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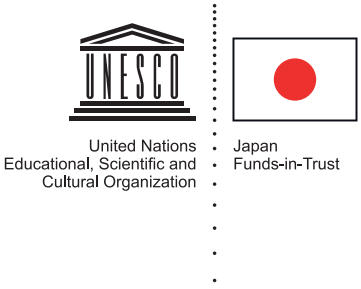
ICT for higher education

case studies from Asia and the Pacific



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Preface

The trend towards a knowledge-based economy has emphasized the importance of universities as repositories of valuable human capital. In particular, the accelerating shift to hightechnology and information technology economy requires sustained human resource development and training. Driven by globalization and pressures to teach and train knowledgeable, skilled and competitive professionals, universities face a huge challenge in increasing access to higher education and improving the quality of higher education against the stark reality of decreasing resources.

Fundamental to the creation of qualified human resources is an accessible, effective and efficient higher education system, particularly when governments are counting on university graduates to be competitive in creating wealth for their country. Universities are therefore compelled to be innovative and lead by using cutting-edge technology to meet these expectations.

With the support of the Japanese Funds-in-Trust, UNESCO initiated a research study on the use of ICT for higher education in the Asia and Pacific region. This publication highlights the results from case studies that investigated the use of ICT in three areas: open and distance learning; blended learning, and administration and management practices. The findings provide useful information on how these higher education institutions at various stages of development capitalize on technology to achieve their goals.

Without doubt, the demands of the 21st century will pressure more higher education institutions to modernize their systems and practices. The experiences captured and insights shared in these seven case studies can be used to help universities that are developing their ICT strategies and solutions to avoid making the same mistakes and leapfrog to the next stage whenever possible.

I would like to acknowledge the contribution of Mr. Chu Shiu Kee, Mr. Subramaniyam Venkatraman and the participants of a regional seminar held in July 2010 that commented on the preliminary findings of the research study. Their constructive feedback has improved the quality of this publication.

Finally, I would also like to thank the authors for their contribution in enhancing the access to and quality of higher education in the region.

Gwang-Jo Kim
Director
UNESCO Bangkok

Content

Acronyms

AAMS	ACADEMIC AFFAIRS MANAGEMENT SYSTEM
AAOU	ASIAN ASSOCIATION OF OPEN UNIVERSITIES
APEID	ASIA-PACIFIC PROGRAMME OF EDUCATIONAL INNOVATION FOR DEVELOPMENT
ASEM	ASIA-EUROPE MEETING
ATM	ASYNCHRONOUS TRANSFER MODE
BBS	BULLETIN BOARD SYSTEM
CALIBNET	CALCUTTA LIBRARY NETWORK
CCRTVU	CHINA CENTRAL RADIO AND TELEVISION UNIVERSITY
CELT	CENTRE FOR EXCELLENCE IN LEARNING AND TEACHING
CMD	COURSE MATERIALS DATABASE
CMS	CONTENT MANAGEMENT SYSTEM
COP	COMMUNITY OF PRACTICE
DEC	DISTANCE EDUCATION COUNCIL
DOSPL	DYNAMIC OPTIMA SERVICES PRIVATE LTD.
e-LGD	E-LEARNING IN GROUP DIVERSITY
ERP	ENTERPRISE RESOURCE PLANNING
EVOD	ENTERPRISE VOICE OVER DATA
F2F	FACE-TO-FACE
FEO	FINANCE AND ENTERPRISES OFFICE
HCM	HUMAN CAPITAL MANAGEMENT
HDI	HUMAN DEVELOPMENT INDEX
HEI	HIGHER EDUCATION INSTITUTION
HELP	HIGHLY ENGAGING LEARNING PEDAGOGY
ICT	INFORMATION AND COMMUNICATION TECHNOLOGY
IGNOU	INDIRA GANDHI NATIONAL OPEN UNIVERSITY
IIM	INDIAN INSTITUTE OF MANAGEMENT
IIMC	INDIAN INSTITUTE OF MANAGEMENT, CALCUTTA
IIT	INDIAN INSTITUTE OF TECHNOLOGY
IPS	INTRUSION PREVENTION SYSTEM
IT	INFORMATION TECHNOLOGY
ITCU	INFORMATION TECHNOLOGY CYBER UNIVERSITY

ITP	INNOVATION, TECHNOLOGY AND PEDAGOGY
IVRS	INTEGRATED VOICE RESPONSE SYSTEM
KDI	KOREA DEVELOPMENT INSTITUTE
KNOU	KOREAN NATIONAL OPEN UNIVERSITY
KVC	KOREA VIRTUAL CAMPUS
LAMS	LEARNING ACTIVITIES MANAGEMENT SYSTEM
LAN	LOCAL AREA NETWORK
LDP	LONG DURATION PROGRAMME
LiMS	LIBRARY MANAGEMENT SYSTEMS
LMS	LEARNING MANAGEMENT SYSTEM
LOD	LEARNING ON DEMAND
MAN	METROPOLITAN AREA NETWORK
MHRD	MINISTRY OF HUMAN RESOURCE DEVELOPMENT
MIS	MANAGEMENT INFORMATION SYSTEM
MOE	MINISTRY OF EDUCATION
NAAC	NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL
NTU	NANYANG TECHNOLOGICAL UNIVERSITY
ODL	OPEN AND DISTANCE LEARNING
OLT	ONLINE LEARNING AND TEACHING
OLUMS	ONLINE UNIT MANAGEMENT SYSTEM
OSPF	OPEN SHORTEST PATH FIRST
QUT	QUEENSLAND UNIVERSITY OF TECHNOLOGY
SCDL	SYMBIOSIS CENTRE FOR DISTANCE LEARNING
SIS	STUDENT INFORMATION SYSTEM
SLM	SELF-LEARNING MATERIAL
SMS	SHORT MESSAGE SERVICE
SNU	SEOUL NATIONAL UNIVERSITY
SOTAs	SCHOOL ONLINE TEACHING ADVISERS
STVU	SHANGHAI TELEVISION UNIVERSITY
TALSS	TEACHING AND LEARNING SUPPORT SERVICES
UGC	UNIVERSITY GRANTS COMMISSION
UNESCO	UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
VLM	VISIONARY LEADERSHIP IN MANUFACTURING
VPN	VIRTUAL PRIVATE NETWORK

Use of ICT for higher education

An overview of case studies from the Asia and Pacific region

Lay Cheng Tan[1]

Education is important for social and economic development, and higher education is a key area to maintain a country's competitiveness in the global economy. As proclaimed in the Communiqué adopted by the participants of World Conference on Higher Education in July 2009, "At no time in history has it been more important to invest in higher education as a major force in building an inclusive and diverse knowledge society and to advance research, innovation and creativity" (UNESCO, 2009).

The demand for higher education has accelerated worldwide. Between 1999 and 2008, the number of students enrolled in higher education institutions (HEIs) increased by 65 million, with much of the growth being seen in East Asia and the Pacific (UNESCO, 2011). In fact, the global demand for higher education is predicted to expand from less than 100 million students in 2000 to over 250 million in 2025 (UNESCO, 2011a). This is likely to include the rising numbers of adults who seek to enrol in courses to upgrade their skills and qualifications. The OECD has estimated that participation rates of 40-50 percent in higher education are essential for strong economic growth (UNESCO, 2011a). Despite the impressive statistics, most regions around the world have yet to reach this target. Governments and educational institutions are looking for innovative ways to increase access to higher education and improve the quality of their programmes and courses in a bid to improve their competitiveness.

The prevalence of information and communication technology (ICT) and the impact it has made in all aspects of our lives are compelling reasons for HEIs to try to capitalize on 21st century tools and technologies to address 21st century issues and challenges. This has motivated some HEIs in taking the lead to reshape the landscape of their educational systems as well as teaching and learning practises. Over time, the number of universities embracing new technologies to conduct the business of education is expected to soar. However, many HEIs may require guidance and assistance in their change process to minimize their teething problems, reduce costs, utilize appropriate technology and tools, and engage staff with proper knowledge and skills.

UNESCO Bangkok coordinated a research study to document the use of ICT for higher education in the Asia and Pacific region in 2009 with the support of the Japanese Funds-in-Trust. Targeted at Ministry of Education officials and specialists responsible for higher education, administrators and faculty members of HEIs, and higher education and ICT providers, the objective of the study was to increase understanding of how ICT can be used to:

- design and develop curricular contents;
- deliver higher education programmes and courses;

1 Asia-Pacific Programme of Educational Innovation for Development (APEID), UNESCO Bangkok.

- enhance the learning process; and
- increase the efficiency of the administration and management of educational systems.

Seven case studies from Australia, Hong Kong (Special Administrative Region of China), India, People's Republic of China, Republic of Korea and Singapore were commissioned to focus on three main areas:

- Open and distance learning
- Blended learning
- Administration and management

Open and distance learning (ODL) has opened the door to higher education for many students. The burgeoning number of ODL students can be attributed in part to the increasing use of ICT in HEIs, as testified by the educational institutions featured in this report: (i) Symbiosis Centre for Distance Learning (SCDL) in India has more than 200,000 students from all over India and over 40 countries, with 150 employees and over 400 visiting faculty members; (ii) Shanghai Television University (STVU), an open university in China, serves more than 100,000 teachers and students; and (iii) Korean National Open University (KNOU) is a mega-university for ODL with more than 180,000 students. The flexible teaching and learning system is well suited for students who are unable to attend regular classes, and facilitates self-paced learning.

Even traditional universities are offering distance learning and integrating blended learning to complement their face-to-face classroom settings as described in the case studies from Queensland University of Technology (QUT), one of Australia's largest public universities hosting 40,000 students and 4,000 staff, and Nanyang Technological University (NTU) in Singapore, a tertiary institution with about 30,000 undergraduate and graduate students.

In all the cases discussed in this publication, ICT is used not only for the delivery of lectures and materials, but also for administration and management purposes. It is clear that administrative functions such as student registration, grades, course schedules and even staffing evaluation, have benefitted from the use of ICT. The chapters on the Hong Kong University (HKU) and the Indian Institute of Management, Calcutta (IIMC) focused specifically on administration and management issues, albeit under highly different conditions and perspectives. They provide an interesting contrast but also reveal several areas of similarity regardless of their starting points or resources available.

Key features and functions highlighted in the seven case studies are listed below.

- ### Website and portal

The HEI's website and portal represent the window to all information about the educational institutions, courses and on-line services. As far as possible, no efforts have been spared to ensure user-friendly navigation and easy access such as one-time login ID authentication process. The website and portal have essentially become the gateway to a virtual campus where staff and students are able to conduct many activities, access information and materials, and interact with each other without having to be physically on campus.

- ## Student information system and services

The student support system is another priority area that strengthens HEIs' online teaching and learning platform. It covers a broad range of items including student registration, personal particulars, admission records, course selection and enrolment, examination timetables, test scores, transcripts and other student-related data. SCDL's Student Care Department and HKU's Student Connect are dedicated to serve the students' needs as well as ease administrative processes. SCDL's placement cell is a helpful facility that offers assistance to students looking for work opportunities. STVU's enrolment system is an integral part of its digital campus. Students' information is stored in a database which is easily accessible by both students and administrators. STVU has embarked on popularizing the smart card to handle ID recognition, financial services, information services, processes and so on. STVU's advisory service system facilitates students in getting online advice from their instructors on the selection of topics all the way through to completing their theses, freeing them from time and physical constraints. STVU has also implemented a returning student service system to assist students who cannot finish their programmes as scheduled, facilitating the recognition of credits that can be accrued for up to eight years.

- ## Learning management system

The learning management system (LMS) forms the backbone for designing online courses and managing the classes, assignments and tests. A robust LMS will go a long way in supporting both the instructors and students by ensuring effective interactions between instructors and students, uploading and downloading of lessons and course materials, submissions of assignments and reports, evaluation and grading of examinations. SCDL has customized Moodle, an open source LMS programme, to suit its requirements. STVU's Online Training Centre portal includes many elements, e.g., video tutoring, online counselling and online laboratories. KNOU has a well-developed system with the support of two consortia – Korea Virtual Campus (KVC) with 10 universities and Information Technology Cyber University (ICTU) with 36 universities. QUT's LMS – Online Learning and Teaching – is its first university-wide attempt, with continuous upgrading towards a sophisticated interface, to support blended learning. At the heart of NTU's eLearning initiative is the edveNTUre system using a LMS from Blackboard, and its blended learning model is driven by its commitment to facilitate effective learning through reciprocal communication between human and human or between human and machines. IIMC uses third party vendors to provide the facilities and infrastructure of their virtual classrooms.

- ## Learning materials

To support online education, learning materials must be made available to students anytime and anywhere. Understandably, HEIs with greater resources are able to tap into more advanced technology to deliver their materials, but by and large all of them provide a diverse range of online materials, including real-time and pre-recorded lectures, multimedia courseware, virtual laboratory, videos, MP3 files, library, and so on. For students who have limited or no Internet access, some of these learning materials are also available offline in the form of CDs and DVDs. KNOU students have access to multimedia lectures containing dynamically animated contents produced using a multimedia tool and delivered together with PowerPoint slides. Tutorials are available to facilitate self-paced learning, embedded with advanced learning diagnosis and self-evaluation. To encourage high-order learning, KNOU includes project-based learning together with discussions and seminar sessions, features that are also available in the other HEIs.

- Administration support and human resource management system

An efficient system that handles student affairs and manages programmes and courses is a boon to both administrators and academic staff. At the same time, the HEIs have drawn attention to the utility of ICT for human resource management. SCDL has noted the reduction of overheads and cost savings associated with manpower and administration by relying on ICT solutions. HKU has started a major upgrade of its administration and management system in line with an education reform towards a four-year undergraduate programme in Hong Kong. Expecting an increase in the number of students, courses and staff, HKU has chosen to use Oracle's PeopleSoft software for its new human resource management system to support staff selection, recruitment and appointment, contractual agreements, performance management and staff development and so on.

Major issues

By all accounts, the outcomes of utilizing technology for higher education have been very encouraging. The collective wisdom of countless professors and experts collaborating online, not bound by time and space, has contributed to the production of high quality teaching and learning resources. Innovative tools and technology, coupled with animated, interactive contents and activities have increased students' attention and interests.

Notwithstanding these positive feedback, some issues and challenges have emerged that should be considered by other institutions when designing and implementing their own ICT for higher education plans, such as:

- Lack of support from management;
- Unclear division of function and power;
- Uncoordinated planning and implementation;
- Question of ownership;
- Shortage of trained staff to cope with the diversity of responsibilities and tasks;
- Resistance from staff and reluctance to be re-trained; and
- Insufficient funds for developing, purchasing and implementing ICT.

Some of these issues can be avoided through proper preparation and planning. HEIs that are set up specifically to offer ODL, such as SCDL, STVU and KNOU, may face less resistance from management and academic staff. Nonetheless, they also have to overcome the issue of insufficient or untrained personnel to operate and maintain the systems, design the curriculum and teach the courses. Therefore the recruitment of qualified staff and re-training of the whole range of professionals are high priorities to ensure the smooth implementation of any ICT-based systems.

STVU emphasizes the importance of a holistic approach that takes into account all aspects of the systems – network, platform, resources, application and service. Likewise, KNOU has a four-phase strategy that incorporates needs analysis and design, development, implementation and evaluation to make sure that the design and development of course contents match the diverse learning needs and capacities. Needs

assessment also plays a vital role in HKU's plans in upgrading its management systems. Various teams and committees comprising representatives from many departments and disciplines were formed to share information and seek their consensus as one way to increase their sense of ownership in the process and outcomes.

Perhaps, a more compelling factor for the successful development and adoption of ICT in any educational institution is its readiness for e-learning. Korea's ICT infrastructure and standing is the envy of many countries in the region. The Internet, mainly through broadband connections, has reached more than 80 percent of Korean households in 2010 (ITU, 2010). Likewise, Singapore is able to implement sophisticated systems based on its fully established infrastructure and facilities. Australia and China are also well positioned to do the same, but it appears that the level of development is largely dependent on the commitment and resources of individual institutions. India is still working to improve its readiness as a country on the whole. More resource-rich HEIs in India have institutionalized the use of ICT into their systems, but even they have several barriers to overcome before they can achieve their objective to deliver high quality e-education seamlessly.

Finally, ensuring adequate resources is a common issue for all HEIs, even for countries and universities which are better endowed. Under pressure to excel, be competitive and not be left behind, both administrators and academic staff are constantly reminded that they have to secure funding not only to sustain the progress made, but also for future developments.

Conclusions

It must be remembered that integration of ICT into higher education cannot be accomplished overnight. It takes years of planning and preparation, refining and retuning the systems. The other thing to keep in mind is the rapid change and development in technology. It is not uncommon to find innovative tools and practices once very much in vogue quickly losing grounds to newer inventions. Any investment made in the now "outdated" technology could therefore be lost – a situation to be avoided at all costs especially in view of limited resources. This certainly creates a dilemma. On the one hand, development of ICT for learning is a long-term project; on the other, the ICT sector advances too fast to permit ponderous consideration and decision making. Clearly, this requires holistic and careful planning, supported by up-to-date information and expert advice that will consider factors such as pedagogy, quality learning, affordability, existing infrastructure and resources, staff capacity and course content development and above all, it is critical to have a vision with clear objectives and strategies based on candid understanding of the institution's strengths, weaknesses and core competencies.

Human resource development is another priority area. Engaging key stakeholders early in the change process is essential to get their buy-in. While incorporating ICT into the institutions is more technical in nature, management, administration and support personnel must also understand and support all decisions made. At the same time, some academic staff may not welcome disruptions to their routines and methods of teaching, and may even see ICT as a threat to their careers. Organizing orientation and training programmes will help to alleviate some of the anxieties and misunderstanding, and build the capacity of existing staff to carry out new responsibilities and tasks.

Students are ultimately the main beneficiaries of the push to capitalize on ICT to improve the access to and quality of higher education. Students in the 21st century are ICT natives who welcome the introduction of technologies in their learning process. They may even demand the universities to modernize their systems and teaching practices to keep up with workplace requirements. The anywhere, anytime mode of learning and the networked communities harmonize very well with young people's lifestyles and the communication media of their time and age. All e-learning courses will have to be designed to match their learning styles and needs.

It follows that the content and quality of the e-learning materials are equally crucial. The attributes of ICT enable the use of a variety of resources previously unavailable to students off campus. Real-time or taped lectures, online assignments, self-assessment activities, multimedia and online library complement more traditional mode of distance learning through TV and radio. Links to resources from world renowned universities and professors are now easily available at the touch of a fingertip. MIT's Open Courseware containing lecture notes, readings, tests and video lectures, can be downloaded for free, alongside materials from other prestigious universities.

Development of e-learning content should also be properly planned and managed. This requires input not only from instructors and content specialists, but also from educational technologists, computer analysts, web programmers and web designers. The quality of the content will also benefit from a rigorous process of feedback and revision, which can be measured against a set of pre-determined performance indicators.

The omnipresence of ICT has dictated the necessity for all educational institutions to adapt to the changing times. The demand for access to higher education can be, and has been, boosted by technology. The following chapters in this publication discuss the issues in greater details. The experiences shared in the seven case studies provide an insight into how each institution addressed its own needs under different conditions. HEIs who are embarking on their own journey to incorporate ICT into their educational systems will find nuggets of valuable information in these chapters.

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ICT for distance learning

Symbiosis Centre for Distance Learning, India

Swati Mujumdar[2]

Introduction

In developing as well as developed countries, distance education has gained tremendous significance. Policy makers across the world recognize the potential of distance education to achieve access, equity and reach in education. Distance education being a more flexible and cost effective option has emerged as a formidable alternative of higher education in many developing countries. While one must admit that the traditional education system has played an important role in expanding education, particularly in urban areas, one must also accept its limitations as a means of mass education, and especially quality education for rural areas.

New technologies can help distribute education from the world's best sources to all the people who are in need of education irrespective of age, sex, creed, religion and socio-economic status. Innovations in information and communication technology (ICT) have played an important role in distance education especially to improve quality and expand its reach. Through the use of new communication technologies, education has been extended to large audiences especially in rural and remote areas, with tremendous flexibility in subject matter and locations served.

Distance education in India

Although the Indian education system is the world's biggest, the country also has the largest number of illiterate people. Distance education presents a major alternative in reaching out to them. Currently, distance education in higher education contributes about 24 percent of the total enrolment. The Indian Government has ambitious plans of increasing this to 40 percent by 2012.

India has only one central Open University, the Indira Gandhi National Open University (IGNOU). Each state also has a state Open University set up by the local state government. In spite of this and due to the need of educating a huge population, many private, un-aided distance education providers have mushroomed in all corners of the country. A lack of proper regulatory frameworks for distance education has resulted in questionable quality and credibility of such distance education programmes. It is in this context that the Symbiosis Centre for Distance Learning (SCDL) was established in 2001 to provide quality education through the open and distance mode to students from India and other countries. SCDL caters mainly to higher

2 Principal Director, Symbiosis Centre for Distance Learning, India.

education and has gained tremendous popularity owing to its pursuit of excellence in distance education. Today, it has over 200,000 active students from India and over 40 different countries including the United States, United Kingdom and the Middle East.

Symbiosis

Symbiosis, a group of educational institutes, was set up in 1971 by Dr. S. B. Mujumdar. Underlining its botanical term meaning – 'living together for mutual benefit' – Symbiosis was established mainly for the welfare of foreign students, to provide them a home away from home. The vision of Symbiosis is to bring about international brotherhood through excellence in education. Symbiosis comprises a multidisciplinary, multicultural group of schools, colleges and a university under its aegis, spread over 13 campuses in central India with more than 30,000 students studying on campus in the conventional education system. It has more than 3,000 international students from over 70 countries enrolled in its programmes. Symbiosis is ranked among the top education providers in India[3] and is known for excellence in education.

Case study: Symbiosis Centre for Distance Learning

The Symbiosis Centre for Distance Learning (SCDL) is a part of the Symbiosis group and is a private distance education provider offering mainly postgraduate programmes in various disciplines including management, information technology, education, humanities and law. It is located in a large campus in Pune, Western India. It has state of the art infrastructure with world-class facilities such as video conferencing, an e-communication centre, well equipped laboratories and classrooms, library, audio-visual halls and conference halls. All SCDL centres are connected through a virtual private network. All activities and operations are carried out mainly in a centralized fashion using innovative ICT solutions. SCDL has not only created a large network of study centres, but it is a pioneer in developing many ICT solutions and facilities to improve the quality, accessibility, delivery and reach of education to thousands of distant learners.

SCDL offers blended learning programmes combining self-learning material (SLM), e-learning, online learning and faculty-based learning. The use of innovative technology solutions has helped SCDL to achieve academic and operational excellence.

Today, SCDL serves more than 200,000 students from all parts of India and over 40 different countries pursuing various programmes through distance learning. SCDL has some 150 employees and also uses the expertise of over 400 visiting faculty members.

Objectives of SCDL

The objectives of SCDL are to:

- Provide a self-paced, self-styled learning environment;
- Provide skill development and lifelong learning programmes and courses suitable for a wide range of learners representing diverse backgrounds, age groups and socio-economic status;

3 The Times of India Group, edition 30th March 2009.

- Provide flexible and convenient education delivery and assessment solutions to make the learning and testing process effective;
- Provide friendly and affordable student care services to create an enjoyable learning experience for distant learners;
- Create innovative and value-added learning opportunities by constantly updating content and developing new education programmes in line with market requirements;
- Create a virtual campus where learners can come together to share experience in order to develop and nurture a learning community;
- Implement cost-effective ICT solutions to supplement all aspects of education delivery, content creation and student care and support services;
- Achieve academic and operational excellence by defining measurable quality parameters both in academic as well as administration areas; and
- Manage exponential growth in student enrolment effectively by evolving innovative ICT-based practices rather than increasing manpower and administrative costs.

Use of ICT in improving student support services and the evaluation process

In distance education, students are geographically dispersed and come from different age groups and backgrounds. The institute has experienced exponential growth in student enrolment from about 8,000 students in 2001 to over 60,000 students in 2009. The active student strength of SCDL at present (2009-2010) is approximately 210,000. Due to this sudden growth, the institute faced many challenges such as managing a huge student base without losing its focus on quality and student satisfaction. A top priority was to scale up faculty and staff strength quickly to match the growing student numbers. Increasing its manpower and administrative costs would not have guaranteed efficiency in managing the large student enrolment. After careful consideration, the institute decided to rely on innovative and cost-effective ICT-based practices to resolve the problems.

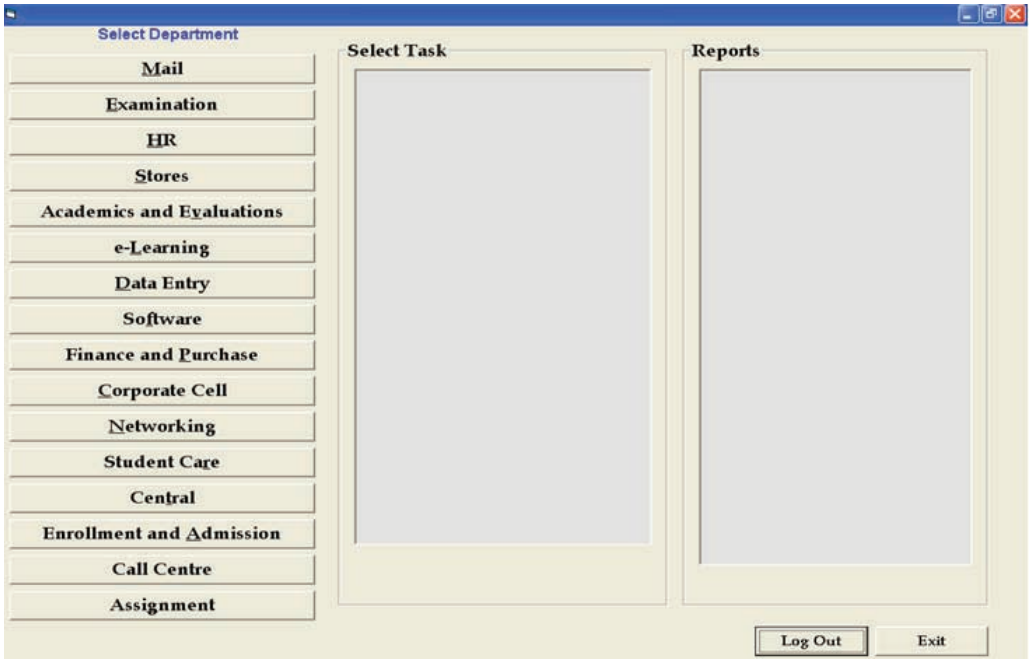
Student Information System (SIS)

An important activity in distance education is to provide student support services, an area that is often neglected. When student enrolment increases, it is the first section that needs to be scaled up in terms of staff number and capacity. Hiring trained staff to handle student enquiries is not an easy task in India, especially in education, as mid-level personnel can find high paying jobs in the growing information technology (IT) sector. SCDL's decision to ensure effective student support services led to the creation of a Student Care Department enabled with home-grown ICT solution – the Student Information System (SIS). The department – consisting of two sections, a Dedicated Student Call Centre and an E-Communication Centre – manages the SIS and the information which can be viewed under 'Student Centre' on the SCDL website, thus providing students with access to many online services.

