages, this unit starts with the familiar Windows user interface and works back from that well understood starting point to the principles, techniques and skills that underlie the development of the software. Students learn the same material as covered by traditional first programming units,

but do so in a manner that integrates it into the electronic world that they know. Our experience has demonstrated that this enables students to more readily understand and master the very complex and abstract subject matter.

The curriculum for a new degree, the Bachelor of Information Technology, is currently being accredited. This new degree will have four streams: Computer Science and Software Development, e-Systems, Multimedia and Information Modeling. It is characterized by set of twelve (12) common core units, eight (8) stream core units and four (4) elective units. This course will prepare graduates for the e-World even better.

Another innovative program has also been introduced, the Bachelor of Information Technology (BIT) leading to Honours, which is designed to create elite graduates in the field of IT&T and is a joint venture between the Schools of Information Technology and Information Systems. It is expected that many of the graduates from this program will become the future IT&T leaders in Australia. As an integral component of the course, students will work with two industry sponsors during their second year, so gaining essential workplace skills that will ultimately make them very employable within an industry that has a serious skills shortage.

The Master of Information Technology (MIT) is designed to enable students to continue working in a professional capacity in business, industry and government bodies using leading edge computing technology. To this end the course, through specialized streams aims to provide up to date knowledge of recent developments in computing and network technology and at the same time foster continuous learning and development in order to efficiently address, influence and propose technology changes. Graduates will be able to perform their existing roles more effectively in business, industry, government bodies and other organizations, in order to provide better services, achieve better performance and lower costs. Through a range of teaching and learning strategies the course covers technical and theoretical foundations of topics and gives students the opportunity of applying this knowledge in practice. Students are offered a choice of units, allowing them to tailor their studies to their individual interests and needs while still meeting the academic requirements of the course.

People who wish to change their career path and professionals who have significant relevant work experience have access to the Graduate Certificate of Computing or the Graduate Diploma of Computing within the MIT course. The Graduate Diploma/Graduate Certificate of Computing enables graduates to take up IT&T related jobs in business, industry, government bodies and the education sector.

Some students, mainly those who have achieved excellent results during Honours study, enroll in research based PhD and Master Courses. Research topics of PhD and Master students reflect the "hottest" topics and research specialization of staff of the School of Information Technology, such as cluster and grid computing, data mining, parallel processing on computer clusters, e-business systems, communication risks and technologies and information technology for the information economy.

Experienced professionals from industry and businesses who satisfy the entry requirements can enroll in DTech courses. These students carry out innovative research that addresses industry and business needs generated by IT&T technologies. Students are supervised by specialists of the School of Information Technology and relevant industry or business.

The 'e-commerce revolution' is addressed within Deakin at two major levels: the technological level addressed by the School of Information Technology, and management and sociological level addressed by the School of Information Systems.

The School of Information Technology introduces the issues and solutions even in an introductory unit that is offered to all Deakin students. Students of the Bachelor of Computing program can study the e-business issues by taking units such as Information Systems in Organizations, Electronic Business Systems, Data Mining, Distributed Systems, and Computer Security. Students of the Master of Information Technology course can specialize in e-business by taking one of the course streams that comprises four advanced units.

Not only do education students learn about the impact of IT&T on the delivery and character of education, but also all Computing students in the School of Information Technology experience the issues associated with the changing image of education and learning by enrolling in units, which are offered via the Internet. Their experience helps to shape the delivery and character of e-education by providing constructive comments and suggestions while learning in the environment. In particular, they experience that FirstClass and other communication technologies are used as learning tools to facilitate transmission of knowledge. Not only do students have to learn to navigate the tool itself initially, they also have to accommodate the limitations as well as utilizing the advantages of electronic communication. These skills are highly transportable to any computer supported collaborative work environment that is increasingly being used within large, distributed organizations. By exposing students to a range of tools, such as email, WebCT, FirstClass etc. we increase their competency with them and facilitate their acceptance and use of new tools.

7 Specializations in Aspects of the E-world

The 1996 edition of the Good Universities Guide listed just three specializations (with a total of three courses) in the broad area of e-commerce, the Internet, and multimedia. The current edition lists 14 specializations ranging from desktop publishing and electronic commerce to interactive multimedia and network publishing, with dozens of courses. How is the University positioning itself in relation to this kind of curriculum innovation?

Computing courses offered by the School of Information Technology directly cover the areas of e-commerce, Internet, and multimedia.

- e-commerce issues are dealt with at the technological and risk areas in units of the Bachelor of Computing. In particular, the current Information Systems stream comprises Information Systems in Organizations, Electronic Business Systems, Data Mining, Distributed Systems; and Computer Security. Advanced units that cover the above subjects are offered in the Graduate Diploma of Computing course. One area of specialization of the Master of Information Technology is devoted to e-commerce;
- The Internet is covered in an introductory unit offered by the School of Information Technology. Students who enroll in this unit acquire knowledge of communication via the Internet, its basic services such as WWW, email, file transfer and have the opportunity of hands on experience with these tools. The Internet is addressed at the advanced level in the computer network unit.

Furthermore, students learn how to program internet-based, distributed applications using the Java programming language. The issues of the Internet are also addressed in the Distributed Systems unit. The impact of this network and its technologies on business, industry and society are addressed in these and other units, in particular, when e-commerce topics are dealt with. One stream of the Master of Information Technology stream is devoted toward network computing, where the Internet is a major area of interest from the point of view, of both technology and its impact on business, industry and society.