The SIS (Figure 1) was developed over a period of three to four years by the SCDL Software Department.

It is similar to an enterprise resource planning (ERP) system which tracks complete student details from enrolment to graduation. The data stored in this system are also available for student viewing through the SCDL website. The system has thus created a completely transparent, accurate and real-time environment which is accessed by both students and staff. It allows for tracking of demographic data, communication data, dispatch details, fee payment details, call and grievance history, academic performance data, and more. The system is role- and privilege-driven, thus ensuring complete data security. The SIS forms a critical backbone for the smooth working of all SCDL departments. It has also created an implicit workflow management to ensure that the SCDL management is provided with accurate management information system (MIS)[4] reports from time to time.

Figure 1: Student Information System (SIS) home page



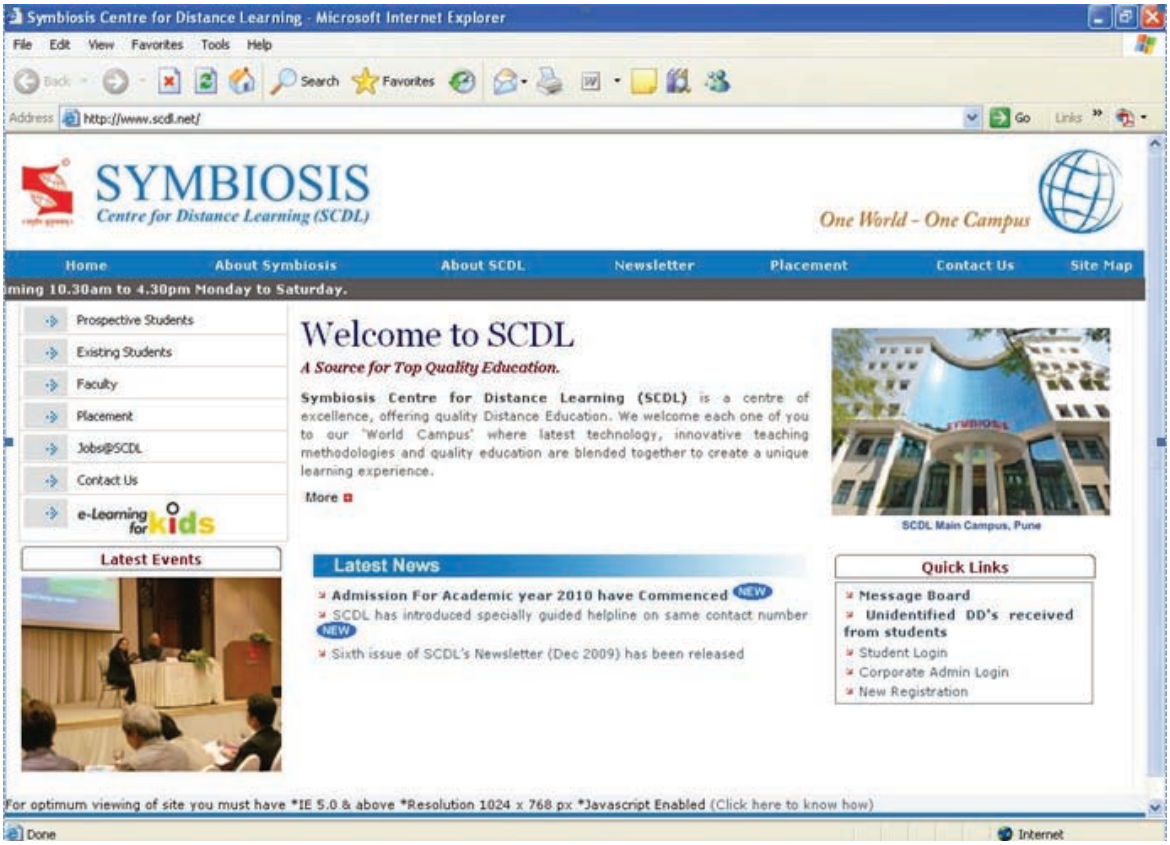
SCDL website

The institute provides a completely personalized website (Figure 2) which allows students to access a host of online services, e-learning courses, online learning, Moodle,[5] SIS data, Post my Query Interface and Live@Edu. The most popular services are online assignment submissions and booking for on-demand examinations. The website has a single login facility and a Student Centre which creates a personalized learning environment for each student. Students can view important tracking information such as dispatch status of any material sent by the institute. A message board in the Student Centre displays messages from the institute. The website acts as a virtual campus nurturing a learning community of over 200,000 distant learners. SCDL also plans to introduce Internet-based virtual classrooms for the benefit of its widespread student community. The website provides learning aids such as interactive e-learning courses, faculty chat sessions and archived lectures. The website also provides a separate environment for potential students including counselling for suitable SCDL programmes. Potential students can track their enrolment status while the admission process is underway without calling the institute.

4 MIS is a type of high level report giving summarized information generated by software systems for assisting top management in decision-making.

5 Moodle is an open source learning management system.

Figure 2: SCDL website home page



Student support services: dedicated Student Call Centre

It is often the case in many educational institutes that when students call with a query they get transferred from one department to another before their query is answered. In distance education institutes, this problem is compounded by the large number of students and comparatively fewer administrative staff. A simple query results in serious student grievances if not handled properly. The Call Centre thus enables students to address their enquiries to trained call operators who not only have an understanding of academic and administrative policies, but are also trained to handle customers, in this case, students. This customer-centric approach has greatly enhanced the image of SCDL among its students. Further, the various departments of the institute are now released from finding the time to answer student calls. This has in turn increased their efficiency at work.

As I am a working student, time is a major constraint. The Student Support Services provided by SCDL especially the call centre, E-Communication Centre and website have enabled me to get my enquiries answered quickly. As such I do not have to spend much time on follow-ups with SCDL for simple issues. I am happy that Symbiosis has invested in providing students with such useful facilities which have made my academic journey quite enjoyable!

Meenal Kulkarni
SCDL Student

Periodic training programmes are arranged for call operators on various policy matters covering fees, enrolment and admission cancellation as well as how to deal with demanding students and when to pass such calls to the Call Centre team leaders. Many business processes are implemented and improved upon from time to time within the Call Centre to ensure greater student satisfaction. To handle student calls effectively, the call operators have access to data on the SIS.

One feature available from the SIS is the Student View which provides complete student details once the registration number of the student is entered. The call operators are able to view fee payment details of the students, demographic details, academic record, emails and other communications and materials dispatched to the students by the institute.

The Call Centre has also implemented an Integrated Voice Response System (IVRS) which provides automated answers to commonly asked questions. To access their complete records in the system, the students are required to enter their unique registration numbers and birth dates. After the data are authenticated, the system provides complete student details to the students using voice response. This system has helped to reduce the number of calls transferred to the call operators. The call operators also track complete call history within the SIS for future reference. Students whose queries may be complex or require documentation are requested to address their queries via email to the E-Communication Centre, thus facilitating the call operators to handle a large number of calls rather than spend too much time on individual enquiries.

***SCDL** has introduced a specially guided telephonic helpline for students – the Interactive Voice Response System. Earlier, students had to call SCDL for even simple enquiries. However, since complete student records including academic and administrative data are available through this system, students do not find the need to speak to an operator for routine information. Further, while waiting to get connected to an operator, students hear important messages recorded by SCDL on various activities. Our call operators are able to handle many more calls now.*

Devashree Navale
Call Centre Head, SCDL

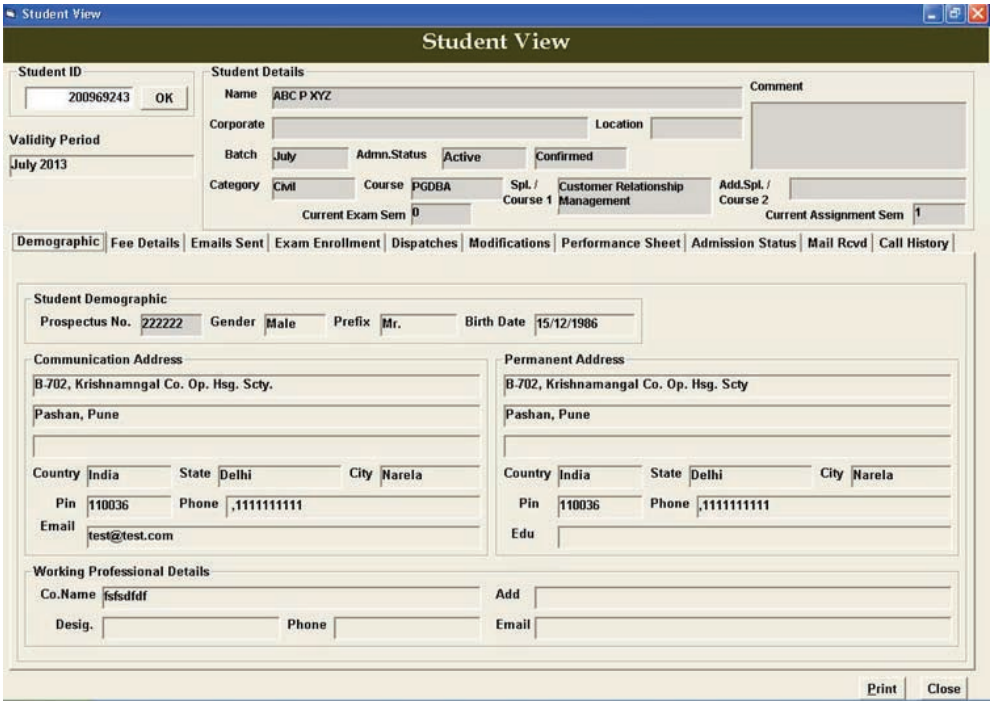
The call operators and their responses are monitored for quality by the team leaders and head of the centre. The Call Centre receives about 1,800-2,000 calls daily which are handled promptly by 21 call operators. The Call Centre head also analyzes the nature and the number of student calls and enquiries received each month. Such analyses are useful in giving advice to other departments to modify unclear or confusing policies. These practices have helped to reduce unnecessary calls and create clarity amongst students.

Below are some screen shots of the Student View, Fee details tab and Dispatch details tab available in the SIS. Each of these tabs shows complete details and data for a specific student whose unique registration number has been entered into the system.

Student View

This Student View (Figure 3) gives complete demographic, contact and programme details of the student including admission status, specialization courses and registration validity period. This information is extremely useful to the SCDL staff handling student enquiries as it is available at the click of a button by simply entering the student's registration number. Further, the system also allows SCDL staff to update the information and keeps a history of the person responsible for the update and the time it was made, thus ensuring transparency.

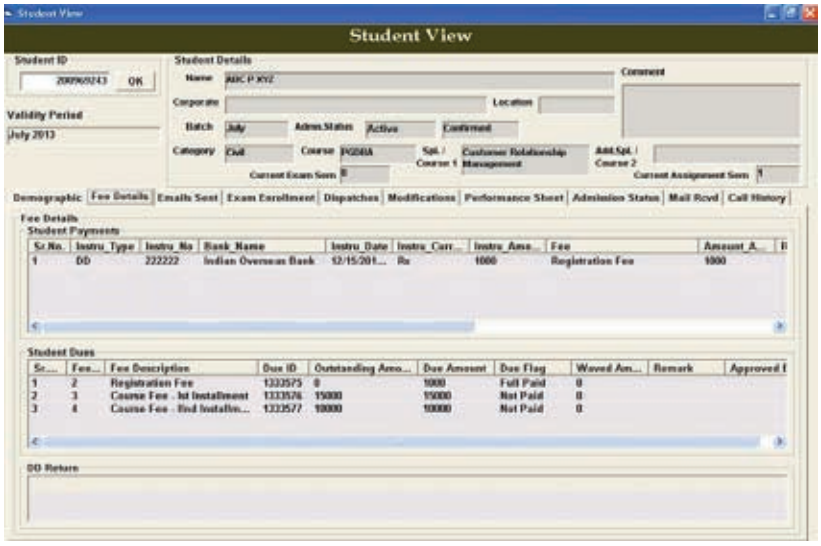
Figure 3: Student View displaying complete student details



Fee details tab

The Fee Detail tab (next page, Figure 4) provides data on fees collected and fees due. The view lists the fee instrument details, the bank from which it was drawn, instrument date and so on. On the same screen the Fees Due information is displayed in a separate section. The fees due are dynamically calculated each time a fee is received from a student. Some fees are payable in instalments so the screen also displays the instalment amounts due from a student enrolled in a particular programme. To calculate the fees due, the Finance Department of SCDL enters the programme and course fees at the beginning of each academic year. Separate master screens have been created for data entry by the Finance Department. This master data related to fees is entered once only.

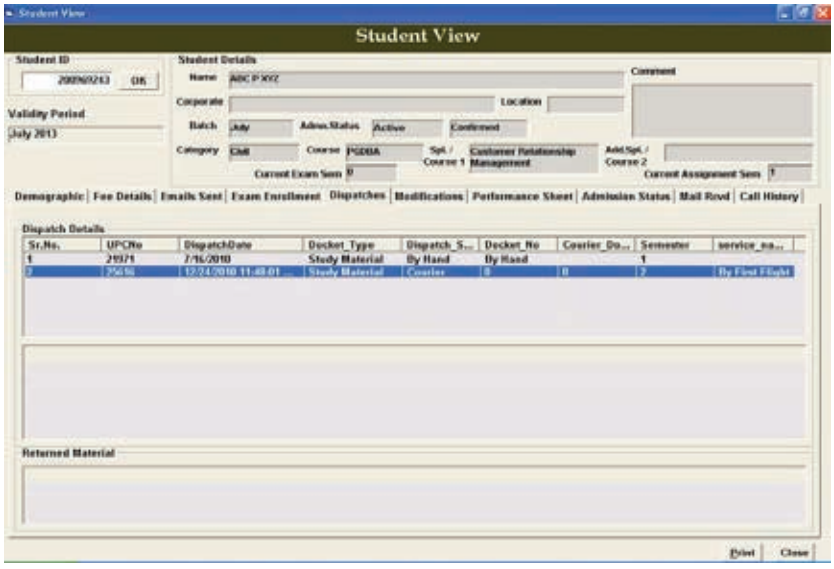
Figure 4: Fee details and fees due from a student



Dispatch details tab

The Dispatch detail view (Figure 5) provides important information to students about any material or communications dispatched by SCDL to them. In India, all distance education providers supplement the learning experience by providing printed books to students in the form of SLM for each course of the curriculum. The SLMs are comprehensive learning guides designed especially for distant learners with tone, content and format suitable for this kind of audience. SLM design, creation and printing are major activities for all Indian distance education providers. Although many have migrated to online models with e-books and other aids, the printed SLMs are still extremely popular with students and therefore form an inevitable component of delivery.

Figure 5: Dispatch details of all materials and SLM sent to a student by Symbiosis



One of the major challenges associated with SLMs is the expense of printing and dispatching them to students whose addresses keep changing, especially in the case of working students. Guaranteeing timely delivery is also an area of concern due to issues with courier and postal services. To cope with this challenge, SCDL created a system which tracks the dispatch of SLMs and other important documents/material sent to students. The data are tracked from dispatch to delivery at the students' addresses. The students are able to view this delivery path through the website. When students change their addresses, the changes are immediately reflected in the online system and delivery is scheduled accordingly.

The SCDL Academics Department creates excellent quality SLMs for each course and also arranges training programmes for authors and content developers to ensure standardized, good quality SLMs suitable for distance learners. SCDL dispatches close to 60,000 SLM kits to students every semester. The Stores Department of SCDL manages the complete operation and logistics related to such dispatches and also enters/updates data in the SIS for student viewing.

The automated address label generation facility and online tracking facility have been a boon for both the Stores Department as well as SCDL students. The unnecessary expenditure related to re-dispatch has also been reduced significantly.

E-Communication Centre

In the early years, geographically dispersed SCDL students used to send their enquiries via the postal services. It was extremely difficult to reply to thousands of letters received each day. Even more difficult was to track each letter as it went from one department to another with the delays accrued at each stage.

Responsibility for such delays was an issue. SCDL was unable to keep a history or record of student issues or create any kind of management information system (MIS) reports as there was no automation for handling student letters. SCDL then decided to setup an E-Communication Centre where communication assistants would handle student enquiries received via email with a guaranteed response time of one business day. Students were encouraged to send their enquiries via email but they had to remember various email addresses, for example, a fee query had to be sent to feequeries@scdl.net.

Post *My Query has helped streamline the work of my team considerably. Duplication of work is totally avoided thus increasing our efficiency in responding to students. I am now able to allocate resources appropriately and handle a larger volume of email enquiries.*

Juhi Gupta
E-Communication Centre Head
SCDL

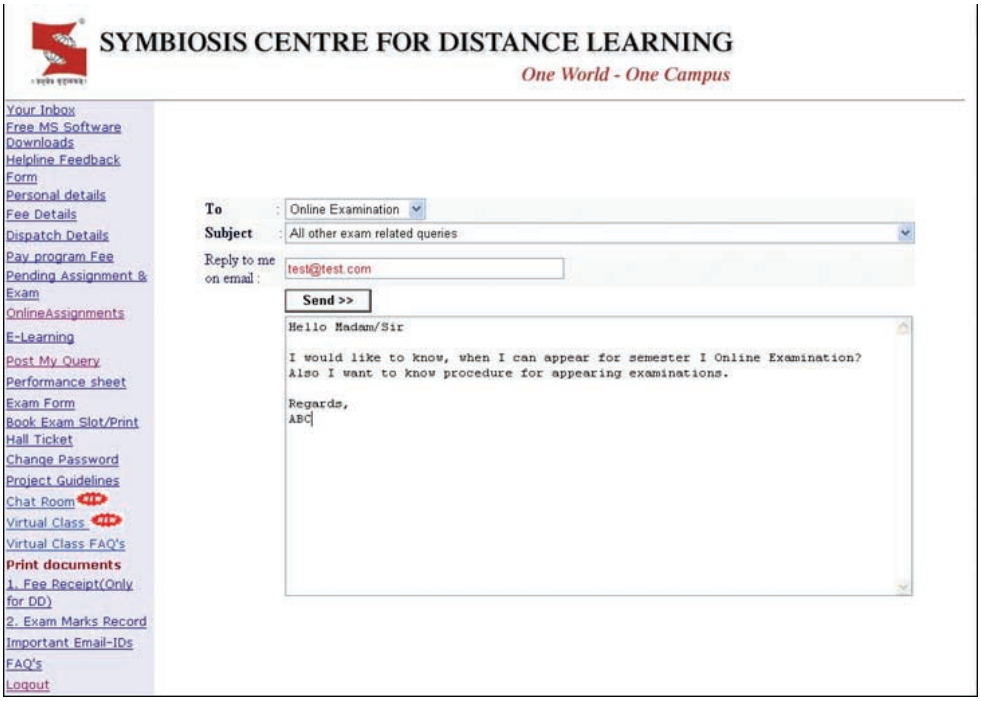
Remembering multiple email addresses created its own problems. For example, students would send the same email to many addresses in the hope of receiving a faster response. It became difficult to create distinct and standard responses without duplication of effort.

A new solution, Post my Query, was developed. This interface (Figure 6) is a part of the Contact Us feature on the SCDL website, allowing students to choose a query from a drop-down menu instead of typing their query individually. The query is then automatically forwarded to the email account of the communication assistant specializing in it. This interface has created a user-friendly environment for students since they no longer have to remember different email addresses. At the same time, this facility has helped to streamline response handling processes and increased overall efficiency of the E-Communication Centre.

The communication assistants are trained on various administrative policies and their responses are monitored for quality by the team leaders and head of this Centre. Standard responses have been created to ensure quality and efficiency of reply. Academic enquiries are diverted to the Academics Department.

The E-Communication Centre receives about 1,200-1,400 emails each day which are handled efficiently by 13 communication assistants. Every month, the head of the Centre analyzes the different types and volume of enquiries received and is able to provide feedback to other departments for policy changes and process improvement. A separate cell has been created for handling student grievances. This cell not only ensures prompt attention but also evolves a resolution by consensus with other departments. Student grievances are thus dealt with in an effective and prompt manner.

Figure 6: Post My Query link on SCDL website allows students to send emails to SCDL



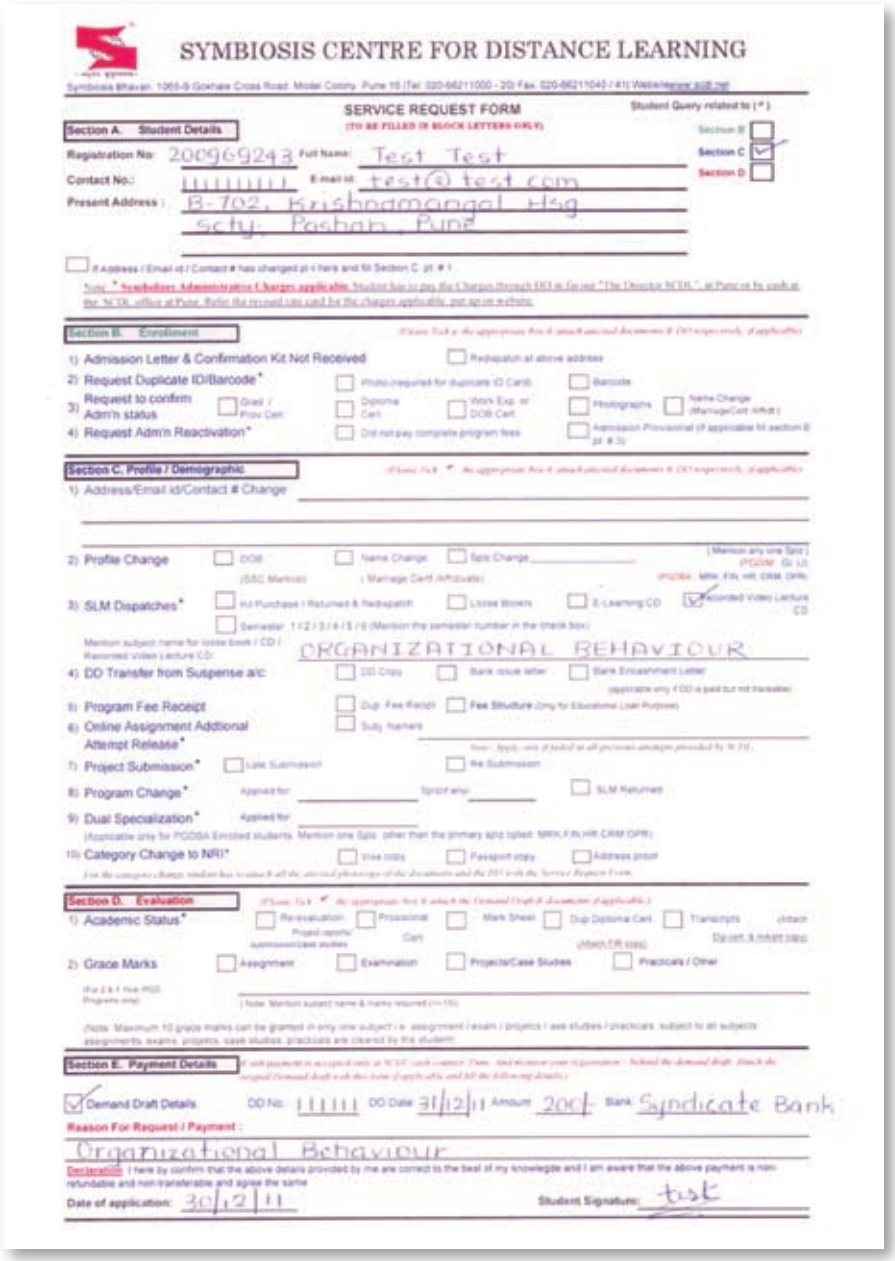
Student request form

Students can send their requests for a service or material using the student request form (Figure 7) on the website. The request is routed to the SCDL Student Care Department. The department guarantees a processing time of two to four business days for all requests. The form also displays a note of supporting documentation which may be required to process the request.

Helpdesk system

SCDL is currently using an online helpdesk to manage IT-related incident requests and resource requests of SCDL staff. For example, SCDL staff may request changes in certain systems, privileges or operation of any part of the SIS. Such requests are routed through an automated helpdesk. SCDL staff/users can raise a 'ticket' for their request and enter the same into the system. This online portal helps users to keep track of the status of their requests. The helpdesk is also integrated with the email system to send updates and notifications. SCDL is planning to extend its use to track students' enquiries in a similar manner.

Figure 7: Sample student request form



SYMBIOSIS CENTRE FOR DISTANCE LEARNING

SERVICE REQUEST FORM

Section A. Student Details

Registration No: 20096923 Full Name: Test Test

Contact No.: 1111111 E-mail id: test@test.com

Present Address: B-702, Krishnamangal Hsg Scty. Pashan, Pune

Section B. Enrollment

1) Admission Letter & Confirmation Kit Not Received — Redispatch at above address

2) Request Duplicate ID/Barcode*

3) Request to confirm Adm'n status

4) Request Adm'n Reactivation*

Section C. Profile / Demographic

1) Address/Email id/Contact # Change

2) Profile Change

3) SLM Dispatches*

4) DD Transfer from Suspense a/c: ORGANIZATIONAL BEHAVIOUR

5) Program Fee Receipt

6) Online Assignment Additional Attempt Release*

7) Project Submission*

8) Program Change*

9) Dual Specialization*

10) Category Change to NRI*

Section D. Evaluation

1) Academic Status*

2) Grace Marks

Section E. Payment Details

Demand Draft Details DD No: 11111 DD Date 31/12/11 Amount 200/- Bank Syndicate Bank

Reason For Request / Payment: Organizational Behaviour

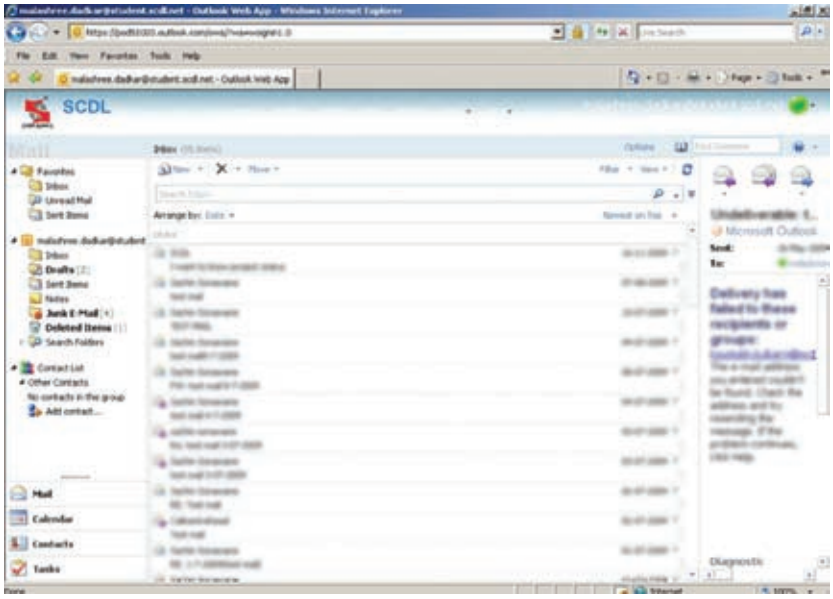
Declaration: I here by confirm that the above details provided by me are correct to the best of my knowledge and I am aware that the above payment is non-refundable and non-transferable and agree the same

Date of application: 30/12/11 Student Signature: test

Live@Edu

Live@Edu (Figure 8) is a worldwide programme run by Microsoft, which has enabled SCDL to give students a host of cutting edge communication and collaboration tools – tools which will help them to express themselves and increase their avenues in collaborative learning with students and the faculty. Live@Edu offers a suite of applications – mobile, desktop and web-based – to help students to collaborate on campus and create a community.

Figure 8: Live@Edu personalized mail box for students on the SCDL website



Microsoft live email

A 10 gigabyte mailbox account is provided to all students and alumni, branded with SCDL and domain name (e.g.: Reg2010XXXXX@student.scdl.net). Email groups can be easily created and managed.

Microsoft Live SkyDrive

Students can have easy exchange of personal learning content, presentations and case studies through online storage with 25 gigabyte space.

Placement cell

SCDL is one of the very few distance learning institutes that offers placement assistance to students. Many renowned companies such as Wipro, WNS global, Serra International Pre School and Rubikube solutions have placed SCDL students. SCDL has created an online Yahoo group where any student who has a yahoo email account can register free of charge for the latest updates regarding placements. This is a

unique, creative, educative and supportive group, and encourages students to apply for work placement opportunities with corporations. SCDL also arranges periodic Placement Weeks where companies and students seeking placement can interact with each other in one location (Figure 9).

Figure 9: Interview in progress in placement week at SCDL

Use of ICT in supplementing learning experiences

Asynchronous learning aids

SCDL experimented by introducing two learning aids, namely, e-learning courseware and pre-recorded lecture DVDs. Both were developed in-house. Over the past six years, SCDL has pioneered the development of such ICT-based learning tools which have benefited the student community. A recent survey of over 16,000 SCDL students suggests that they found such modern technology-based learning aids useful and interesting. Students located in remote areas increasingly have computers at home or work with periodic access to the Internet. As a result, using such learning aids to supplement the learning experience is not only possible but highly appreciated.

E-learning courseware

SCDL has created a user friendly interface for more than 80 e-learning courseware titles of an international standard. The e-learning courses act as supplementary learning tools to the SLM and form an integral part of blended learning programmes. The e-learning courses are interactive and based on case studies, examples and scenarios, thereby providing an enjoyable learning experience for students. The courses are available both through the SCDL website as well as on CDs for those who may not have access to the Internet. They are popular learning aids as they enhance understanding of the subject matter rather than reiterating theory or definitions. SCDL's E-learning Department develops these high quality e-learning

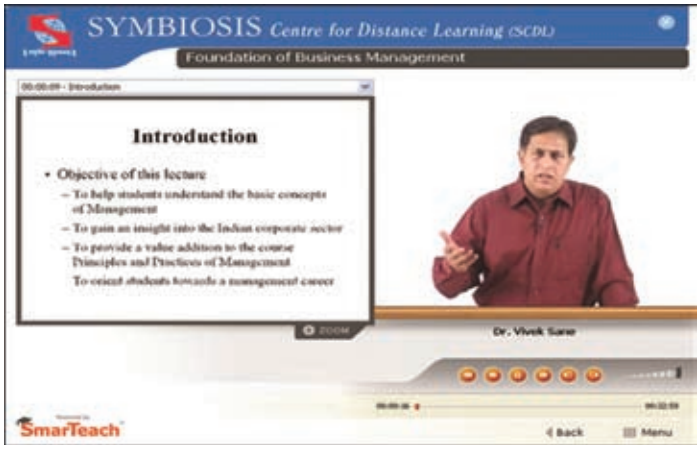
courses with the help of subject matter experts. Figure 10 shows a sample screen of an e-learning course for a management programme.

Figure 10: Sample e-learning course interface

Pre-recorded lectures on DVDs

Lectures from expert faculty (Figure 11) are recorded on DVDs for various courses. SCDL has created over 35 lectures on DVDs to date. They not only provide the lectures but also the faculty notes and presentations to students. Included on each DVD is a glossary and links to further reading. What started as an experiment in learning has become quite successful. Students find this form of learning useful, although asynchronous in nature. The lecture DVDs are in great demand and SCDL plans to produce many more for a variety of courses.

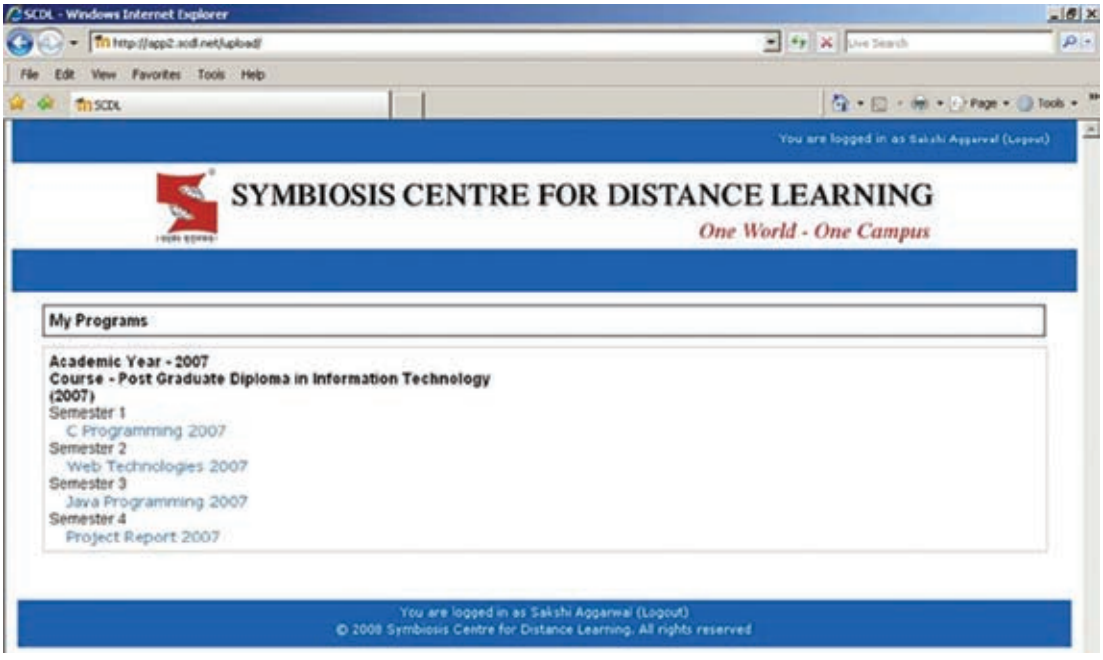
Figure 11: Pre-recorded lecture DVD user interface



Moodle learning management system

Figure 12 displays the home screen available to students when they login to the Moodle learning management system (LMS). Moodle, an open source system, has been customized and implemented at SCDL through the website. It allows students to upload project report files, submission and assignment files. The uploaded files are then allocated to the concerned faculty for evaluation and feedback. Both the grades and feedback given by the faculty can be viewed by students online. Students can also check the status of their submissions at any time and can interact via the system with faculty or co-students. This online environment has provided tremendous convenience and flexibility for SCDL distance learners. At the same time, SCDL students can benefit from the interaction with faculty and other co-students. Instead of an expensive LMS, this open source system has been used effectively by SCDL to benefit its students.

Figure 12: Moodle user interface home screen



Use of ICT in evaluation and assessment

Online assignments

Evaluation of students' performance is always an area of concern. This is particular challenging when the student numbers is large giving rise to a corresponding huge amount of assignments and examinations to be assessed. In the case of SCDL, each student submits on average 20 assignments and an equal number of examinations over a period of two to three years. With yearly enrolment figures of about 60,000 students, SCDL faces a massive challenge of evaluating over 1 million assignments and 1 million examinations over a three-year timeframe. Furthermore, ensuring standardized, high quality evaluations and monitoring of the evaluation faculty who are spread across India become extremely difficult.

In an attempt to tackle this problem alongside the issue of students who might have cheated or plagiarised their assignments, SCDL introduced a sophisticated assessment engine which takes as its input thousands of objective test items or questions. It then generates a random test paper for each attempt based on the rules provided. The assessment engine was put on the SCDL website thereby allowing students to complete their assignments or take the objective tests online at their convenience. These assignments are self-correcting and provide detailed feedback and a score card at the end of each assignment. Students can re-do an assignment to improve their scores. The online assignments provide a flexible, self-paced and convenient learning environment for students. Since the tests are generated randomly, the chances of copying or other malpractices have been completely eliminated.

Students find the objective assignments challenging and in fact like to repeat them at higher levels of difficulty since the questions are designed to match the comprehension levels of the learners. The SCDL Academics Department continuously engages itself in developing good quality objective questions and arranges periodic training programmes for faculty and staff on various instructional models such as Blooms Taxonomy, which can be used to develop such objective questions

On-demand examinations

To complement the online assignments, SCDL introduced on-demand examinations in 2004. The system allows students to attempt an examination whenever they feel they are prepared enough to do so. The SCDL website provides an online examination booking system (Figure 13). This system prompts the student to select a date, time and location. The student is able to print a Hall Ticket and attempt an examination at any of the SCDL designated examination centres across India and in other countries.

The on-demand examination facility means that students do not have to wait until the end of the semester to be tested. As a result, students have been taking their examinations throughout the academic year, thus leading to more evenly distributed examination sessions across all months. Every student attempts about 15 to 20 examinations over two academic years. As a result, in every academic year almost 400,000 to 500,000 examinations are attempted by SCDL students. The on-demand examination facility has enabled SCDL to manage thousands of examinations efficiently and to maintain the quality of assessment.

Table 1 shows the number of on-demand examinations attempted by students enrolled in the July 2009 academic year from December 2009 to February 2010. The data indicate that students are able to fully use the facility and that the total number of examinations being attempted in a year is evenly distributed across each month as compared to a semester-end system.

I have my own business and am pursuing a programme at SCDL. The on-demand examination facility is very convenient. The ability to appear for any examination from any available location as per my schedule has offered complete flexibility which is essential for a working student. It is due to these innovative facilities that I am able to complete my programme in time and get leverage in my business and career.

Akshay Dhoka
PGDIB Student
Proprietor, Anand Travels

Both the online assignments and on-demand examinations have provided a completely flexible and convenient testing environment for the students. Data gathered over the past few years showed that SCDL students were able to complete their academic requirements within the prescribed duration of their programmes and did not have to use the extended registration facility normally provided to all distance learning students. SCDL administrative overheads related to evaluation have also reduced significantly while the quality of evaluation has not been compromised at all.

Figure 13: On-demand examination slot booking system available on the SCDL website

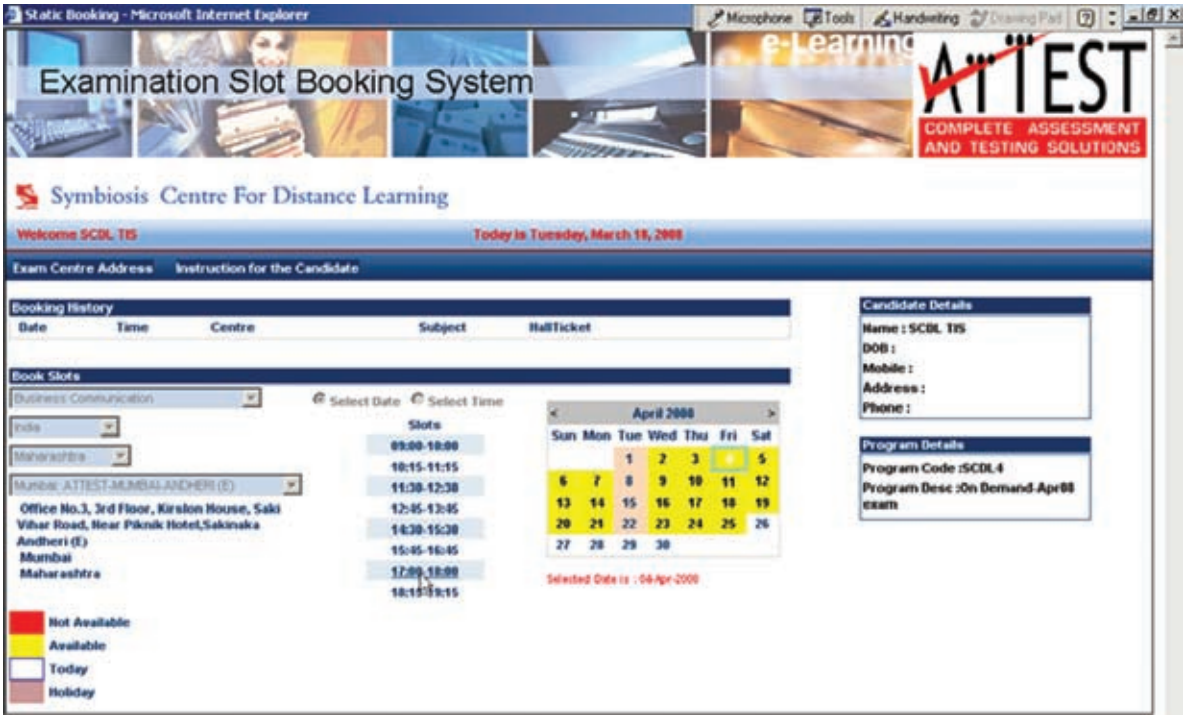


Table 1: Number of examinations attempted by 2009 batch of students over three months

Month	Number of examinations attempted
December 2009	*50,883*
January 2010	*53,275*
February 2010	*60,516*

Conclusions

SCDL has faced many constraints and challenges in trying to deliver education to students across India and in other countries, including:

- Managing large numbers of students effectively: without compromising quality and without scaling up staff numbers proportionately since SCDL has over 200,000 active distance learners.
- Training existing staff in IT skills and to recruit trained manpower from time to time.
- Motivating and creating a positive attitude among existing staff members and academic faculty members to receive training on the various uses of ICT, e-learning, online teaching and so on.
- Persuading management to support the implementation of IT solutions and online learning components as part of the education delivery model of SCDL.
- Developing, purchasing and implementing appropriate IT solutions only where necessary and ensuring proper fund allocations by controlling costs associated with implementation of expensive IT solutions.
- Tracking, managing and maintaining complete data related to students' demography, academics, fees, submissions, examinations and profiles.
- Maintaining a culture of professionalism in dealing with students and ensuring high efficiency at all levels of administration and management.

SCDL has capitalized on ICT to address and overcome these constraints and challenges. The outcomes and impact of the various approaches and solutions have provided much satisfaction to both staff and students of SCDL, including:

- Student-satisfaction ratios have increased;
- Drop-out rate amongst distant learners enrolled with the institute has decreased;
- Student data related to academics, fees and administration can be tracked accurately;
- Real-time, accurate MIS reports to management on various aspects of academia, administration and finance are readily available;
- Relevant data to assist management in taking key strategic and policy decisions from time to time can be easily provided;
- Systems and processes are dynamic, robust and scalable;
- Self-paced learning environment provides great convenience and flexibility to students;
- Learning experience of students and creation of a virtual community of students are enhanced;
- Costs and overheads associated with manpower, administration, evaluation, dispatch and postage have been reduced; and
- Management of large numbers of students was achieved effectively without compromising on quality.

Therefore, it can be seen in SCDL's case that the use of ICT in education has proven effective in improving the quality and delivery of education and the quality of student care services. Just as it is important to develop and implement innovative ICT solutions for education, it is equally important to create and build a business process to support such initiatives. Unless old business practices are discarded, the overall efficiency of the organization and quality of education and its delivery cannot be realized.

SCDL has chosen to implement simple, inexpensive yet innovative ICT solutions which have improved to be successful in helping the institute to provide cost effective, user friendly and quick student care/support services to all students, regardless of their location. The use of ICT has also enabled SCDL to keep manpower investment and administrative expenses low. Although student numbers are huge, ICT-based practices are preferred to scaling up manpower.

Nonetheless, there is still more to be done for SCDL to continue to capitalize on new technological innovations in the future, including the following:

- SCDL will introduce faculty chat sessions wherein students can interact with faculty. These sessions will be pre-announced via the SCDL website so that a maximum number of students can take advantage of them.
- Virtual classrooms to facilitate student and faculty interactions in a classroom environment through the SCDL website. This facility will enable students to have an enriched academic experience not confined to physical boundaries or the constraints of time and location.
- Career counselling for prospective students will go online on the SCDL website. Based on students' education backgrounds and areas of interest the faculty will suggest suitable programmes and give advice on how to achieve career goals.
- Extending the helpdesk services to students to allow them to raise issues or enquiries using an online system available through SCDL website. This system will provide students a 'ticket' for their query/ issue with details or scanned copies of any supporting documentation. Once the query is received at SCDL, it will go through a 'Work Flow Management System' that will track the flow of student query as it goes from the Student Care Department to other departments. The system will display the name of the person and department who is handling each student query, the length of time they have been handling the query and the possible completion date for the query. The information will help the students in tracking the status of their queries and reduce the number of calls they might have made to follow up on their questions. The SCDL management will also benefit by getting critical MIS reports from this system and understand which departments or staff may be taking too much time on which type of enquiries and the reasons for the delays. Query analysis will also help the management in understanding the quantum and nature of seasonal enquiries and possible solutions to reduce them.
- Payment gateway will allow students to pay examination fees, service fees and other types of payment through the SCDL website. The current challenge is the high volume of transactions resulting from large student numbers. This facility will reduce administrative overheads related to payment transactions as well as ease the transaction processes for students.

Finally, it is important not to lose focus while implementing ICT solutions. Often, organizations implement expensive and excessive ICT-based practices resulting in other human resource issues. SCDL focuses on providing innovative student support services and quality education and uses cost effective ICT solutions only as and when required. SCDL makes the maximum use of new technology with the resources available to it.

Distance education in Shanghai Television University, People's Republic of China

Chen Xin[6]

Introduction

Shanghai Television University (STVU) was founded in 1960 to provide access to education through formal and non-formal modes of learning. In the early stages, the university relied principally on television to transmit lectures and materials. With rapid technological advances, STVU has developed into an open university using modern telecommunication media and devices to offer distance education to a wide spectrum of society, including teachers, civil servants, migrant workers and the elderly, in both urban and rural China.

Currently, STVU has a network based on a highly connected information technology (IT) infrastructure that covers more than 50 branch campuses and serves the operational needs of over 100,000 teachers and students. The educational application of information and communication technology (ICT) has been, and will continue to be, a core element in STVU's development.

In 2008, STVU was awarded the UNESCO King Hamad Bin Isa Al-Khalifa Prize for ICT in Education for its project on building digital lifelong learning that reaches 230 community learning centres in the Shanghai area. The project exemplifies the effectiveness of ICT in breaking through the confines of time and space that have limited traditional teaching and learning practices.

As part of the UNESCO project on ICT for higher education supported by the Japanese Funds-in-Trust, this report will present the ICT-learning support system in STVU.

STVU's strategy in setting up an ICT-based learning support mechanism

By taking full advantage of IT, an ICT-based learning support system has been established in STVU. The

6 Vice President, Shanghai Television University, China.

system consists of a network, a teaching platform and teaching assistance systems (e.g. Online Classes and Faculty Seminars). This learner-centred service mechanism was set up to optimize autonomous learning based on these characteristics:

- Scientific: In providing learning support, choices need to be made between a holistic approach and a fractional approach in accordance to learners' needs and distance education theories.
- Targeted: Services have to be diverse to match learners' areas of studies and academic proficiencies. The effectiveness of the support system should also be analyzed and adjusted simultaneously to satisfy the learning objectives.
- Efficient: Feedback to learners' queries should be prompt, precise and thorough with the help of modern technologies and tools such as the bulletin board system (BBS), email or short message service (SMS).

The strategic guideline in the construction of the teaching platform is *'holistic in plan, sustainable in development, step-by-step in implementation and innovative whenever possible'*.

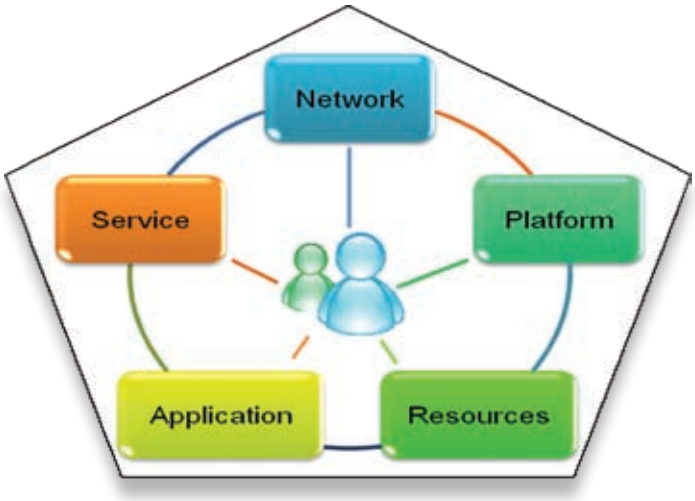
- Holistic in terms of establishing a system that is structured by a unified framework and defined by standardized operational procedures and data collection.
- Sustainable in terms of ensuring the continuity of the ICT-based learning support system, paying special consideration to the integration of the IT applications in the past, present and future.
- Step-by-step in terms of integrating ICT systematically and gradually based on needs and progress made.
- Innovative in terms of using appropriate and cutting edge ICT applications to address and solve problems in the provision of learning support services.

To sum up, STVU's efforts to optimize the ICT-based learning support system has been managed carefully resulting in continuous improvements to the delivery of services to both staff and students.

Framework of the ICT-based learning support system

The framework of the ICT-based system was established after years of development. It comprises five components: network, platform, resources, application and service, as shown in Figure 1.

Figure 1: Components of the ICT-based learning support system in STVU



Network

Until 2009, the STVU network consisted of four branches connected by four Cisco 7609 routers in a double directional structure with each link in gigabit Ethernet.[7] The linking-load balance and link redundancy were achieved through the use of Open Shortest Path First (OSPF) routing protocols. Equipped with a 100 megabyte exit for the public network, 100 megabyte exit for the education research network, 1,000 megabyte for the main campus network and 100 megabyte to desktops, the institute's network connects more than 50 branch campuses through the Asynchronous Transfer Mode (ATM)/Metropolitan Area Network (MAN)-based virtual private network (VPN).

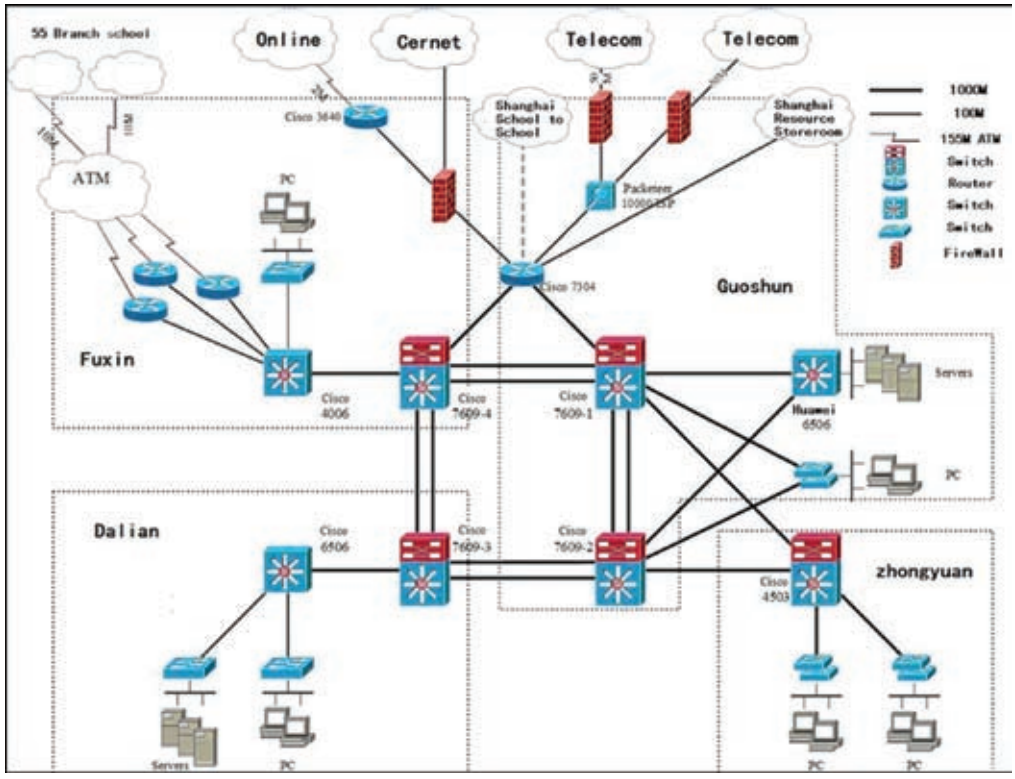
Network safety is secured by a hardware firewall, the intrusion prevention system (IPS), email gateway and antivirus software. The STVU network now reaches 19 districts and counties in the Shanghai region covering an area of more than 6,000 km2. The network equipment is summarized in Table 1 and the network topology is shown in Figure 2.

Table 1: STVU network equipment, 2009

Equipment type	Quantity
Routers and network equipment	168 sets
Servers	110 sets, with 8 blade systems
Storage system	4 systems, with a capacity of 20TB

7 The Ethernet is a system which enables users to share the same connection and thus creates a network. Gigabit Ethernet refers to various technologies for transmitting large amount of data and information at high rate speeds.