- Multimedia Technology is one of the four streams of the Bachelor of Computing course. Students are offered the opportunity to acquire knowledge and skills that allow them to design and develop multimedia applications, use networks to support such applications and understand the impact of this technology on business and industry activities.

8 Challenges of E-learning and E-teaching

Some believe that a university can become a university of the 21st century, and eventually an e-University, if there is a uniform infrastructure based on basic PC- and 100Mbps network infrastructure, some services for administrative dealings with students, some good editorial services, and Web based materials for individual course units. Some academics believe that the changes underway within universities and higher education are strictly about putting content on-line. They also fear that they will not be needed anymore. That would be a fast and very inexpensive solution.

However, the achievement of e-Learning and e-Teaching and the preparation of students for the e-World are much more complicated and expensive. This is because there is a need for the following three elements:

- a very high quality computer and network infrastructure to be provided by telecommunication companies;
- appropriate prioritization and investment strategy of a university, which are needed to synthesize new learning and teaching methodology, develop and/or purchase software and equipment, employ new academic and support staff who are able to build necessary systems and offer services to students; and
- high quality academics and support staff.

Here we only address the last two elements.

Students (off- campus as well as on-campus) these days expect much more than on-line access to unit materials and communication with their lecturers via e-mail. Furthermore, it is possible for students to use "learningware" for self study, however, the majority of them, even as our experience shows, will continue to need and want support from academics. There is a need to provide interactive web sites that could enhance students' learning. Also, "anyplace-anytime" technologies are needed to provide flexibility and support to life long learning of students.

Dealing with students and their learning problems on-line requires excellent knowledge of a study material and learning techniques as well as web site support tools. Students wish to participate in meetings and this opportunity must be created. This requires both excellent on-line conference environment and skills, which must be

exploited by academics to support different kinds of meetings (e.g., tutorial-type, brainstorming, problem solving).

We have academics, offices, laboratories – we will continue to have them even when the changes underway would reach the state of e-Learning and e-Teaching. In particular, we will need excellent academics that would be able to find ways and implement them for themselves and their professional colleagues to make instruction more about learning and less about teaching.

This leads to another issue, which is how to “keep on board” academics that have initiated and continue to make possible the changes leading toward e-Learning and e-Teaching. They are able to identify the productivity of instruction from the point of view what is learned, how long it takes to learn and at what cost. They are our greatest assets.

We have achieved a lot in carrying out projects leading toward e-Learning and e-Teaching. However, we know little about how students learn when they use and are supported by these new technologies. Furthermore, while we have embraced these new technologies there has been no time to develop a culture for the e-World.

9 Conclusion

Whether we like it or not we will become a part of the e-World, in particular by becoming an e-University. Our contribution to building it is through the provision of an environment that offers e-Learning opportunities to students and provides e-Teaching services.

The School has learned that the development of an e-Learning and e-Teaching environment is expensive and cannot be seen as something that could be supported by basic infrastructure and putting unit content on-line. It requires vision, good planning, leadership, some enthusiasts of e-Learning and e-Teaching, support of academics, technical and administrative staff, and a lot of work

The School of Information Technology is on an excellent path, based on well-defined plans that leads toward e-Learning and e-Teaching. Our experience shows that e-Learning and e-Teaching is for students who study in both modes of study, on-campus and off-campus. The School has acquired, developed and efficiently used tools (systems) that support students in their e-Learning activities and academics in providing e-Teaching services. Academics of the School use information and communications technologies in core educational processes in support for students from disciplines other than information technology. Despite the fact that Computing is a laboratory discipline academics and technicians of the School have developed information and communications systems that create excellent opportunities for students to e-learn about information and communications technologies in computing areas of specialization. As the outcome of these initiatives and work, students that take our courses and units are well prepared to work in the e-World.

It is important for all academics who wish to embark on projects involving e-Teaching and e-Learning to distinguish between the electronic delivery of a large number of documents to students and teaching of students. The delivery of documents ignores the large role played by the sharing of inferred knowledge that occurs in face-to-face lectures, tutorials and discussions between academics and students [1]. We

need to examine ways to capture and replicate this type of teaching and learning in an e-Environment. We would all do well to consult educationalists on this.

Academics need to evaluate these teaching methods and compare the success of these students and their reaction to this environment with the face-to-face environment in order to improve the student's learning experience and outcomes. In particular, we need to examine the learning outcomes for cohorts of students from different backgrounds and age ranges in order to identify different requirements of different students. In the School of Information Technology we have long accepted only student who are older than twenty one years old for off-campus units. Anecdotal evidence suggests that these more mature students are more successful when studying in an independent and electronic environment.

What we have re-learned now, when carrying our work toward e-Learning and e-Teaching, is that the School's (the authors believe higher education) greatest asset is intellectual capital (human capital), not intellectual property. Education cannot exist without human communication and resource sharing – the Internet provides excellent leverage for both of them. The School has embarked on the e-Learning and e-Teaching path and demonstrated that student learning and our teaching have been greatly improved due to the computer and Internet based services. However, the School cannot be asked to spend more time and go for the next step toward e-Learning and e-Teaching unless there is a real support to do this. This is not one group of academics and support staff individual game – it is an institutional game. Furthermore, the benefits of e-Teaching and e-Learning should be looked at very critically. This issue has also been addressed by other researchers e.g., [2].

References

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