Figure 2: Network topology of STVU



To ensure an efficient network, the equipment used must fulfil the following requirements:

- The deployment of various network exits meets the demands of all kinds of external links from staff and students, and guarantees the multi-connections among campus networks.
- The deployment of a double directional structure safeguards the normal working condition of STVU's core network.
- The installation of the link flow control equipment guarantees normal online teaching activities by balancing the in- and out-traffic volume.
- The deployment of antivirus hardware and software has effectively curbed virus outbreaks within the campus network and external hacker attacks.
- The deployment of anti-spam gateway has effectively filtered much junk mail.

Platform

Modern ICT and multimedia technology are the foundations of distance education, online learning and management. Using new technologies, STVU now boasts an online teaching platform supported by MAN. To provide students with a full range of learning support, the platform has integrated teaching, administration and other teaching assistance systems with different application service systems.

The teaching platform of STVU is equipped with a double domain name (the public domain name at *http://www.shtvu.org.cn* and the education research domain name at *http://www.shtvu.edu.cn*). This helps learners to choose the better link for quick access according to the network environment. The total accumulated traffic volume on the teaching platform was about 1.39 million visitors[8] taking the lead among China's distance education institutions.

The teaching platform of STVU includes the following features:

- One-time login learning portal with ID authentication: Once registered as a user of STVU, both faculty and students can easily access teaching and learning materials with a one-time login to the unified learning portal, which has integrated different systems on the homepage. This improvement has quickened the flow of information and increased efficiency in teaching and learning support.
- Essential platform to offer diversified support: Resource sharing, functional duplication and system interactions have been the major concerns of the university's technical professionals both at the design and upgrading stages. Now, diversified supporting services and applications have been successfully integrated on the homepage with a user friendly navigation bar.
- Database standardization to solve information island problems: The standardization of the university's database aims to solve information island problems[9] arising from the diversified demands of teaching and learning at different times with different purposes. These varied data and systems have been processed into a core database, integrating teaching resources of different academic subjects. Technically, as a data-exchange platform, the sharing of teaching duties and materials is achieved successfully through the current platform.
- Security system of online teaching: A security system, which includes an integrated information safety system to handle vulnerabilities and standards for platform construction, safeguards the efficiency of online learning through improved management of data and communication.

Resources

In 1999, STVU established some guidelines on online teaching and learning practices for its faculty and students. In terms of resource development, faculty members were asked to spend approximately 50 percent of their efforts on application and promotion, 30 percent on software development and 20 percent on hardware expansion. Students were encouraged to follow the 'one-three-five' formula: in one semester, each student should interact with tutors or classmates with at least one BBS message, three emails and five reading sessions of online learning resources.

In tandem with the rapid development of ICT applications in education and a better understanding of online teaching, learning resources are increasingly seen to be a component that will be highly demanded by the students. To meet this anticipated need, STVU has adjusted the 1999 guidelines to emphasize the building of multimedia courseware, case libraries and online self-assessment. Strict requirements are now in place to promote the application of the resources, especially by faculty members who are responsible for organizing web-based teaching and seminars. As a result, the extensive application of BBS, audio, video and other systems has facilitated the use of online learning resources and enriched the teaching and learning approaches greatly.

8 End of June 2010.

9 Information islands refer to a situation in which the ICT applications in each department are disconnected from each other. This means that information cannot be shared and functions are disjointed.

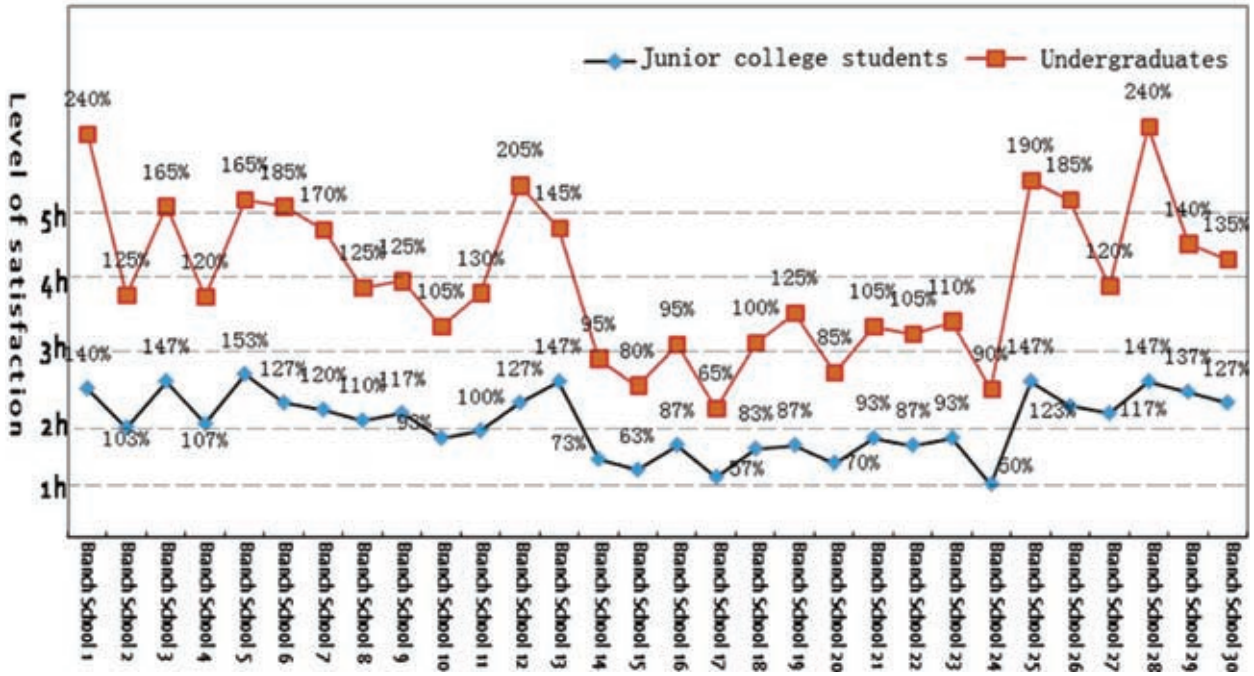
Online learning resources

- **Guided learning resources:** There are 1,339 courses in the STVU Online Class – a platform where the e-learning resources are posted. As required by the academic administration, about 500 of these courses must be upgraded each semester. Statistics show that 484 courses have been revised in the fall semester of 2009. Upgrading of the course resources can be done by academics themselves any time based on their own judgment. Resource types, learning contents, learning activities and course forums can be rearranged according to the teaching and learning context. In addition, easy access to the core database makes the resource upgrading more convenient and effective by sharing resources from different academic subjects.
- **Supported learning resources:** About 300 courses have online assignment tasks which can also be self-assessed by the students. These online tasks offer feedback automatically and can be repeated to improve students' learning, thus help to reduce students' learning anxiety and encourage their involvement in course study. Another feature is the online recording of scores which accounts for 20-40 percent of the final marks. About 100 courses have this facility.
- **Online library:** The online library holds 24,328 volumes of e-books and 8,115 e-magazines. It also provides access to the New Oriental Multimedia Learning Library, Chinese Lecture Library, and Learning Support System for Self-study Learners. The off-campus access to these resources through VPN has improved their usages significantly.
- **Online video resources:** Through the use of a self-developed Enterprise Voice Over Data (EVOD) system, up to 300 hours of online video resources have been recorded since 2000. In addition, another 3,000 videos have been made using streaming media technology. Since 2007, lectures of about 119 courses were recorded using Stream Master software, adding 350 hours to the video resources. Supported by five different servers, access to these resources is quick and easy.
- **Network courses:** To date, STVU has developed more than 96 web-based courses with multimedia courseware, five e-lab systems, four online case banks and fifteen other learning websites for different majors and subjects.

All these online learning resources are used by the students extensively, as demonstrated in Figure 3. The graphs represent the results of a survey of more than 30 branch schools in 2009 to determine the number of undergraduates who spent three hours studying online per week and the number of junior college students who spent two hours studying online per week.[10] Eighteen out of 30 schools reported that their junior college students spent 2 hours per week for online learning, while 24 schools indicated that their undergraduate students studied at least 3 hours per week online.

10 The numbers in parenthesis represent the percentage of students who met these criteria: for undergraduates have studied online for at least three hours per week; for junior college students – have studied online for at least two hours per week. 100% and above indicate that the students met the respective targets.

Figure 3: Results of a survey on online learning



Offline learning resources

Offline learning resources have been designed for those who do not have Internet access. They include 37 courses on multimedia CDs, learning packages for 30 courses and 500 kinds of mobile learning materials, e.g. MP3 files.

Applications

A series of ICT applications developed to offer open and distance learning in STVU has ensured the efficiency of administration and management, student admission and registration, curriculum design, course schedules, provision of materials and resources, teaching processes, examinations, monitoring and assessment. Examples of these applications are described below.

Online classes (main campus)

Online classes at the main campus are used by course coordinators to post curriculum information and provide learning resources (Figure 4). The system allows students, teachers and course counsellors to communicate and exchange information in a virtual classroom environment. Students can submit assignments to be graded by their teachers. This convenient arrangement fosters a learning community and reduces the loneliness caused by distance.

Figure 4: Online classes (main campus)

Opened since the fall semester of 2000, hundreds of thousands of STVU students have benefited from the online classes. The various functions have been upgraded and expanded to meet the growing and diversified needs of the students.

The major features of the online classes include:

- Curriculum information.
- My online class containing personalized course information.
- Learning resources with tabs for guided learning, independent learning and supported learning, thus facilitating the upgrading and browsing of course materials.
- Interactive studies via virtual Question-and-Answer rooms where discussions on various subject matters are conducted between teachers and learners, either synchronously or asynchronously, thus facilitating online teaching and group discussions.
- Study records containing personal Internet access information.
- Tool kit containing practical learning tools, e.g., notepad, SMS and school calendars.
- Question banks containing questions which are used to formulate online course assignments and tests, and in return serve as depositories for submissions and grading of student assignments.
- Score query providing information on academic achievements and credits.

Results from the university's survey during the spring semester of 2009 confirmed the popularity of these features, as can be seen from the statistics below:

- More than 300,000 people have registered.
- Nearly 90,000 people have Internet access records.
- More than 3.45 million records of Internet tracks.
- About 430 sets of assignments were completed and graded.
- About 61,000 BBS messages were posted.
- Approximately 12,800-person SMS enquiries were received.
- More than 1,500 Internet connections recorded daily on average.
- 2,629,319 visits recorded for online classes.
- About 10,000 sessions of synchronous teaching (including the branch schools) were conducted and 1.5 million messages posted by teachers and students with an average of 15 messages per student.

Online classes (branch campus)

Online classes (branch campus) are fully connected to the main campus system, providing a platform for administration of branch schools in curriculum arrangement and teaching management (Figure 5). The connection not only ensures the synchronization of the online courses between the main campus and branch schools, it also provides effective support to local tutors carrying out the appropriate teaching and learning activities.

Figure 5: Online classes (branch campus)

This system has two main functions. One is concerned with academic activities, with local tutors offering learning support to branch school students. The other is related to the university's system management, a

hierarchical structure for daily operations with STVU at the top, branch schools in the middle and different teaching locations at the bottom. Through this application, academic activities and daily operations of the branch schools are monitored comprehensively to maintain the academic quality of branch schools.

Since 2005, STVU's 50 branch schools have successfully conducted their daily operations with this system.

Faculty seminar system for teaching and research

The system for faculty seminars facilitates the management of, and communication between, STVU course coordinators and local branch school tutors (Figure 6). Administrators monitor the academic activities of the faculties based on feedback statistics through the system. The recording of each online seminar also offers information to assist the university in its self-assessment and evaluation exercises. About 3,000 sessions of web-based seminars of different courses have been conducted since the autumn semester of 2005.

Figure 6: Faculty seminar system for teaching and research

Returning student service system

A returning student is one who could not finish his/her study in the scheduled time (2.5 academic years) for various reasons and has come back to continue learning. As a rule, the accrued credits are fully recognized for eight years starting from the first enrolment.

The system offering support to student returnees was initiated in 2005 and has benefited numerous undergraduates and junior college students (Figure 7). The facility contains information related to their continued study, courses, curriculum, examinations, scores, learning resources and the latest policy on returning students.

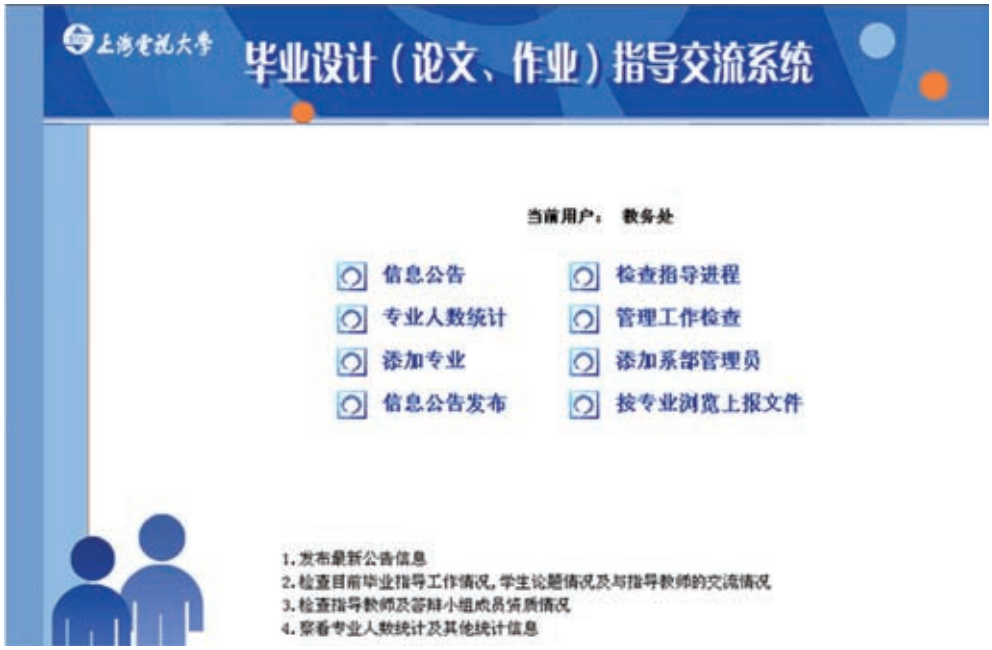
Figure 7: Returning student service system

Advisory service system for graduation project (thesis)

STVU's advisory service system was set up in September 2004 to assist students in preparing their theses as part of the requirement for graduation (Figure 8). Reflecting the university's individualized learning support principles, the advisory platform enhances communication between thesis instructors and students, and between course coordinators and thesis instructors. Students receive advice from topic selection through to the finalized drafts. Easy access to the instructors and advisors, freed from time and physical constraints, has proven to be effective for both the instructors and students.

The system is also used to monitor the thesis writing process including the verification of the qualifications of thesis instructors, members of oral defence team and students. Another versatile function is the system's tracking facility to manage the communication between instructors and students. Data from 2005 illustrate the utility of this system. A total of, 2,695 thesis instructors' qualifications were examined, and 21,000 thesis topics were evaluated and suggested. In addition, 4,159 undergraduates and 13,934 junior college students (representing 98 percent of the undergraduates and 72 percent of the junior college students, respectively) communicated with their instructors through this system.

Figure 8: Advisory service system for graduation project



Enrolment system

Inaugurated in September 2000, the enrolment system (Figure 9) is an integrated part of the digital campus, serving as the source of students' information which is stored in a database accessible also by the administration system. This facility provides real-time control and instant management of STVU's enrolment procedures. The system was upgraded with additional statistical functions and verification of qualifications.

Figure 9: Enrolment system

Curriculum plan and course management system

The system offers information on several aspects of curriculum and course management. It simplifies course query and selection for students (Figure 10). It also records the workload of teachers and information about the courses offered in each semester. The system has been in operation since the autumn semester of 2006 and is being upgraded.

Figure 10: Curriculum plan and course management system

Test control system

The test control system mainly supports management and communication between STVU and test venues during examination periods, particularly in the provision of test services and supervision of venues (Figure 11). Test services include the posting of test information, rules and regulations, and related news. The system is equipped with MSN video and audio software to deliver the information. Supervision of test venues comprises the correction of mistakes in the test papers and the detection of 'ringers', i.e., people taking tests for others. Cameras are used in each test room. Communication between STVU and different test venues can be done simultaneously through the system. The channel can be switched easily from real-time to recorded communication.

The system has been in service since June 2005. Communication among test venues has been greatly promoted and facilitated with nearly 1,000 messages released through the system to date. Above all, the system provides instant communication accurately and efficiently, which in turn improves the management of the examinations.

Figure 11: Test control system

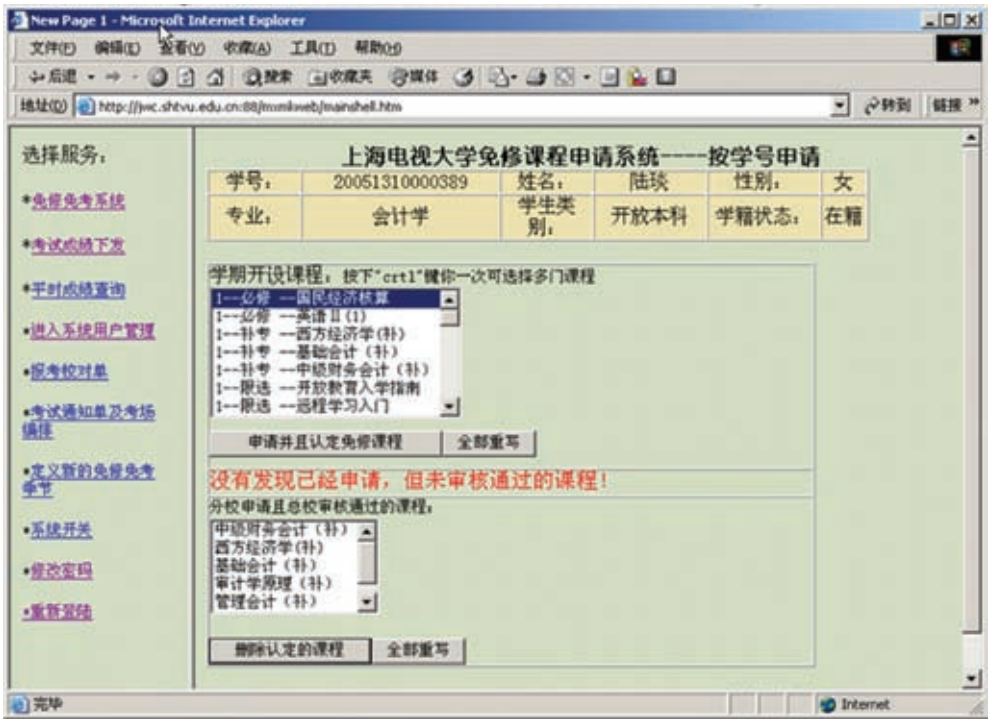
Course credit transfer system

The course credit transfer system is used to manage and exchange information on credits between STVU and the branch schools (Figure 12). Supported by a shared database, the system enables online transfer of course credits through the following functions:

- Accept individual applications or group/class applications for course credit transfer at branch schools.
- Examine the qualifications of applicants and inform them of the results through the system.
- Provide authorized statistics of applicants and acquired course credits classified by class and by branch schools.
- Prepare and send learner credit transfer records to branch schools for archiving and to China Central Radio and Television University (CCRTVU) for examination as required.

The system has greatly improved the efficiency of communication about course transfer between STVU and branch schools. Course credit transfer information of each branch school can now be obtained directly by STVU while branch schools can provide instant feedback to the applicants. The delivery of the credit transfer records to CCRTVU also guarantees the accuracy of the information. Application of the system has improved work efficiency and benefited STVU and the branch schools economically.

Figure 12: Course credit transfer system



Mobile campus

The mobile campus system (Figure 13) serves the management of information of academic affairs, communication between academics and class counsellors, and score enquiries. Information management on academic affairs includes all kinds of notification relating to change of class times, holidays, tests, tuition payments, and maintenance of online classes. Communication management refers to the instant and direct interactions among class counsellors, students, management staff and academics. Score enquiries can be responded to as soon as the latest scores are released.

Currently, the mobile campus covers all branch campuses of STVU to serve 100,000 teachers and students. There are plans to extend its coverage to the surrounding cities and provinces, and to improve the efficiency of ICT applications according to the needs of STVU. Research on new functions will be conducted based on the 3L teaching approach, i.e., course teaching plan structured by guided-learning, supported learning and independent-learning.

Figure 13: Mobile campus

Online practice system

Increasing emphasis has been placed on giving students more practical training and exercises in various subjects in recent years, resulting in an efficient online practice system (Figure 14). In particular, two kinds of achievements have been made. One is that more web-based practice resources have been developed. The other is the establishment of the STVU Online Training Centre portal which has facilitated the teaching of many practical courses such as Social Investigation and Social Practice. The portal includes the following elements:

- Web-based distance laboratories for Logistic Management, Business Management and E-government System.
- Web-based virtual laboratories for Remote Control of Electromechanical Devices, Electromechanical Integration Technology, e-Commerce, Financial Regulation and Professional Ethics, Spoken English and Practical Chinese Writing.
- A depository of case studies with multimedia courseware for different majors and subjects, such as Business Management, Accounting, and Administration.
- Practical learning outcome libraries containing Student Best Papers, Student Multimedia Products, Student Anime Works and Student Application Works.
- Online practical sessions on specific subjects such as Communication System for the Instruction of Graduation Design (Thesis) and Communication System for the Instruction of Social Practice.
- A multi-navigation system with a single sign-on function that enables users to move through the different levels to access the resources easily and quickly. The system also keeps track of the usages and provides statistics for other administrative databases.

The STVU Online Training Centre is continuously being upgraded to meet the ever growing teaching and learning demands. Several components that were established have become indispensable to the teaching and learning platforms for many majors and subjects, including the Communication System for Instruction of Graduation Design (Thesis) and the Remote Control of Electromechanical Devices.

Established in 2005, the Communication System for Instruction of Graduation Design manages the verification of instructors' qualifications, instructors' workloads, selection of topics for graduation thesis projects, teaching practices and monitoring of related work. The web-based laboratory for the Remote Control of Electromechanical Devices is used by Mechanical Design and Automation staff and students for the graduation project designs, course development and practical experiments. This online facility has provided learners with more practice opportunities and offset the deficiencies of equipment in some teaching locations. The system is applicable for the following: programming experiments on multi-model programming controllers, experiments on multi-function simulation boxes, and experiments on AC Servo Systems for example.

Questionnaire surveys of graduates targeting their degree of satisfaction with the online practice system have been conducted every year since 2005. Participants are asked two questions:

- Do you think the web-based experimental course is helpful in fostering your observation and analytical abilities and in improving your practical skills?
- Do you think the web-based laboratory satisfies your experimental learning needs?

The survey results since 2005 can be seen in Figures 15 and 16. Both graphs show that at the initial stages in 2005 and 2006, the degrees of the satisfaction were rather low at 15 to 20 percent. However, the levels of satisfaction rose sharply to 75 percent and over with greater financial investment and improvement, allowing for minor adjustments to meet the expectations over the years.

Figure 14: Online practice system

Figure 15: Results of survey on satisfaction in fostering skills

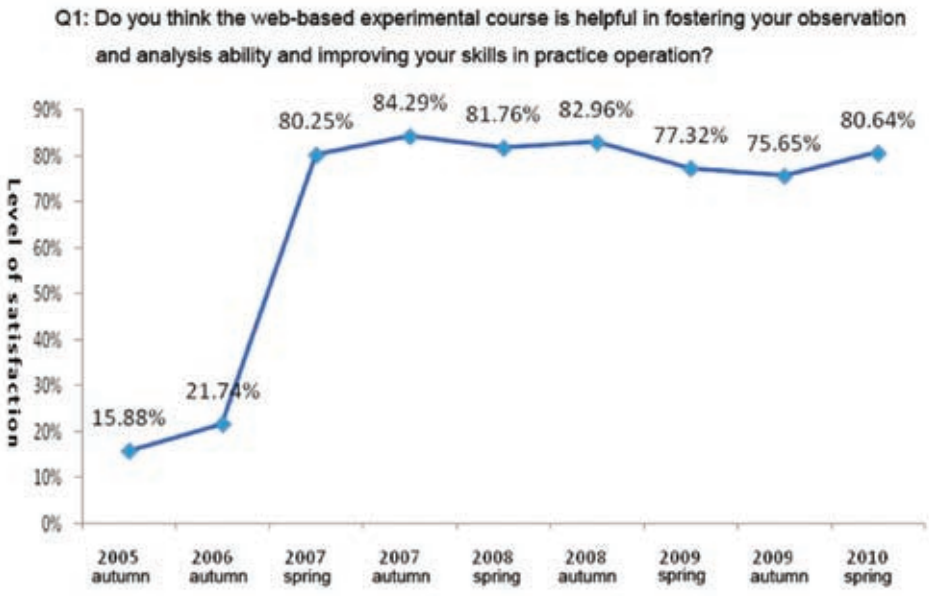


Figure 16: Results of survey on satisfaction with experiential learning

Services

Improvement of the ICT Service Function in STVU

Service is always at the centre of the STVU's learning support. As early as 2004, the first One-stop Service Centre appeared in Minyi Branch School. It was quickly introduced to other branch schools resulting in 23 branches setting up their own One-stop Learning Support Centres. Using a face-to-face approach, the Centre provides a comprehensive information inquiry service from admission to graduation, and covering almost every aspect of the learning process. Once in the Centre, learners gain a thorough understanding of the learning mode at STVU. At the beginning, the Centre mainly served as a student enrolment agency. Now, each centre is equipped with computers and copy machines.

To improve its support services, the Educational IT Centre of STVU was established in 2006. The Centre is responsible for web-based teaching in terms of management, application and maintenance. The optimization of the teaching platform as well as technical support to learning resources development is also the Centre's responsibility.

In 2008, another kind of service centre was set up in STVU – the Distance Reception Centre, which focuses on multimedia information inquiry and consulting services. Currently, the Centre offers consulting services for admission and learning support, ICT technical support and the like. The Centre also receives complaints and suggestions from learners, faculty and branch schools, and more importantly, it provides instant, efficient services to learners through telephones, faxes, emails, letters and the Internet.

Provision of ICT services for learners

The ICT services provided to learners at the beginning of their study include training and developing skills for:

- Conducting online learning.
- Obtaining multimedia learning resources, learning support information and course information.
- Using teaching facilities.

The ICT services provided during the learning process include:

- Facilitating learning with guided-learning resources in Online Class by course coordinators.
- Facilitating learning through teaching platforms, emails, telephones, short messages, blogs and wikis; and monitoring learning by online formative assignments and self assessments by both course coordinators and the local tutors.
- Following-up on learners' progress through the Academic Management Software as well as on management of registration information, implementation of the curriculum, information of learners' status and graduation qualification audit.
- Tracking learners' online learning records, assignments and test scores by class counsellors from branch schools to help learners keep up with the teaching schedules.

Guaranteed ICT services

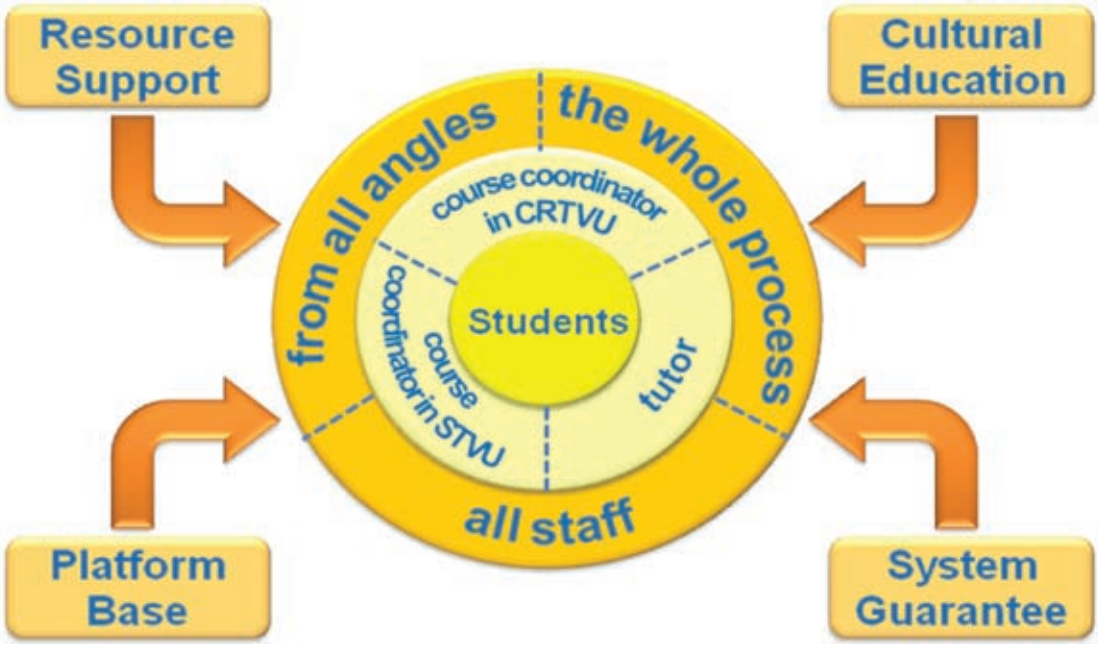
The ICT-based information system is equipped with servers for email, blogs, wikis and BBS. The technological applications have guaranteed the following activities:

- Tracking, analyzing, synthesizing and categorizing BBS messages by course coordinators to identify features and problems of a particular teaching practice.
- Organizing and conducting real-time online forums, a required teaching task, by both course coordinators and local tutors with an SMS alert service.
- Dealing with complaints and inquiries through the hotline by the Distance Reception Centre and forwarding the records to respective departments for solutions.

Features of the information-based system

Guided by the educational mission of STVU – For All Learners, All for Learners – the information-based system of the university is constructed to fully reflect the characteristics of its comprehensive learning support system. Features of the system are shown in Figure 17.

Figure 17: Features of the information-based system in STVU



Efficient in terms of concept and quality

Taking learner group identity and personality into consideration, STVU aims to provide learners with full, thorough and efficient support that meets the following conditions:

- ***Clear concept of services:*** Following the learner-centred principle, the provision of continuous and efficient academic and non-academic services involves joint efforts from academic, management and ICT professionals. Services to learners need to be monitored and appraised by management through a set of clearly defined procedures.
- ***Full range of services:*** Services to enhance learning need to cover all aspects of web-based learning from guided-learning, supported-learning to assignments and examinations.
- ***Customized services:*** Support for adult learners has to be tailor-made to match their respective academic proficiencies, job positions, career goals and living conditions.
- ***Diversified approach of services:*** Services should be offered through multiple modes, including the university's networks, telephone, face-to-face communication, Internet, and so on.
- ***Open services:*** Learning support requests from learners should be delivered by the network anytime and anywhere.

Holistic in terms of form and content

The learning support system needs to be optimized in both form and content to provide effective and efficient services, based on the following guidelines:

- ***Service selection:*** The selection of the service type and approach should align with those most favoured by learners.
- ***Function categorization:*** There should be clear definitions of the functions and roles of each service type within the system.
- ***Resource allocation:*** This must be linked to high quality and appropriateness of the services to be provided.
- ***Media selection:*** The selection should be based on the efficiency of the media type and convenience of usage.
- ***Relationship coordination:*** The linkages among the various components of the learning support system should be unified and well-coordinated.

Unity and learner-centred in terms of design and operation

To emphasize the learner-centred focus, individual differences and the overall development of students should be taken into consideration in designing the learning support system, especially in:

- Planning and designing an overall learning support mechanism.
- Selecting functions and structures of the learning support.
- Designing all components of the learning support system.

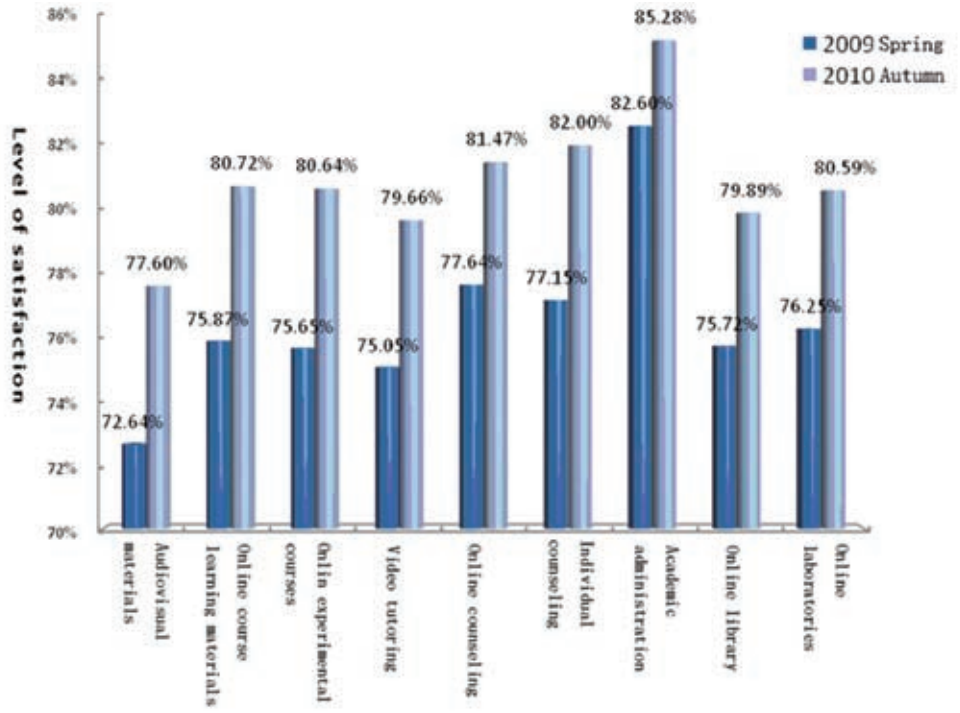
Enhanced usage of ICT applications to facilitate education reform

STVU has been undertaking a systematic education reform since 2007 with a focus on strengthening the ICT applications in teaching and learning. It also surveyed the students to find out their degree of satisfaction in the following areas:

- Audiovisual materials (including VCD).
- Online course learning materials (including courseware).
- Online experimental courses.
- Video tutoring.
- Online counselling.
- Individual counselling (by email, telephone and letters).
- Academic administration (including enrolment, registration, examination queries, etc.).
- Online library (electronic reading room, digital library and so on).
- Online laboratories.

The levels of satisfaction ranging from 72 to 85 percent in the 2007 and 2009 surveys were an improvement compared to the results of 2005 and 2008 with satisfaction rates of 14-84 percent. The results of the 2009 and 2010 surveys are shown in Figure 18.

Figure 18: Degree of satisfaction to web-based learning support, 2009/2010



STVU continuously analyzes the changes of learner groups and social demands so that it can respond to new situations and enhance the quality of distance education through ICT as one of its strategies, as illustrated below.

STVU information-based development plans

STVU has been developing its education network system for distance education since the 1990s and has played a significant role in the online learning of millions of TV university students. It recognizes the need to continuously invest its resources to develop its IT infrastructures and systems proactively to meet emerging problems. The 2007 plan explicitly urged the establishment of a unified, multi-level and open information framework for resource sharing and sustainable development. In November 2008, it injected RMB 1,500,000 to initiate the Information-based System Framework project which led to the construction of a unified user management system and data exchange platform in 2009.

The expansion of the various systems and processes has resulted in increasing data and connectivity problems. To resolve these issues and improve the quality of online education system, STVU initiated a project to reconstruct the Integrated Education Platform in 2008 with a budget of RMB 5 million. It selected Microsoft (China) as its contractor and testing commenced in 2010.

STVU also invested RMB 400,000 in 2008 to establish a wireless campus network. This was aimed to provide a flexible, convenient and efficient environment for teachers and students to meet the increasing demands for mobile learning and administration, as well as cater to the university's broad range of activities and meetings.

In recent years, the smart card has become a key component to represent a digitalized campus in China. The smart card's multiple and convenient functions cover ID recognition, financial services, information services and process integration with just one card. STUV's smart card project was initiated in 2009 with a budget of RMB 4,700,000 to be implemented in four campuses in time for the university's 50th anniversary in 2010.

While sparing no efforts to build an open and distance university of 'first class at home, influential abroad', STVU also aims to contribute to Shanghai's lifelong education system and the development of a learning city. In 2007, STVU formulated a plan to support branch schools through the following strategies:

- Improve the schools' information-based system to solve existing bottleneck problems.
- Support and facilitate the schools' operation, and improve services to faculty members and students.
- Build on the information-based system and promote lifelong and community education to support the development of a learning city and open university.
- Establish new schools and sustain their development with the help of ICT.

The main tasks to be carried out include:

- ***ICT infrastructure:*** Improve the Skynet, ground grid and TV network; improve connectivity and integration of the entire network to provide an efficient infrastructure for the university.

- ***Software and applications:*** Integrate new technology and software into the original platform and applications, and optimize their usages.
- ***Content and resources:*** Increase the quality and quantity of materials and resources to enhance the concept of lifelong education in Shanghai.
- ***Networking culture and administration:*** Provide appropriate facilities and technology to create a healthy, harmonious and energetic networking culture and environment for teachers and students.

Conclusion and reflections

After years of development, integration and practice, the application of ICT has successfully supported open and distance education in STVU. Its extensive and efficient infrastructure that extends beyond the confines of a single campus but reaches out to more than 50 branch schools is a major source of pride for STVU. Another area of impact is the improved learning as a result of the collective wisdom of experts and professors, high quality teaching resources, excellent teaching experiences and modern teaching approaches all easily accessible anytime and anywhere. Teaching with multimedia courseware has greatly increased students' attention and interests. At the same time, learning becomes more flexible and satisfactory as students with different backgrounds and academic levels can learn at their own pace.

However, STVU's achievements are not only the results of technological factors – network, platform, resources, applications and services – but should also be attributed to the university's management systems, practices and accountability in all areas, i.e. budgeting, implementation, supervision, monitoring and evaluation. The university also takes great pride in recruiting and training talented staff who are knowledgeable and proficient in modern teaching design, computer and network technology, communication, research and programme development.

Nonetheless, STVU acknowledges that there is still room for improvement, particularly in the following areas:

- Develop a more balanced system with clearer division of function and power, operational regulations and procedures.
- Improve regulations for operational mechanisms.
- Build professional teams and talents to meet the needs of STVU's IT systems.
- Improve assessment and examination systems.
- Ensure adequate financial investments.

STVU plans to continue harnessing new technologies to strengthen the integration and administration of education resources, and diversify services to meet students' individual needs. It is also looking into the following;

- Establishing a comprehensive certificate system for different majors.
- Facilitating credit recognition and transfer between universities.
- Combining diploma education with training courses in collaboration with the Shanghai Service Centre for Human Resource Development.

- Working with polytechnic institutions to enable their graduates to continue their studies.
- Integrating digital learning resources of higher education, vocational education and continuing education.

Fully utilizing ICT to enhance the learning support service is a long-term project. On the basis of current ICT-based learning support systems, STVU will optimize and upgrade its existing system to lay a solid foundation to become a first-class open university at home with worldwide influence.

ICT for open and distance learning

Korea National Open University, Republic of Korea

Tae Rim Lee[11]

Introduction

Since its founding in 1972, the Korean National Open University (KNOU) has become the Republic of Korea's mega-university for open and distance learning (ODL). It consists of four colleges[12] including 22 departments. It has more than 180,000 students and has turned out more than 500,000 graduates to date[13]. A graduate school based on e-learning was established in 2001 and now comprises nine departments offering lifelong learning opportunities for Korean citizens.[14]

The large number of students indicated the demand for continuous learning in Korea. Socio-cultural and environmental changes related to ODL also dictated the necessity for KNOU to redefine itself.

First, the delivery of distance education has changed as information and communication technology (ICT) develops. KNOU had been using one-way delivery through television, radio and audio cassette tapes since its establishment. The one-way mode of instruction isolated students in their learning process. Advances in computer science and modern communication technologies have opened the path for a two-way delivery system that enables learners to actively participate in the learning process. ICT applications supporting e-learning or mobile (m)-learning offer more alternative instructional models for students to interact with their instructors and peers.

Second, a hot issue materialized when several cyber-universities began conferring bachelor's degrees. Since 2001, 16 cyber universities have been established (Ministry of Education and Human Resources Development, 2003). This resulted in competition among the conventional distance education institutes, KNOU and the new cyber universities. The Korean government and universities have tried to address this problem through the formation of consortia. KNOU is a member of the Korea Virtual Campus (KVC) consortium which consists of 10 universities as well as the Information Technology Cyber University (ICTU) which consists of 36 universities. As a result, KNOU has collaborated on several e-learning projects with other universities within these two consortia.

Third, the students at KNOU have diversified. In the past, most were those who could not enter university

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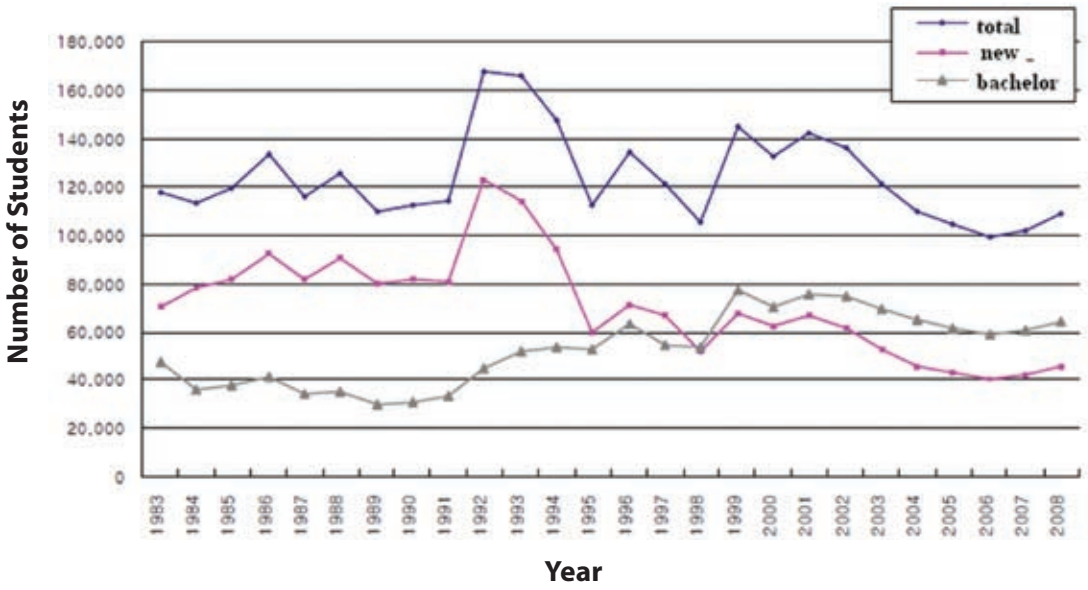
13 *http://www.knou.ac.kr/engknou2/aboutknou/HK1_1.html*, (accessed 8 March 2011).

14 Department of Practical English, Department of Public Administration, Department of Management, Department of Home Economics, Department of Computer Science, Department of Nursing, Department of Lifelong Education, Department of Early Childhood Education and Department of e-Learning.

after graduating from high school. Now, the proportion of students who enrol at KNOU for re-education or transition into a different major after a bachelor's degree has grown considerably since 1983, as can be seen in Figure 1. This implies a need for a flexible teaching-learning system that corresponds to the varying levels and demands of the students.

This paper describes the initiatives undertaken by KNOU in response to these trends, particularly in using ICT for e-learning and m-learning to provide multimedia resources and enhance interactions between students and their instructors and peers.

Figure 1: Trend in students' enrolment in KNOU according to their education level



e-learning projects in KNOU

Objectives of e-learning adaptation

In upgrading its e-learning courses, KNOU aims to:

- ***Provide students with easy accessibility to learning resources***

One advantage of distance education is the flexibility of learning anywhere and anytime. This provides opportunities for those who have difficulty in following fixed and regular course schedules (KNOU, 2003).

- ***Provide comprehensive self-learning materials***

Research has shown that learners can study effectively on their own if they have access to the right materials (KNOU, 2003). Managing and delivering these materials through ICT can enhance the learning experience and engage the students more meaningfully in the learning process.

- ***Motivate the students to become self-regulated learners***

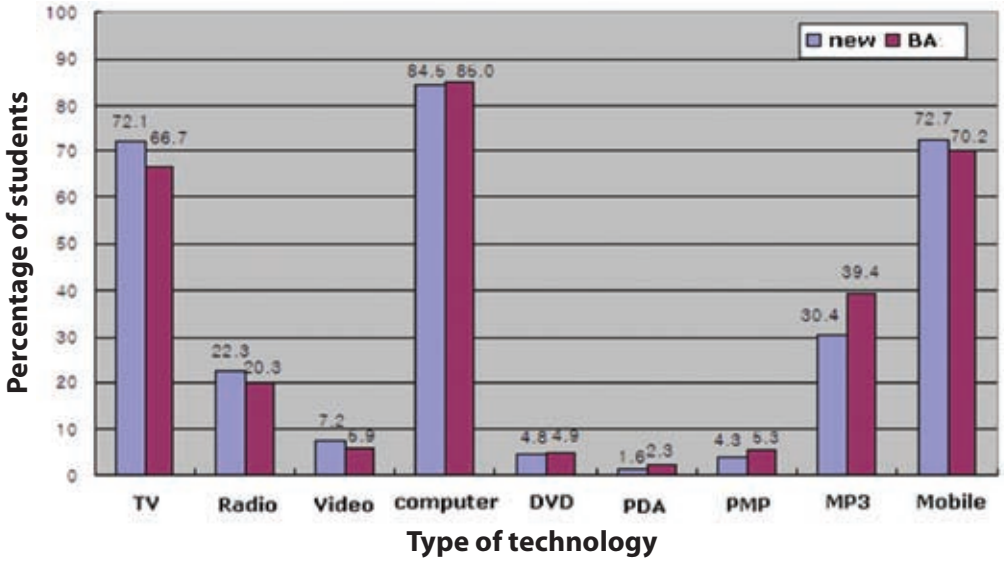
Self-regulated learning ability is an important factor in determining the success of e-learning since the learner is responsible for deciding the study process and method. It encompasses the characteristics of meta-cognitive strategies that manage, control and improve one's learning through setting the goals of study, reviewing, evaluating and managing oneself (Knowles, 1975). It also includes a motivating element to continue one's learning and a behavioural element to practice (Zimmermann, 1990). Since e-learning requires learners to play an active role in their learning process, they naturally develop self-regulating ability.

Readiness for e-learning

According to data from the National Computerization Agency (2004), the number of Koreans owning personal computers reached 55.8 percent in 2003. About 68.2 percent of the population had Internet access in 2004 with 26 percent having broadband services. The number of Internet users had increased to more than 80 percent in 2010 (ITU, 2010). The data imply the sufficiency of technical infrastructure, which is the ideal condition for the adaptation of e-learning.

To provide the most effective e-learning services, the following conditions need to be met at the three levels of the participants in the e-learning system – learners, instructors and the service organization. First, how well learners can prepare for learning is influenced by how much they can use the Internet and the high-speed network. According to a survey of 102,940 students (52 percent of the total number of students who registered for the first term of 2003), 95.3 percent were using the Internet (KNOU, 2004). In addition, 81.9 percent had high-speed network. However, only 12.8 percent accessed the Local Area Network (LAN), with the majority of the distance learning students having no difficulty in using a variety of multimedia learning resources. In 2007, 84.7 percent of the registered students said that their main communication and information delivery tools were computers with 83 percent accessing their classes through high-speed Internet. These findings strongly support the investment in and development of high-quality learning content. Figure 2 illustrates the usage of various technologies and tools among the students.

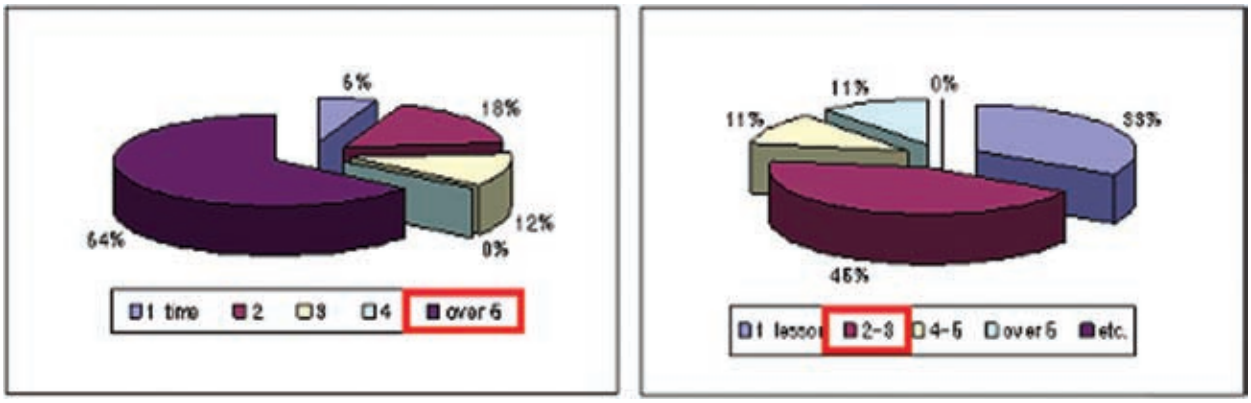
Figure 2: Distribution of students' communication tools



(new = admitted as a freshman; BA = admitted as a junior or sophomore)

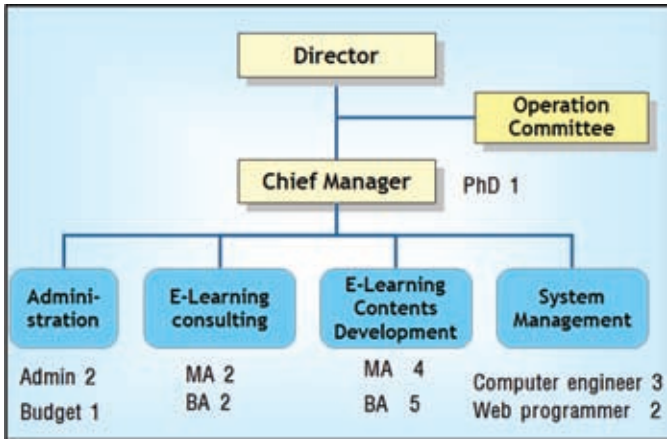
Second, the preparation and experience of instructors also influence the development and quality of e-learning content and course management. In 2004, 55.9 percent of KNOU professors had experience in developing e-learning contents. In fact, 90 percent of Faculty of Science professors had content development experience. Figure 3 illustrates the number of e-lectures and e-lessons developed by KNOU professors.

Figure 3: Professors' experience in e-learning lectures and the number of e-learning courses



Third, preparation at the organization level is also an important factor. In 2011, the e-Learning Center (Figure 4) was established to facilitate online graduate school programmes of four departments with 24 specialists including educational technologists, web programmers, web designers and computer system analysts. The e-learning hub site, "e-Campus," was launched and 38 e-learning courses were developed and funded by Ministry of Education (MOE) and Human Resources Development.[15] By 2004, KNOU had developed e-learning content for 103 courses (18.9 percent) out of a total 554 courses and had e-learning staff who were wholly responsible for content development, course management, consultation, faculty training and educational programme management. From 2004 to 2005, the e-Learning Center developed eight international e-learning courses in English, courses on Korean History, Korean Culture and Art, Economic Development and Economic Policy in Korea, Click Korean [for learning Korean], Statistics, Water Quality Test Methods, Introduction to Computers, and History of Economy (see *http://elic.knou.ac.kr*).

Figure 4: Organization chart of the e-Learning Center



15 In 2004, US$34,000 for 13 subjects; in 2005, US$1,150,000 for 34 subjects including international versions of the products.

Development of e-learning courses

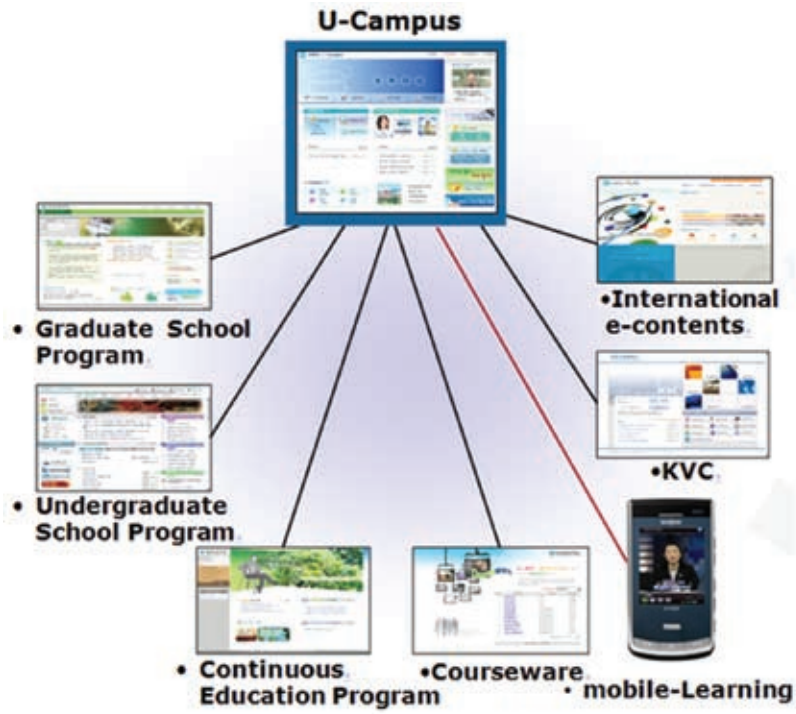
KNOU has implemented e-learning projects under the KVC and ITCU consortia. In 2004, KNOU courses amounted to 30 percent of all KVC courses. Out of the total number of 554 courses on offer in KNOU, 39 courses have been operated by the KVC or ITCU, and 64 courses have been used as supplementary materials in classes delivered through other media.

Classes provided through TV, radio and cassette tapes are also available online at the KNOU Learning on Demand (LOD) homepage with support from Korean IBM. Materials previously available through the cable TV channel OUN can also be downloaded. The LOD service contains the entire 554 courses prepared by KNOU Digital Media Center professionals and IBM computer system designers. Furthermore, non-KNOU students can also pay a fee to access 110 open courses.

KNOU U-campus

Figure 5 shows the structure of the KNOU U-campus.

Figure 5: Structure of KNOU U-Campus



KNOU established a graduate school in 2001 and 223 graduates completed their studies in 2004. In 2009, the university offered 129 graduate courses for 1,537 registered students. Table 4 shows the steady increase in the volume of online courses and registered graduate students from 2001 to 2009.

Table 1: Number of graduate courses and students

Section	2001	2002		2003		2004		2005		2006		2007		2008		2009	
	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
No of courses	8	16	20	32	16	20	32	40	40	46	46	50	47	58	56	66	63
No of students	198	368	304	535	368	304	535	549	432	629	455	707	493	741	589	879	658

The Graduate School has been offering online lifelong learning at the masters' level since 2001. Teacher-training in-service programmes were introduced in 2004, and other professional training programmes are expected to be available in the future. The e-Learning Center developed and managed the contents in four phases – analysis/design, sample course development, whole course development, and operation/support – to ensure that they match the diverse learning needs and capacities.

The international e-content contained subjects such as Korean history, Korean culture and arts with several chapters available in English (Figure 6), Chinese and Japanese. These materials are used in exchange programmes with universities across the world including *Asian Association of Open Universities (AAOU)* and e-Asia-Europe Meeting (e-ASEM) members.[16] During the planning and production of the 'Introduction to Statistics,' several modules were exchanged with the Fern University in Germany and the Japan Open University.

Figure 6: English e-learning contents

16 AAOU is a non-profit organization of higher learning institutions primarily concerned with education at a distance. e-ASEM is an e-Learning network for promoting cooperation among Asian and European countries on ICT skills, e-Learning and culture of e-Learning in lifelong learning.

Following these trials, the e-Learning Center developed five more international e-learning titles (Figure 7) with funding from the MOE *(http://elic.knou.ac.kr/)* including:

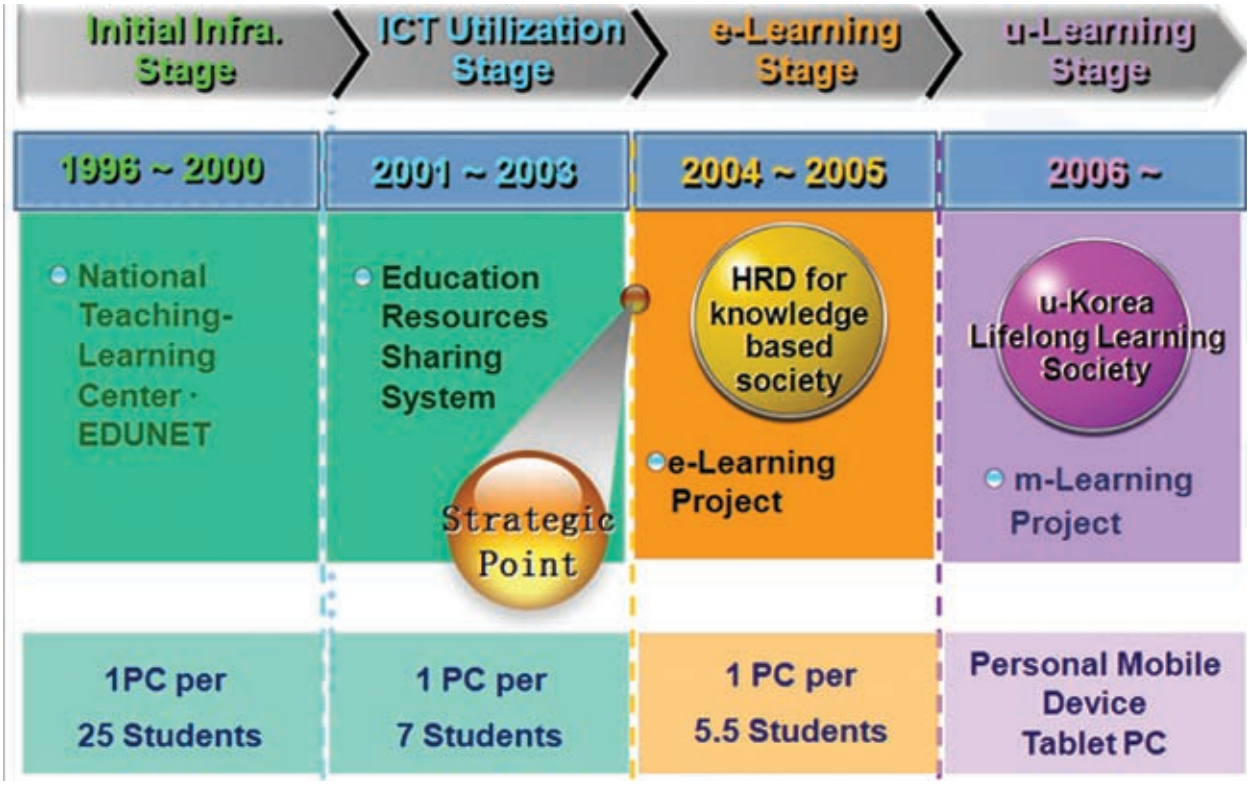
- Economic development and economic policy in Korea (produced in cooperation with Korea Development Institute (KDI) and used for students in the international school programme)
- Click Korean (produced in cooperation with Seoul National University (SNU) International Language Center and used for foreign students learning Korean in SNU)
- Water Quality Course (produced in cooperation with the Department of Civil Engineering, University of Wisconsin, Madison and used as supplementary materials for their students)

Figure 7: KNOU e-Learning International Campus (eLIC) homepage and list of contents

Major issues

The variety of educational demands and changing paradigms in ODL were strong motivators for improving educational media through ICT applications. As seen in Figure 8, access to ICT resources and the World Wide Web has increased rapidly and the mode of teaching and learning has to keep pace with this progress. The educational space needs to be enlarged to accommodate these demands. Standardization and quality control processes will be needed to support development of high quality e- and m-contents, to be followed by the eventual transfer of e-contents to m-learning contents.

Figure 8: Progress of adopting ICT in education in Korea

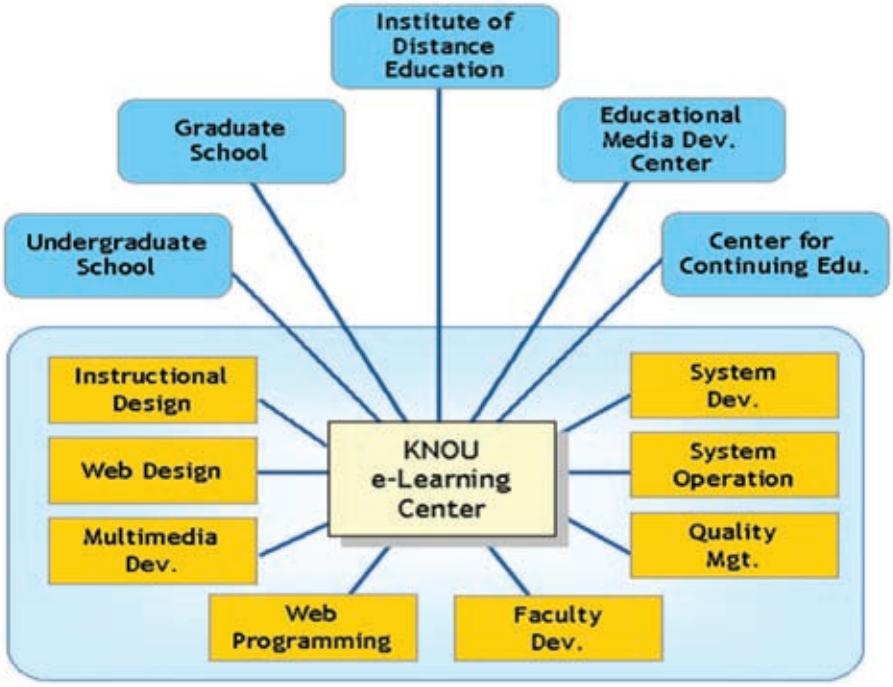


KNOU: Policies, strategies, programmes and projects

Policies and strategies

The e-Learning Center is collaborating closely with five institutions in the university (Figure 9): Undergraduate School; Graduate School; Institute of Distance Learning; Educational Media Development Center and the Center for Continuing Education.

Figure 9: Cooperative organization system of e-Learning Center of KNOU

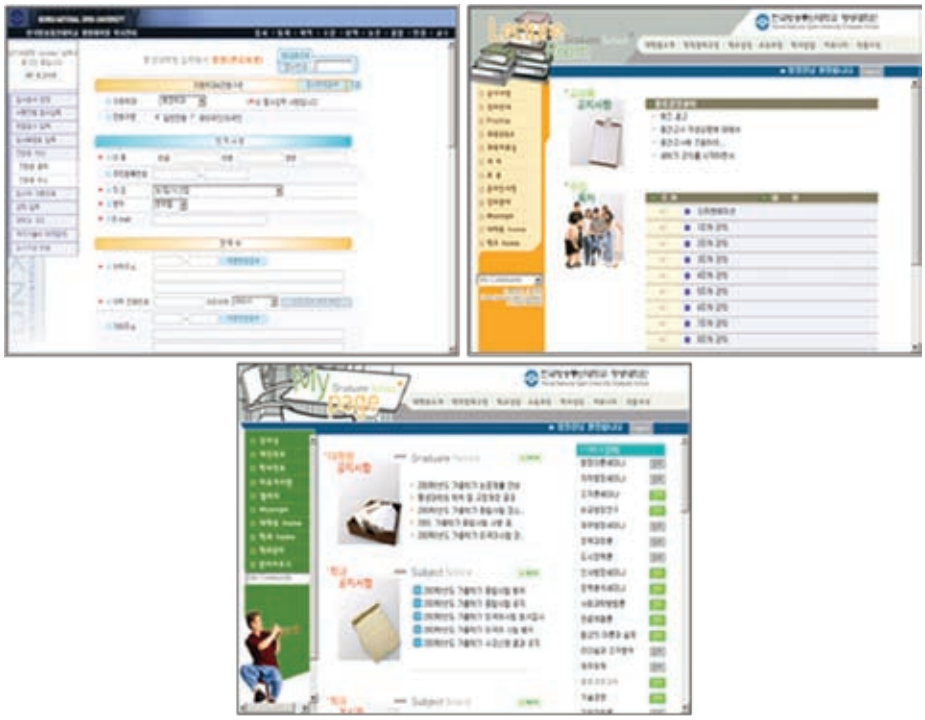


The e-Learning Center promotes the KNOU vision of Knowledge Networking and Opportunity for Upgrading which underlines five e-values for promoting good quality e-learning: excellence, expertise, enthusiasm, extension and empowerment (Figure 10).

Figure 10: Vision and values of KNOU e-Learning Center

The main responsibility of the e-learning system division is managing the Academic Affairs Management System (AAMS), Learning Management System (LMS), and the learning platform (Figure 11).

Figure 11: Main responsibility of KNOU e-learning system division



KNOU has many LMS and content management systems (CMS) for various types of courseware in the Graduate School Division, Undergraduate Division and Center for Continuing Education. The logical components of the e-learning system at KNOU are shown in Table 2.

Table 2: KNOU LMS and CMS

Divisions	Main Systems
Graduate School	School Affairs Management System
	Learning Management System (LMS)
	Contents Management System (CMS)
	Community System
	Evaluation System
Undergraduate	Learning Management System (LMS)
	Contents Management System (CMS)
	Evaluation System
Center for Continuing Education	School Affairs Management System
Courseware	Contents Management System (CMS)
KVC	School Affairs Management System
General	Media Streaming system
	Mailing System

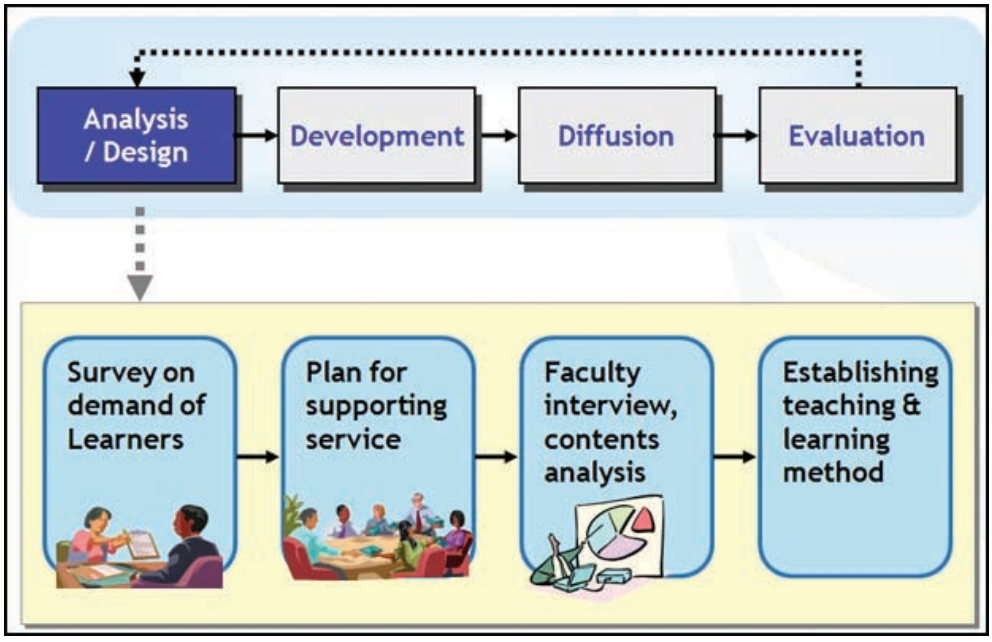
KNOU has also instituted structured e-learning consulting process. During the initial consultation process for preparing the e-contents, the team follows a four-step process: needs analysis and design, development, implementation, and evaluation of course satisfaction. The content development process also consists of four phases: analysis and design; design and development of an overall teaching plan; assessment and management; and final evaluation. After the final assessment conducted among the target learners by specialists of the developed plan, the content is reviewed for future development.

Analysis and design

At the analysis and design phase, a plan for content development is prepared after a needs analysis; and selection of a learning strategy through interviews with instructors and subject analysis (Figure 12).

- ***Learners' need analysis***: Learners' need analysis is conducted through a survey which includes basic socio-demographic information (sex, age, education, career, and specialization if any), level of advanced learning (in applicable corresponding subjects and level of interest), level of digital literacy (level of computer and information use), and learning style (self-learning ability level and media content preference).
- ***Instructor analysis:*** Teacher analysis is conducted through interviews to determine appropriate teaching-learning strategies and propose plans for lectures and delivery of materials.
- ***Subject analysis:*** The subject matter to be taught is analysed to understand the characteristics of the subject and to devise the most suitable learning mode that will enhance the comprehension of the subject.

Figure 12: Analysis and design of e-learning consulting process



Design and development

During the design and development of a teaching plan, the content is developed for a prototype of the overall teaching plan in tandem with the technical support needed to deliver the lectures and materials (Figure 13). With the support of educational technology specialists, the e-Learning Center aims to establish a standardized content design that enables self-learning through analysis. Professional web designers will help to design the screen and interface for the learners. Using the design template, all the multimedia resources are collected from the Digital Media Center and webpages, followed by training on using the design templates (Figure 14) and the content development tools.

Figure 13: Development of the e-learning consulting process

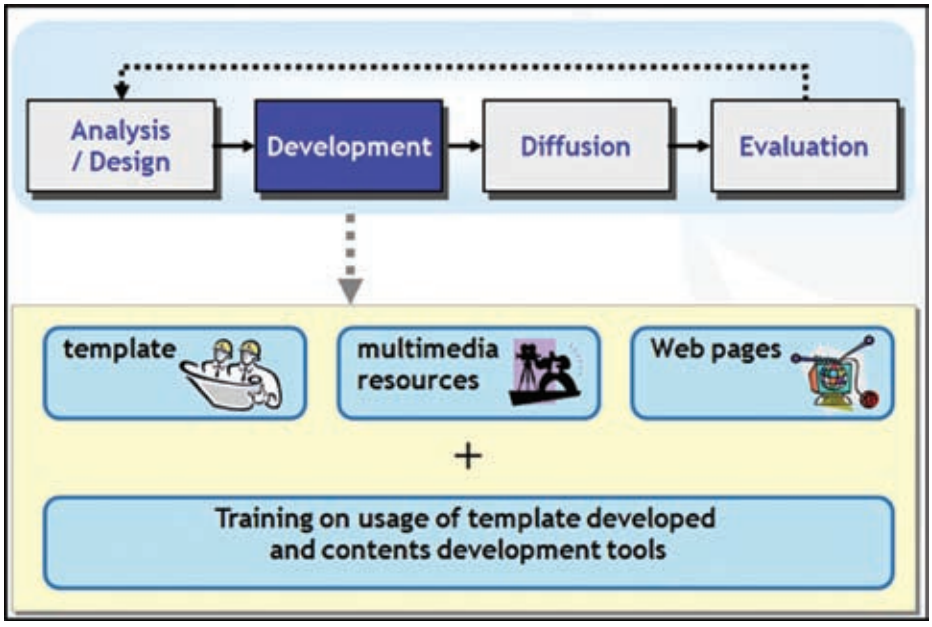
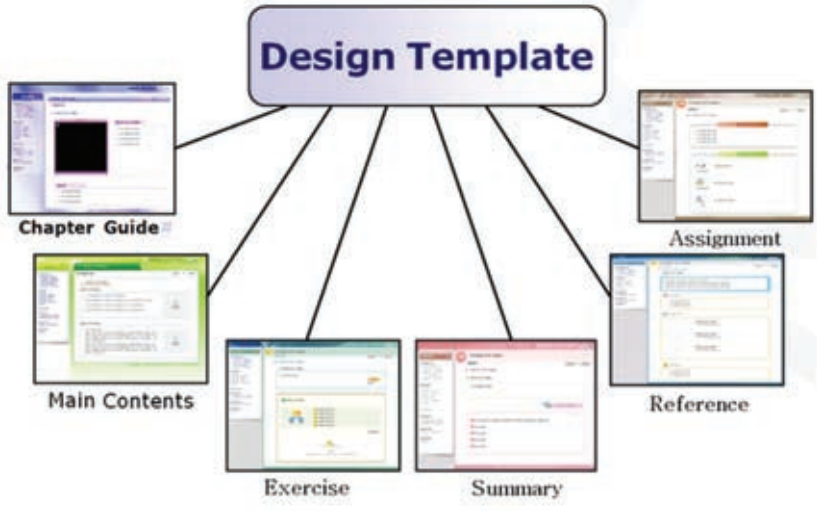


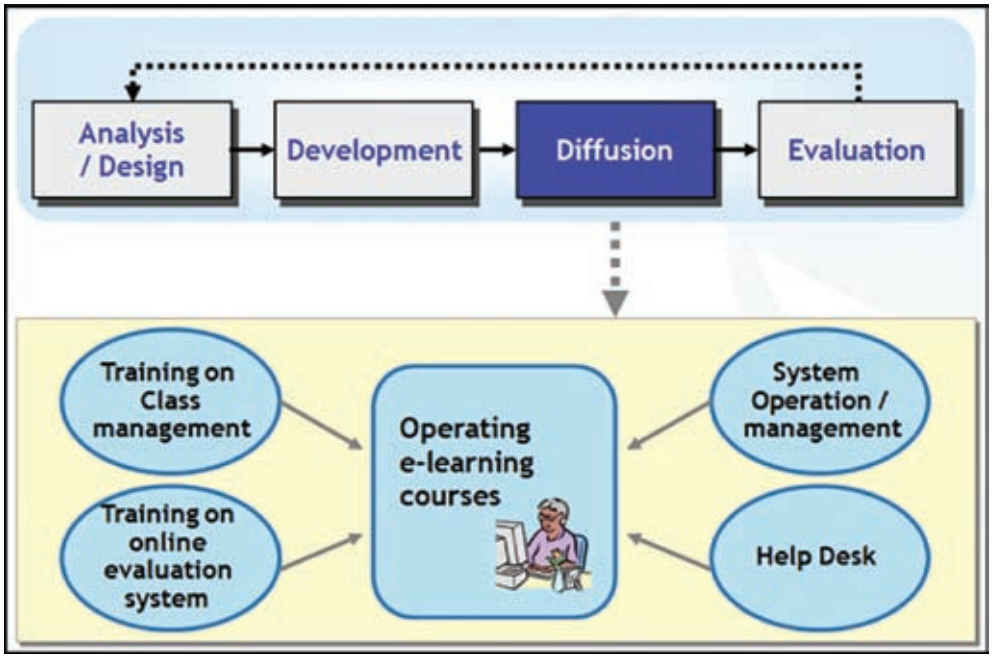
Figure 14: Design templates for e-learning content production



Implementation

During the phase of diffusion, teaching tips, various techniques and strategies required for lectures are provided, e.g., techniques for orientation, task management, discussion management, motivation and ending the lecture (Figure 15). Prior to implementing the course, the quality of teaching will be enhanced by analysing the contents of the e-lecture.

Figure 15: Implementation of the e-learning consulting process

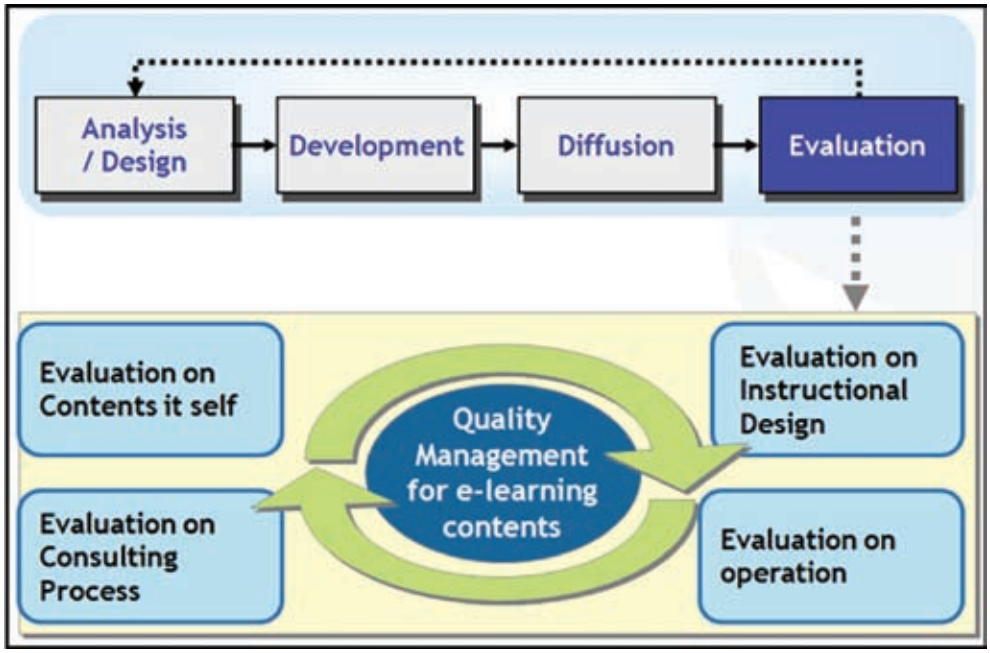


Evaluation of the e-learning content

Evaluation of the e-learning content will include assessment of the first unit at the beginning of the course and the entire content at the end of the course. The results obtained will be used as feedback to improve the content for the next semester (Figure 16). Each assessment is conducted by one subject specialist, two e-learning specialists and the learners.

The subject specialist focuses on the suitability of the subject for the class of a specific major, i.e., appropriateness of objectives, clarity of objective statements, justification of content selection and content construction. The e-learning specialists look at the teaching design including the appropriateness of the teaching-learning strategy, clarity of the objective statements, justification of content selection, effectiveness of multimedia use, appropriateness of screen construction and ease of navigating the screen and content. The learners provide feedback on the subject content, teaching-learning strategies, as well as their degree of satisfaction.

Figure 16: Evaluation of the e-learning consulting process



Programmes

Type of content

The e-learning content can be developed in various forms depending on the target learners, teaching-learning strategy, multimedia support and delivery media. KNOU e-learning content is produced for three modes of teaching and learning: multimedia lecture, tutorial and inquiry learning.

- ***Multimedia lectures:*** Multimedia lectures are used when most of the learning content is to be delivered through video and audio (Figure 17). The content is produced using a multimedia tool (e-Stream) and provided together with PowerPoint data to convey the lessons to the learners. The content is structured and accessed in the lecture index of the PowerPoint slides, and the lectures are presented dynamically with animation.

Figure 17: Multimedia lecture window design

- ***Tutorials:*** Tutorials are used mainly to facilitate self-learning at the learners' own prescribed pace and time (Figures 18 and 19). Activities are designed to promote interaction between the learners and content through advanced learning diagnosis or self-checking to ensure rapid learning progress and the ability to solve problems. Learning content is provided with a focus on the text. Various activities have been added to enable learners to understand and evaluate the level and status of their own learning activities.

Figure 18: Webpage of tutorial style

Figure 19: Webpage for self-checking

- ***Inquiry learning:*** Inquiry learning is used when learners are required to think at a high-level through problem solving (Figures 20 and 21). Such learning activities correspond mainly to project-oriented learning, task-oriented learning and discussion/seminar-oriented learning. Learners are encouraged to participate in learning more positively and solve problems more actively.

Figure 20: Webpage for inquiry learning

Figure 21: Guide for research and seminar

e-Learning in Group Diversity project

As a model project for implementation of e-learning in all KNOU's undergraduate courses, the e-Learning in Group Diversity (e-LGD) project aimed to pinpoint problems and improvements when introducing e-learning to classes. It was developed with three main factors as described below.

- ***Incorporation of various types of e-learning:*** Clark and Mayer (2003) classify e-learning into three types: receptive e-learning designed for information conveyance; directive e-learning for gradual knowledge acquisition and learners' performance; and lastly, discovery e-learning for transition of learning or problem solving. The receptive model recognizes e-learning as a technical tool, while the directive model is a tool for achieving the goals of study given by an instructor. In contrast, the discovery model perceives e-learning as learning environments for developing higher-order thinking that enables learners to deeply explore the courses of study by themselves. These viewpoints provide many suggestions for high-level learning through e-learning. However, the ability to explore complex problems and study high-level thinking enabling deeper understanding of the problems and exploration of solutions through critical proposals is missing (Kolodner and Guzdial, 1996). Therefore, it is necessary to apply more than one type of e-learning to a course rather than to adopt only one. As a result, the e-LGD project comprehensively incorporated various types of e-learning when developing the course content.

- ***Self-regulated learning:*** The e-LGD project also adopted the principles of self-regulated learning which places the responsibility for organizing, operating and evaluating the entire learning process on the learner (Zimmermann, 1990). Self-regulation enhances self-realization or self-satisfaction and is also considered a good application for education. Above all, for web learning without a teacher's direct assistance, it is essential to build up a self-regulated learning environment. By incorporating self-regulated learning into the project, learners have to monitor their progress according to their own learning schedule and evaluate their work to check their personal learning progress.

- ***Instructional design template:*** The instructional design template is useful for ensuring that the content is developed according to various teaching-learning activities and components of study materials (Joung and Kim, 2002). This is particularly critical when developing large-scale content. The e-LGD project used the instructional design template to keep the project participants on track.

The e-LGD project, which ran during the first term of 2004, had courses with varying class sizes from as few as 30 to as many as 1,200 students. Each course consisted of learning content with 20 units and offered announcements related to learning progress, bulletin boards, questions and answers, and archives for learners (Figure 22). An LMS for the e-LGD project was constructed temporarily. In total, 5,243 student volunteers who wanted to take e-learning courses registered for one out of the 10 offered in the e-LGD project. The number of participants in each course is shown in Table 3.

Figure 22: Learning management system for e-LGD Project

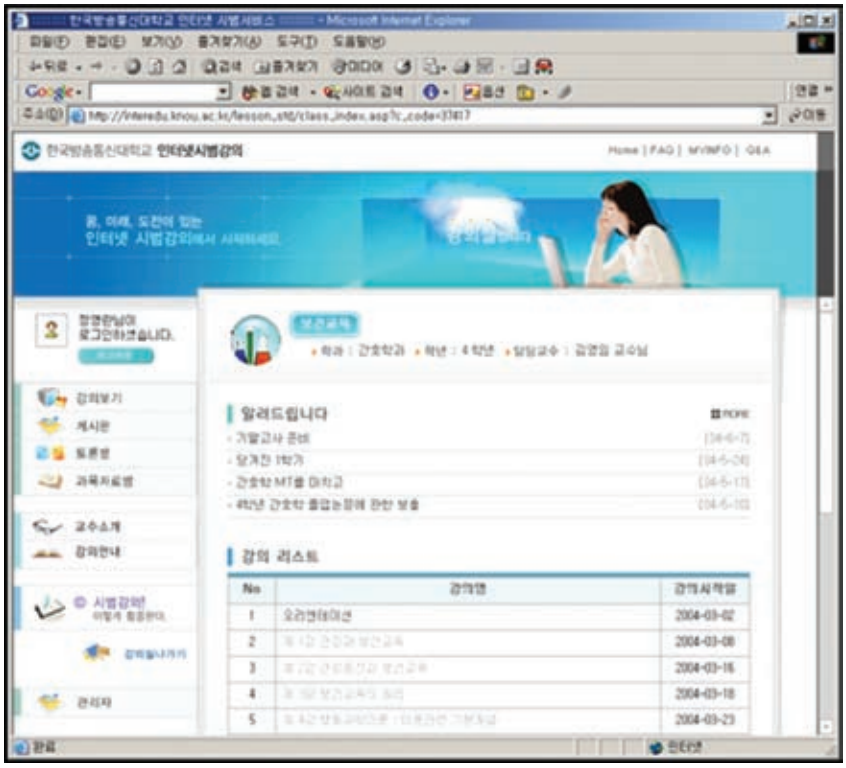


Table 3: Students' enrolment in the e-LGD Project

Courses	No. of students registered for regular courses	No. of students registered for e-LGD	Rates (%)
Course 1	2,679	750	28
Course 2	170	30	18
Course 3	1,186	203	17
Course 4	5,955	1,263	21w
Course 5	1,169	212	18
Course 6	684	209	31
Course 7	4,445	1,096	25
Course 8	489	206	42
Course 9	2,367	345	15
Course 10	4,613	929	20
Total	23,757	5,243	21
Average	2,376	524	22

Study methods

The participants of this study were divided into two groups. The first group of 2,300 students studied through the e-LGD project and had e-mail accounts. The second group consisted of 10 professors who participated in the e-LGD project. After taking e-learning courses for a semester, the students and professors were surveyed and interviewed, seeking their feedback about the study materials, their satisfaction level with learning content, course management, administrative support and improvements they would make. The number of students who responded was 332 (14.4 percent). All the 10 professors responded to the survey.

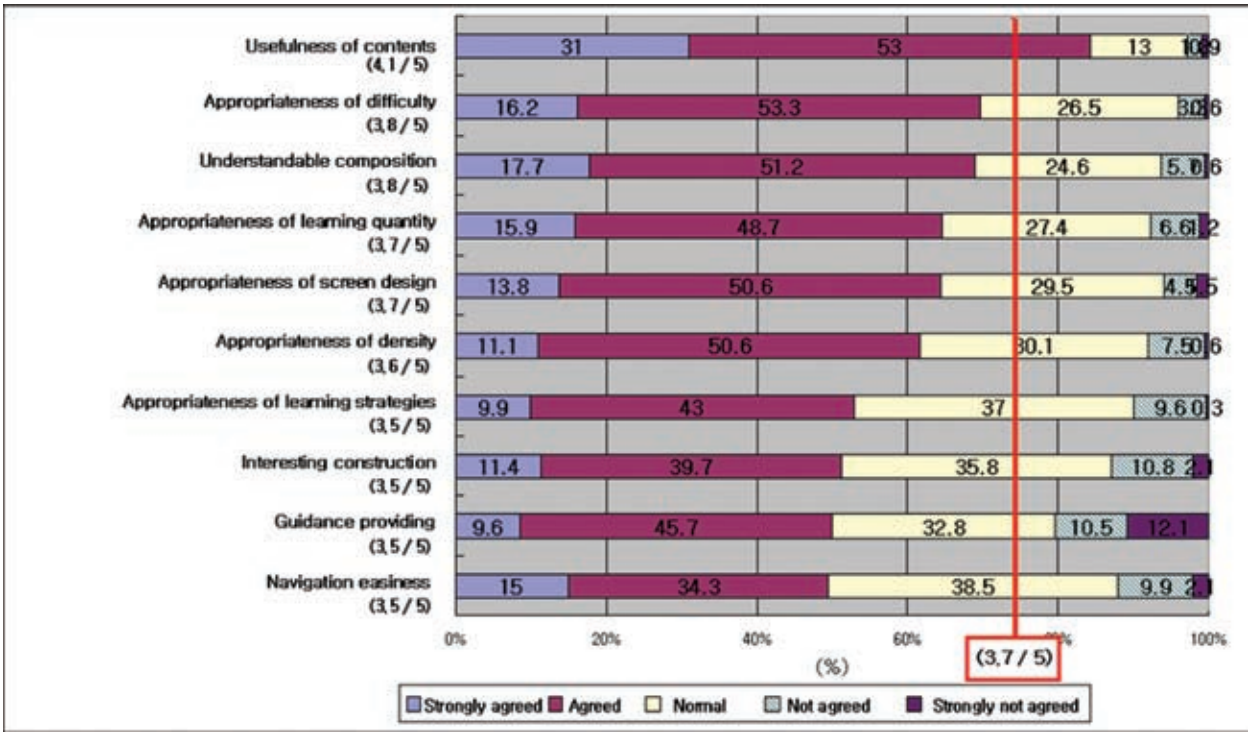
Results

- ***Learning contents:*** The average score of learners' satisfaction with the learning content was 3.7, showing that the learners were relatively satisfied with the content. In particular, among the different items measuring learners' satisfaction, they were highly satisfied with the usefulness of the learning content (4.1), appropriateness of difficulty (3.8), and comprehension (3.8). The lowest score was 3.5 (appropriateness of learning strategies, help and ease of navigation). The value of Cronbach α for reliability of the survey was 0.89. This result means that most of the students who participated in the e-LGD project were satisfied with the learning content. Figure 23 reveals that the media preferred by students was the Internet TV (47 percent) and e-learning courses (37 percent).

  This shows that they preferred learning through ICT. It was also found that they preferred lecture-type content (54 percent) where professors gave extensive explanations about the learning content.

The weight of responsibility the professors had to carry for content development was examined. It was found that most of them spent about two months preparing for e-learning course development (60 percent), and 20 percent spent about 3 months. As for the professors' burden of responsibility according to the media type, providing that weight of responsibility for TV programme production is set to 10, responsibility for e-learning course development weighed 7, and that of radio programme and cassette tape production was 3. These findings are a good point of reference for professors who avoid e-learning because of the weight of responsibility for course development.

Figure 23: Learners' satisfaction with learning content



- ***Course management:*** Professors who were interviewed about e-learning course management indicated that there was no difference in difficulty of managing classes of varying sizes (Table 4). This could be explained by the relatively non-proactive management of courses. Also, students played a passive role in their e-learning courses because they were familiar with the one-way mode class such as TV and radio.

Table 4: Number of notices posted and visits

No.	No. of students registered for e-LGD	No. of notices posted	No. of visits
Course 1	750	9	946
Course 2	30	7	171
Course 3	203	22	384
Course 4	1,263	47	2,079
Course 5	212	5	176
Course 6	209	73	1,466
Course 7	1,096	34	1,313
Course 8	206	8	351
Course 9	345	45	2,614
Course 10	929	49	2,877
Total	5,243	299	12,377

The results shown in Figure 24 indicate that the average satisfaction score of the materials for further study, learning guidance, and faithful feedback was 3.5, and there was little difference between the three items. These results are very reliable as verified by the 0.68 Cronbach α value.

The learners also preferred multimedia lectures that were supplemented by sufficient materials for learning (37.5 percent), guided-study that facilitated self-learning (35 percent), and interactions and discussions with peers and professors (27.5 percent). These results correspond to the responses from lecturers who valued the importance of learning materials (43 percent), guided-study and interactions (28 percent). In addition, both the learners and professors concurred that the most important support is to provide information on study management to assist them in self-management and self-study (Table 5).

Figure 24: Learners' satisfaction level of course management

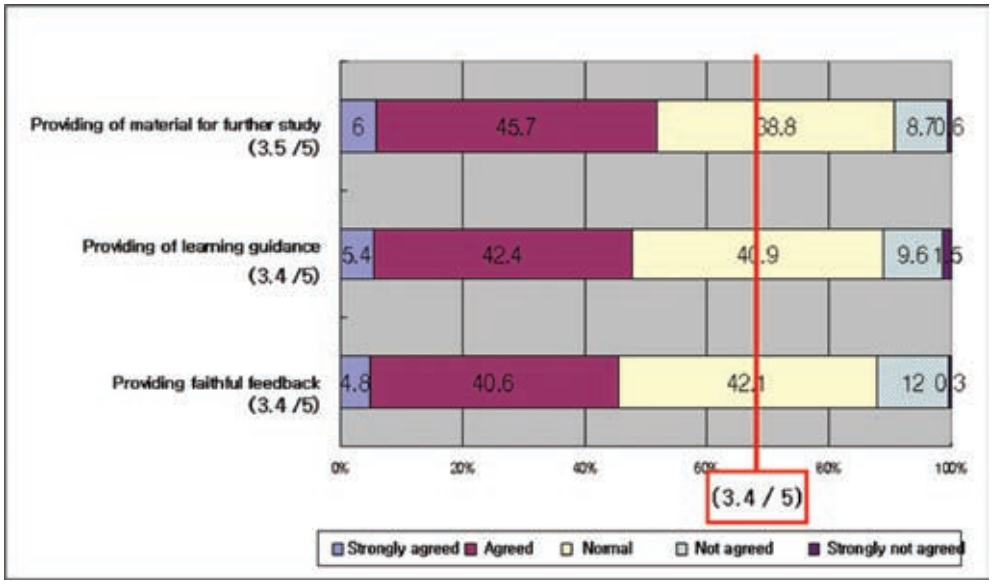


Table 8: Major need of support for learners and faculty staff

Support	Students (%)	Faculty staff (%)
Providing information on study management to facilitate self-study	26.3	24.7
Providing guides for effective study method for each course and tips on study	23.0	23.3
Providing supplementary materials and detailed explanations related to learning	19.0	21.4
Providing self-examination tools	16.7	15.3
Providing opportunities for exchanging opinions with peers and professors	15.0	15.3
Total	100.0	100.0

- ***Administrative support:*** The aspects of administrative support were examined through interviews with the professors. The major findings are as follows.

  First, the professors required administrative support to conduct e-learning courses. Most of those who participated in the e-LGD project asserted that e-learning should be part of all courses. In particular, they suggested that e-learning should first be implemented in courses with smaller classes. They also pointed out that there should be studies on course management and evaluation models according to class size.

  Second, the survey results underlined the need for the e-Learning Center to set up an active support system for content development. Most of the professors agreed that the e-Learning Center is better positioned to maintain such a system than the professors themselves besides emphasizing the necessity for enhancing the efficiency of content development and providing various content models and design templates.

  Third, it is important to differentiate management support according to class size, e.g., dividing a class, giving the faculty more managerial discretion, assigning more tutors and so on.

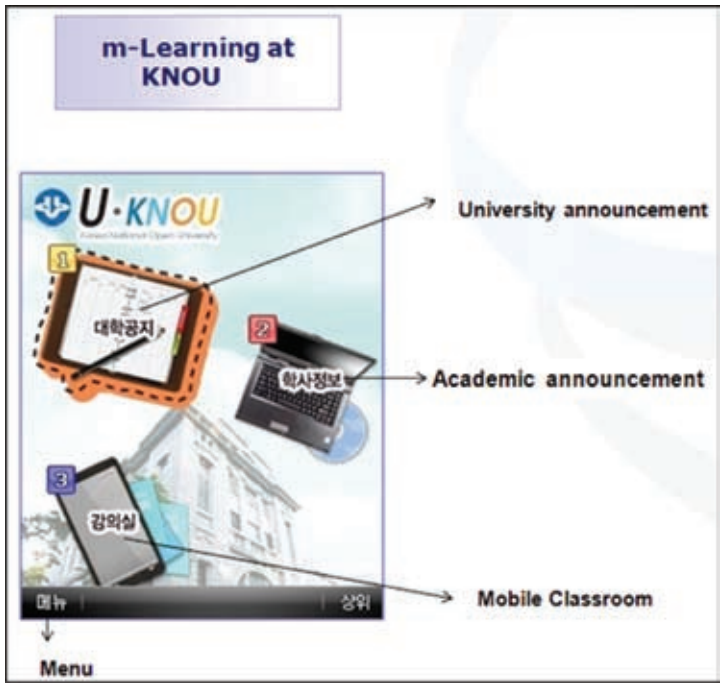
  Fourth, most professors stressed the importance of continuous quality control during e-learning course development by deriving improvement plans according to the satisfaction level of the courses.

Recommendation

It is crucial to evaluate the effectiveness of e-learning courses for further improvements, particularly in view of rapid development in the education sector towards mobile (m-) and ubiquitous (u-) learning. The efficient use of ICT for ODL will go a long way in addressing the needs of KNOU learners. Technologies using mobile devices and wireless Internet services have the potential to introduce innovations in the area of m-learning education. They offer students and teachers the opportunity to interact with and gain access to educational materials without the constraints of time and space.

KNOU had taken the first step in this direction with the launch of the KNOU Ubiquitous Learning Campus in December 2008. Figure 25 shows the homepage of KNOU m-learning, implemented in cooperation with the Korean telephone company KT.

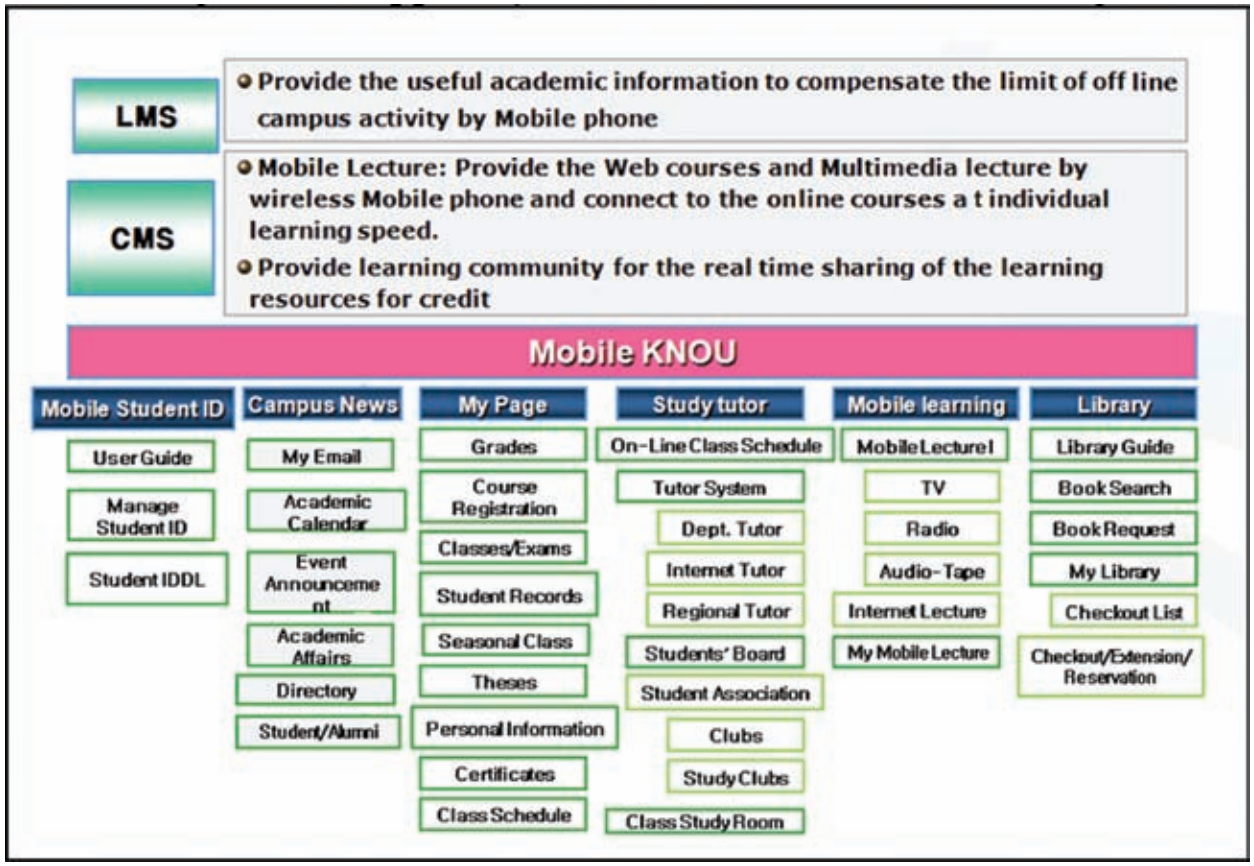
Figure 25: Homepage of KNOU u-learning campus



Mobile campus in hand

The mobile phone has provided a new mode for sharing information. The mobile technology is a key factor in changing KNOU's paradigm and innovating the operation of the U-Campus. The handy devise allows for continuous feedback and evaluation among educational technologists, computer analysts, web programmers, web designers and content specialists. Figure 26 depicts the various supporting features of LMS and CMS systems for KNOU m-learning students.

Figure 26: Support system for the students' m-learning



Quality assurance for ICT education

A KNOU Education Quality Assurance Committee for ICT application in ODL should be organized to replace the conventional semester-based irregular quality assurance system. The committee will be responsible for conducting research and guiding the university in improving the quality of ICT application. Committee members will consist of university representatives, directors of relevant sections such as the Department of Academic Affairs, Digital Media Center, Evaluation and Supervision Office and Deans of all the colleges.

In its practice and operation for quality assurance, KNOU stresses:

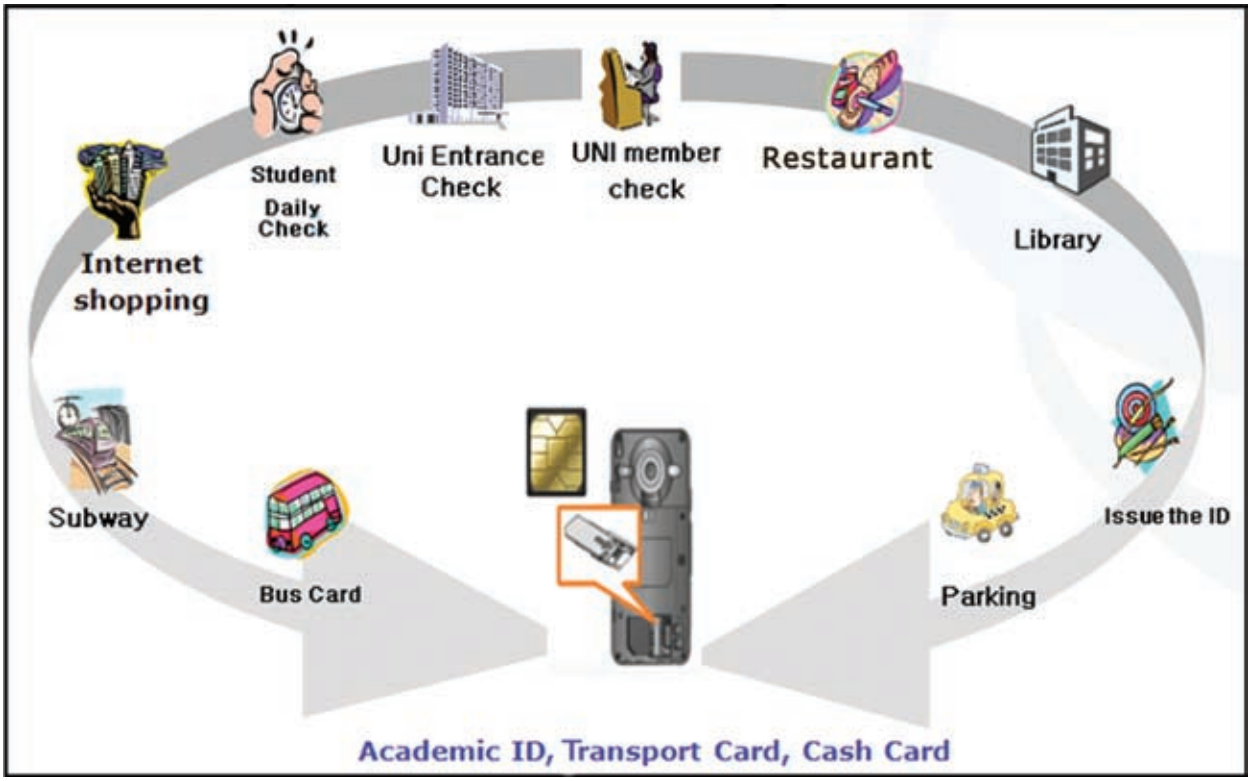
- Development of quality education resources and teaching resources;
- Management of teaching activities and student support services;
- Checking and monitoring of teaching activities on a regular or unscheduled basis; and
- Provision and maintenance of teaching and learning platforms and the support services offered by the headquarters.

In carrying out these tasks, a clear distinction of responsibility needs to be made in addition to mutual cooperation and coordination among the different functional departments.

Future mobile-based campus solutions

In the future, mobile-based campus solutions will enhance convenience to campus life as shown in Figure 27.

Figure 27: Mobile-based campus solutions



Conclusion

Through the e-LGD project and by examining the strategies and plans to introduce e-learning and m-learning courses, evaluate the learning content, manage courses and student support, the following conclusions can be drawn.

- There is no meaningful difference in the students' level of satisfaction with e-learning content and e-learning course management according to class size. Therefore, further studies should be conducted on e-learning course models according to the various class sizes of KNOU. The e-learning courses should be developed by considering various elements such as type of study, class size, study goal and standardized management programmes according to each model. Also, it is necessary to conduct further research on how methods of teaching and learning should be implemented according to the various operation models of e-learning courses. The results of these studies should be introduced into the actual teaching environment to verify their efficiency.

- Improvement in self-evaluation methods is needed for active learning. Based on results from the evaluation of their understanding of the course content, learners seemed to prefer passive lectures from the instructors. However, to enable them to put their learning into practice effectively, learners should be more engaged in evaluating their learning experiences themselves.
- A variety of media including TV and radio should be incorporated into e-learning. Broadcast media developed earlier can still be used in newer courses, particularly when planning for TV or radio programme development.
- A systematic study support system should be established, not only for professors, but also for students. The type of help and support should be carefully studied and appropriate measures be provided to meet their specific needs. Therefore, the creation of a learner-centered service is highly recommended.
- A programme to analyse learning styles and tendencies is required. To develop this kind of programme, information on learners such as their preference and level should be systematically managed and applied to course development and management (Joung and Kwak, 2004).
- Quality should be controlled throughout the entire process of e-learning course development (Joung and Jang, 2004). KNOU has been controlling quality from the e-learning course development stage through to the instructional system design stage. This needs to be extended to include results from the evaluation stage to check whether the feedback has helped to improve the quality of subsequent courses.

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ICT for blended learning

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Introduction

Institutional context

This report focuses on blended learning within the Queensland University of Technology (QUT) which is one of Australia's largest public universities. Although the university in its current format was established in 1989, it contains several previous institutions that can be traced to the earliest forms of technical and teacher education in Queensland in the 19th century (Kyle et al., 1999). The focal point of the report is the experience of QUT's Faculty of Education which was formed from the amalgamation of several teacher training colleges servicing pre-school and kindergarten, primary and secondary teacher education. While the broader university currently employs approximately 4,000 staff and has about 40,000 students, QUT's Faculty of Education employs around 170 staff and has approximately 5,000 enrolled students. The Faculty of Education at QUT is the largest provider of pre-service teacher education in Australia and is one of the largest producers of educational research. A major theme of the Faculty of Education is its focus on education and research that provides teachers, schools and educational authorities with practical solutions to the multifaceted issues facing contemporary education.

Throughout the 1990s a combination of factors combined to force institutions of higher education to explore the unfolding opportunities that information and communication technology (ICT) offered in terms of both enhancing pedagogy while at the same time changing the manner in which administrators and academics engaged with multiple student cohorts. This shift has been profound, yet at times problematic. The Faculty of Education at QUT is not unique in that it has been forced to grapple with multiple pressures of operating within a market environment that demands increasing flexibility. This is particularly evident when one examines the migration of existing and historically entrenched modes of teaching and learning to commercially sustainable interactive learning environments that more take the form of Learning Management Systems (LMS). The technical and associated policy implications associated with this move have been complex and have at times clashed with the need for a parallel shift in the skills and mindsets of some teaching staff who have struggled with the growing expectation that new and emerging forms of blended learning are now part of the core business of teaching and learning within the academy.

During the past decade a number of interrelated terms have been used within QUT in its attempt to embrace the changes that new technologies have made to the teaching and learning experience. An

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internal 2009 discussion paper on blended learning developed by the Faculty of Education's Assistant Dean (Teaching & Learning) Associate Professor Nanette Bahr, suggested that a number of frequent descriptions used in the past only partly captures the true nature and pedagogy encapsulated within the notion of blended learning. *Flexible learning* for example, while popular during the early 2000s depicts teaching and learning environments where there is a "discretionary use of learning technologies and other more traditional pedagogies" (Bahr, 2009, p.1). Bahr argues that flexible learning embraces notions of elastic non-prescribed pathways where students are able to engage with resources and teaching activities on their own terms and in a manner and time they feel are appropriate. While clearly of value in postgraduate teaching and learning scenarios where autonomy and self-directed learning are both desirable and encouraged, such a high degree of flexibility is not necessarily appropriate in first year undergraduate courses. This is particularly the case in pre-service teacher education where there are mandated requirements that institutions and graduating students conform to a highly regulated and closely monitored accreditation process linked to sets of professional standards and attributes that all pre-service teachers require before they are able to teach independently in classrooms.

The notion of *flexible delivery* has been another popular descriptor linked to notions of autonomy and self-direction on the part of the student and in particular 'flexibility' connected to how content is delivered. In a similar fashion to the term flexible learning, Bahr (2009) maintains that the notion of flexible delivery is also limited with the contemporary context of QUT in that it is confined to aspects of delivery and logistics. While appropriate to describe a distinction between on-campus face-to-face and off-campus or external aspects of teaching and learning, the term flexible delivery fails to incorporate the breath and complexity of the contemporary university teaching and learning environment. Similarly, Bahr dismisses the notion of hybrid teaching and learning which was also popular in the first half of this decade (see for example Aycock et al., 2002; Carroll, 2003; Reasons et al., 2005). Bahr suggests the notion of *hybrid* teaching and learning is limited to a simplistic distinction between either face-to-face or web-based environments and therefore fails to incorporate more holistic notions where combinations of both formats are interwoven with the vast array of emerging technological tools and systems on which contemporary higher education pedagogy is based.

While the terms flexible learning, flexible delivery and hybrid teaching and learning in part describe a contemporary blended learning environment, each is limited in that they are heavily rooted to what Graham (2006, p. 5) describes as "two historically separate models of teaching and learning: traditional face-to-face learning systems and distributed learning systems". Blended learning, however, goes beyond any simplistic dichotomy. It is an extremely 'slippery' term that incorporates an extensive range of modes, approaches and integrated forms of technology woven together across multiple teaching and learning systems. An accurate description of blended learning must therefore encapsulate a proper and contextualized understanding of how technologies add to and enhance teaching and learning across a range of flexible course and unit/subject design with an overarching purpose of facilitating student engagement and by association student learning outcomes. In the light of these overarching parameters, this report has adopted Bliuc et al's (2007, p. 234) succinct definition of blended learning as "learning activities that involve a systematic combination of co-present (face-to-face) interactions and technologically-mediated interactions between students, teachers and learning resources".

Historical context of blended learning within QUT's Faculty of Education

While there is a history of Australian federal policy aimed at reforming the higher education sector, individual institutions have for the most part been left relatively free to work within policy frameworks that form broad guidelines. This is clearly the case for blended learning where institutions have embarked on markedly different paths in terms of integrating technology both at a systems and pedagogical level. The historical framework to the Faculty of Education's engagement can be traced to 1987, where the Queensland Department of Education began using electronic mail and computer conferencing software that utilized Australia's national telecommunication company Telecom's Keylink service. At the same time, the notion of online curriculum began to gain interest particularly under the Oz-Projects banner. This development motivated a small group of QUT academics teaching within computer education strand of the Graduate Diploma in Teaching course to begin using the Keylink service. By the early 1990s, the Faculty of Education had moved to a UNIX system and had initiated a project called Open Web Lecture (OWL) that was moved in the late 1990s to a dedicated faculty server and renamed Online Unit Management System (OLUMS). The vastly improved OLUMS system was then opened for general 'online teaching' across the faculty and represents the faculty's first foray into technologically enhanced blended learning. OLUMS provided a web-based system of structured templates that permitted staff to add resources such as lecture notes and PowerPoint slides, generate chat-rooms and manage relatively intricate email discussion lists (streamed audio and video recordings of lectures were later added). It must be stressed that within the context of the 1990s, the skill levels – more precisely the techno-literacy levels – of many staff constrained any faculty-wide engagement with what constituted a basic LMS. Furthermore, despite this system being relatively advanced for its time and receiving almost universal acclaim and positive evaluations from those dedicated staff and students using the system, OLUMS was never truly embraced by the majority of mainstream academics teaching within the Faculty.

Due to the fact that several faculties across QUT had by this time also developed their own online-teaching systems, the university in 1998 established its first policy on flexible delivery. In 2000, the university attempted to combine the three main operating systems into a single in-house LMS. The project was led by QUT's Teaching and Learning Support Services (TALSS) and used several existing systems such as OLUMS to rewrite code so that key in-house university online services could also be interwoven into a single LMS. This new LMS came to be known by the simple acronym OLT (Online Learning and Teaching) and constituted the first university-wide attempt at systems, policy and pedagogical levels to address blended learning across all faculties. As each semester passed, new features were added into an increasingly sophisticated interface. Nonetheless, OLT was always a 'work-in-progress' and it was inevitably compared and contrasted to other emerging LMS such as WebTV, Blackboard and Moodle.

From the initial conception of OLT and the intention of it providing a university-wide platform for blended learning, there was a parallel project underway to produce systemic forms of policy targeting the emerging field of what was termed online-teaching and learning or flexible delivery. In 2000/2001, the university's Teaching and Learning Committee mandated a three-tiered matrix whereby teaching and learning content could be mapped in terms of its compliance with this emerging LMS format. This was achieved relatively simplistically via the notion of a pyramid which graphically represented where particular units/courses were situated in terms of their engagement/compliance, while at the same time presenting staff with a conceptual roadmap to show how they could incrementally migrate their teaching and teaching resources

into the new LMS. By 2001, the university had developed a policy that used the pyramid to articulate (1) achievable levels of service, (2) desirable outcomes for students, and (3) appropriate staff development (Burnett, 2001).

While the pyramid model is no longer in place and is clearly dated in its applicability to contemporary blended learning contexts, it is still useful as a source of analysis into how educational institutions have structured systemic policy that targets a move from traditional face-to-face contexts into a more blended learning environment. The following section of the report briefly describes the three tiers contained within the original pyramid structure. At the time all units (often called courses or semester-long subjects within different institutions/universities) were required to reach a minimum level of access by a prescribed date. This was represented by the bottom tier labelled 'Band A' which mandated a basic level of compliance in the form of:

- a web-based link to the 'unit outline' which was basically an overall summary of the unit containing learning objectives, approaches to teaching and learning, assessment, reading lists, etc.
- timetable information related to the unit listing lecture times, tutorial schedules, etc.
- a link to the university's automated class allocation system where students could arrange their timetables and select classes based on availability of spaces.
- contact information related to e-mail and phone access for the coordinating lecturer and associated tutors.

The next tier – Band B – presented an expanded range of options for online resources. Importantly during this introductory period of blended learning, the university did not have a single preferred structure or interface for its online teaching material due mostly to the fact that new technologies were developing so quickly. In addition, the notion of online teaching and learning while encapsulating elements of notions of blended learning outlined earlier, was for the most part interpreted broadly as an avenue to expand opportunities for innovative mechanisms that basically supplemented the oral lecture or the traditional face-to-face tutorial (Burnett, 2001). In hindsight, it is clear that despite the rapid progress made by small groups of highly motivated and skilled staff, a core problem at this time was one of disseminating knowledge and skills about the transition and possibly more importantly, encouraging staff who lacked the requisite knowledge, skills and motivation to engage with the emerging online teaching and learning interface. Hence it is possible to argue there were indeed great benefits gained from the mandating of not only a minimum online presence across the university, but also a set date for this to occur. The university did not attempt to shut down pockets of innovation that went well beyond the minimum levels and despite quality assurance risks, actively encouraged staff to experiment within Band B. This process generated a range of innovative pedagogy in the form of:

- progressive types of alternative assessment.
- exploration of both moderated and un-moderated discussion forums/groups.
- access to assignment/exam exemplars/examples.
- improved PowerPoint lecture slides notes.
- streaming of lecture audio and later video.
- better integration of library, especially digital, recourses.
- attempts to merge multiple student cohorts (i.e. internal, external, distance, and Internet-based) into a single learning community.

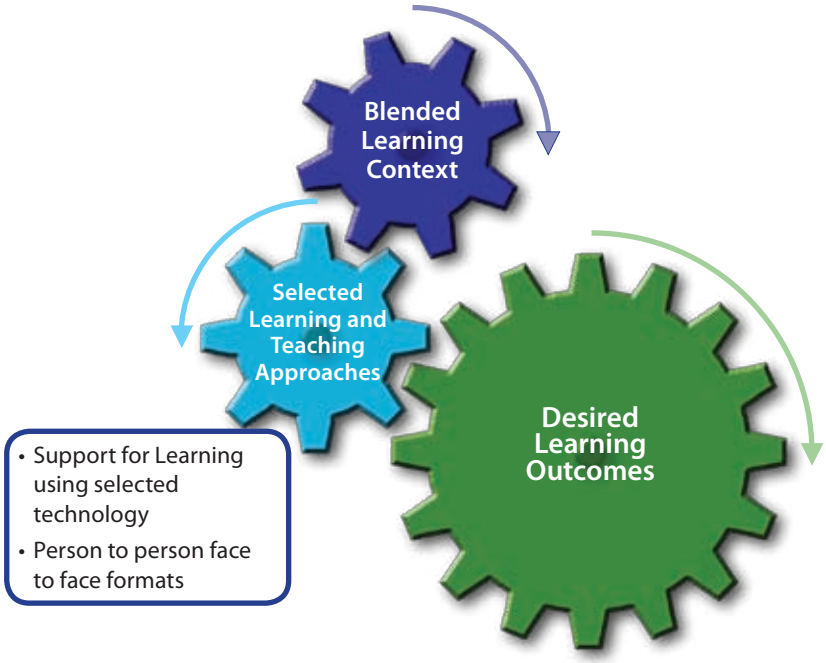
The final level Band C, the top tier of the pyramid, was seen to represent courses and units where the online environment was relied upon extensively. Here it was envisaged that interactive learning and online assessment tasks would replace traditional face-to-face teaching and learning. Few units or courses ever reached this top tier and there was never any policy directive from the university that mandated a system-wide progression to this position.

From 2001 to 2006, the university continued with the development of OLT, while at the same time examined the possibility of moving to a commercial platform such as Web Course Tools, Blackboard Learning Systems or open source options such as Moodle. There were many factors considered in a review process that evaluated the various options/systems and weighed these up against the fact that by 2005/2006, the in-house OLT system had been developed in such a manner that it was linked to other online systems within the institution, including enrolments and student evaluations. While OLT also had several features that were not yet available in the commercial format, over a relative short period it became clear that the cost of maintaining and continuing to add features/tools to the in-house LMS would continue to rise while the cost of commercial licensing agreements would fall. Thus, it was inevitable that at some point a recommendation would be made on economic grounds for the integration of a new commercial LMS into the university IT structure. By 2006 as more universities moved to commercial LMS, QUT finally decided to adopt Blackboard, and a new process began to migrate all online teaching and learning contents across to the new platform. This was achieved in a staged faculty-by-faculty migration over several semesters with QUT Blackboard remaining the current default interface/conduit in 2010 through which the majority of blended learning occurs within the university.

Blended learning in 2010

In 2009, the Faculty of Education's Assistant Dean Professor Bahr produced a discussion paper focusing on blended learning within the university which set out a number of broad learning design considerations (Bahr, 2009). She stressed the link between utilizing new technologies in a fashion that promotes desired learning outcomes and the need for this process to include, where appropriate, the integration of traditional real time face-to-face contexts. In other words, while there may be cases where courses can be taught entirely online, Bahr's argument cautions against any headlong rush to embrace and employ new technologies within an overarching strategy that excludes traditional pedagogies from the course progression of students. Such pedagogies have a long and tested tradition and are the result of an enormous amount of educational research into effective teaching and learning. Bahr sets out several key parameters that should determine the extent and format to which blended learning course designs draw upon available resources, tools and systems. These include factors that motivate and "links student learning to the real world, and where relevant takes the opportunity to build our graduates into highly capable technologically literate professionals" (Bahr, 2009, p. 1). Her model (Figure 1) emphasizes that the key determinate of desired learning outcomes is central to a process that intermeshes with an array of potential learning and teaching methodologies and ultimately determines the mix of modes of delivery, technologies and tools. It is only within the final stage where blended learning is achieved.

Figure 1: Process of learning and teaching methodologies

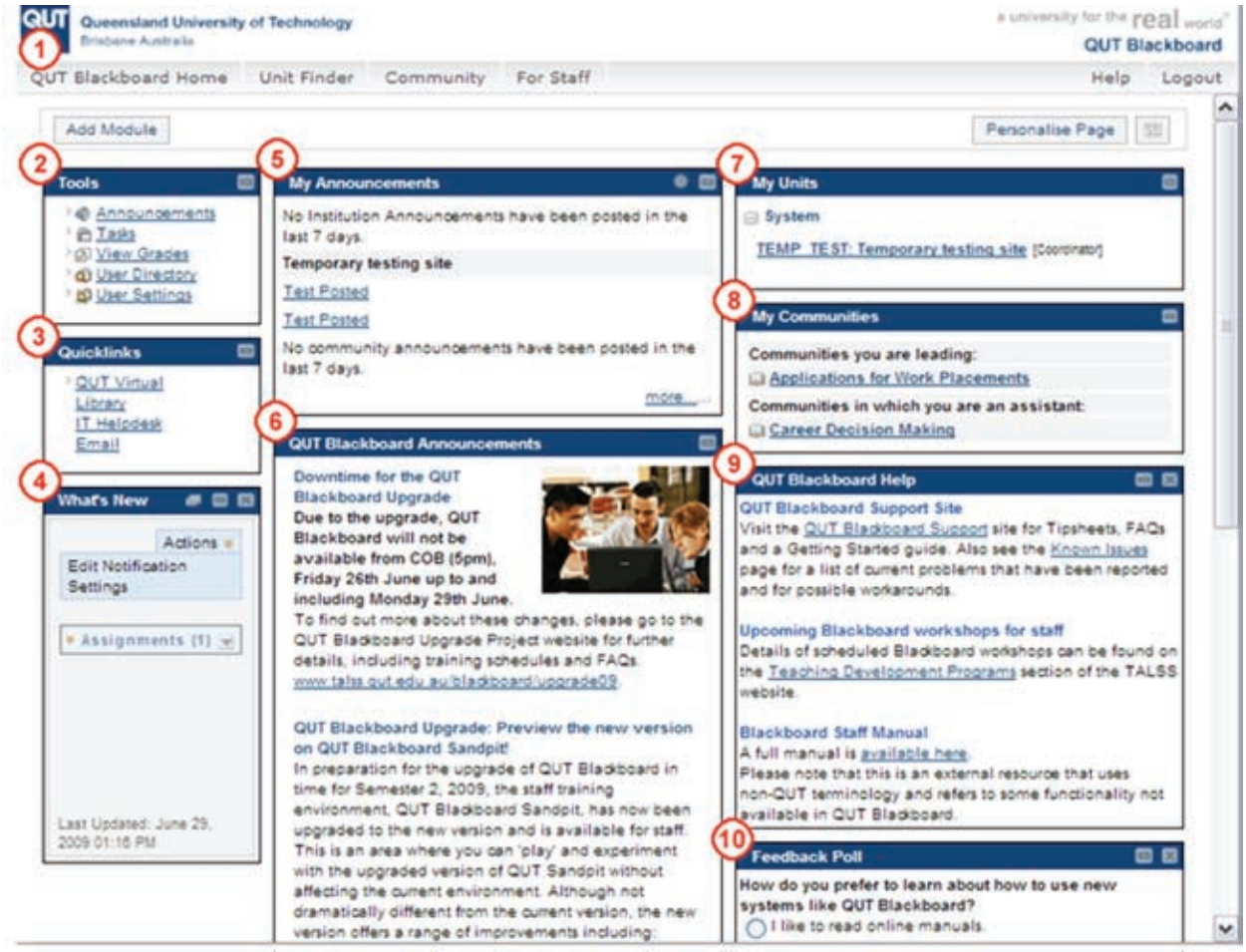


Currently all units are hosted in some form on the central university LMS (QUT Blackboard). QUT Blackboard is not only where teaching and learning material is uploaded and a range of assessment and collaboration tools engaged, it is importantly the primary conduit that serves as the students' first point of access to their teaching and learning material. Nonetheless, blended learning within the contemporary context is something that extends well beyond a single conduit in the form of the LMS for this serves predominately as an interface that mediates management and delivery of content. The following section unpacks a single blended learning site with this LMS to provide tangible examples of types of the pedagogical, structural and aesthetic considerations required during planning and implementation.

Examples of blended learning in practice

The default portal through which almost all units operate within the Faculty of Education is QUT Blackboard. When staff log in, they are presented with a standardized portal which allows access to individual unit sites, a range of support material and university community sites as well as notifications of changes and announcements. Figure 2 shows a generic example of the QUT Blackboard portal/homepage, http://www.talss.qut.edu.au/blackboard/staff/gettingstarted.jsp.

Figure 2: Example of QUT Blackboard portal/homepage



The key components in the portal are:

1. Navigation bar to search and find unit or community sites.
2. Menu of student tools and user settings.
3. Quick links to other QUT online tools.
4. Notifications of new changes that have been made to unit sites.
5. Announcements from the unit or community sites of which the user is a member.
6. Announcements relevant to QUT Blackboard users.
7. List of links to the unit sites for lecturers/professors.
8. List of the community sites for members.
9. QUT Blackboard help links to assist users in developing their unit sites.
10. Feedback poll to seek comments and suggestions.

Staff members in charge of units are termed the Unit Coordinator and are given distinct administrative privileges so they are able to access the key functions of the LMS such as adding content, communicating

with students, managing evaluation, manipulating the various tools, and more generally customizing the blended learning environment to suit a particular set of learning objectives associated with the subject matter or discipline. Importantly, there is university policy in place regarding standard navigation settings of all QUT Blackboard sites and there has been a strong push within the Faculty of Education for each site to retain a consistent feel and standardized navigation structures as much as possible.

Background to the unit's content

The site used as an example in this section is based around the unit EDB003: Teaching and Learning Studies 3: Practising Education. The Bachelor of Education degree is structured around a four-year programme where students complete two semesters per year. Generally one unit each semester is a core/compulsory education unit that focuses on a key aspect of education relevant across the year levels. The EDB003 unit is one such foundation or core subject that all undergraduate students completing their Bachelor of Education degree must complete. Core units are compulsory units and therefore students are drawn from across all of the various strands of the degree that includes Early Childhood, Primary (elementary) and Secondary (high-school) pre-service teachers.

In the case of EDB003: Teaching and Learning Studies 3, the majority of students complete this unit in the third year of their course with the subject matter focusing fundamentally on the importance of sociology as a means of understanding education as both a social and cultural activity. This unit offers a sociological and cultural studies framework that attempts to provide an insightful explanation of how education within its various sites is both constructed and organized. This unit is positioned in the Bachelor of Education degree within the third year for students to add to earlier units where a socio-cultural perspective was introduced. It also allows students to examine a body of sociological theory which they can link back to school settings such as those they encounter while on their practicum (i.e. field studies/practice teaching in other institutional contexts). The EDB003 site has been designed to generate a pedagogical forum with the key goals of facilitating and enhancing students' understandings of the following:

- How broad cultural practices are embedded in education.
- How the social forces that shape our world also impact on education.
- How cultural and social theories provide insights on how the student as a future teacher can and do make a real difference.

Pedagogical considerations and impact on learning outcomes

An important aspect in designing this blended learning site is to facilitate key learning outcomes and to allow students to demonstrate these outcomes through their understanding of the historical, cultural and social nature of knowledge and how knowledge is both created and derived from a variety of sources. Another key learning outcome has been for students to develop a series of strategies that would enable them to work within legal and ethical frameworks in ways that promote and celebrate diversity, equity and inclusivity while at the same time using strategies that promote such structures in practical learning experiences. In addition, it has been essential for the site to promote the conditions for students to identify and establish strategies that facilitate consultative, collaborative and critical relationships across diverse learning environments, communities and cultures. Finally, students need to demonstrate that they are able

to accept responsibility for their own professional learning and career management, whilst at the same time show acceptable standards of communication and professional responsibility. In short, this site is far more complex than one which provides a simple transference of content or online-delivery (Burnett, 2001). EDB003 engages students in a process of pedagogical reflection that enables them to overtly identify how socio-cultural theory is manifest in real-life teaching situations, and demonstrate set learning outcomes in a manner that promotes a safe and supportive learning environment and is reflective of the students' needs.

Design considerations and impact on learning outcomes

As mentioned earlier, blended learning sites within QUT were historically interpreted as falling into three basic categories, and while this framework is no longer used, it is nonetheless still useful as a conceptual matrix. The first of these categories were sites that used a minimalist approach to provide students with access to basic content about the unit/subject. For the most part it consisted of text, images and the default PowerPoint files used in lectures. A second category of sites expanded on this basic platform to include a number of 'tools' that in various ways used the LMS to enhance the teaching and learning exchange and began to engage students in uncomplicated forms of blended learning. Here, sites added to material included in the first category with the addition of video, audio and additional content both in electronic and printed forms. While the sites in the final category were at times described as totally 'online', it is better to conceptualize such sites as providing both face-to-face and off-campus students with an equivalent teaching and learning experience.

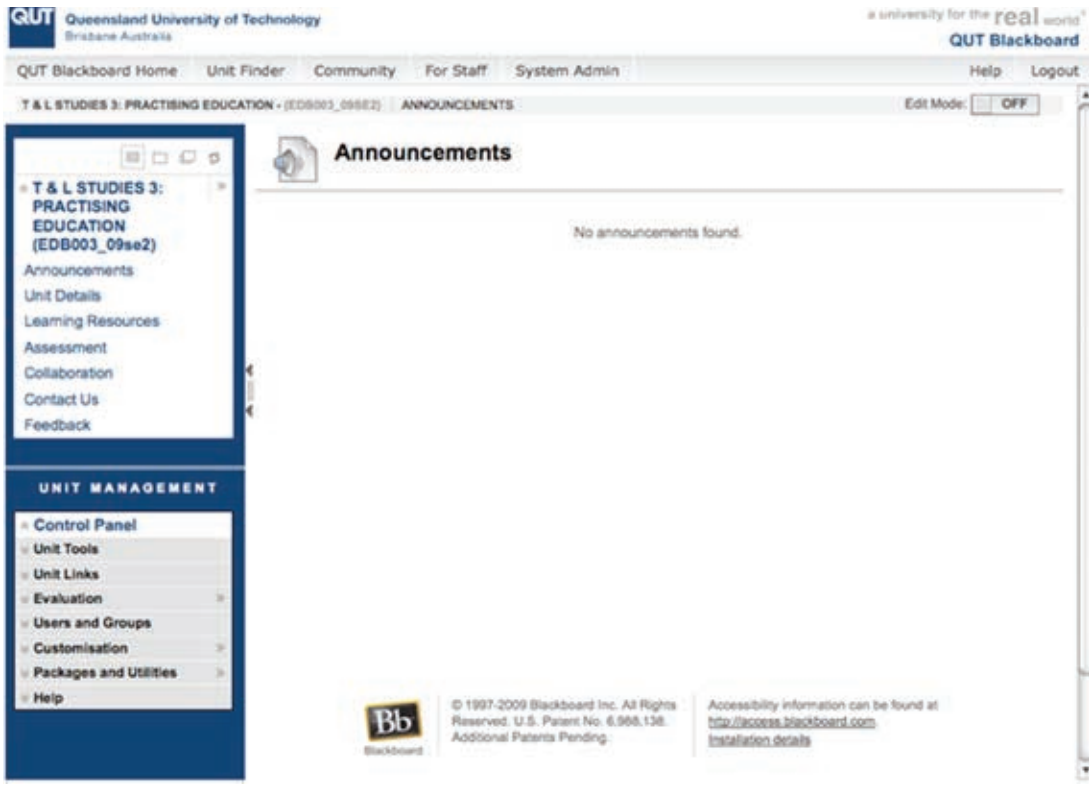
While this is never truly possible, the EDB003 site attempts to mirror the third category due primarily to the fact that there are several distinct cohorts of students enrolled and thus the unit requires a blended learning approach that is responsive to the diversity of students' current knowledge, experience and location. The key issue of 'location' is critical because the course is taught across two separate campuses (Kelvin Grove Campus located in Brisbane and the Caboolture Campus located north of Brisbane). In addition, students can enrol in either a face-to-face format with traditional lectures and tutorials or in a purely online version with Internet mode students enrolling from across Australia as well as internationally. During a recent semester the enrolment breakdown consisted of 629 students face-to-face at the main Kelvin Grove campus, 110 students via Internet and 30 students at the Caboolture campus. The large size of this cohort requires that lectures be presented up to three separate times with video and audio of one of the lectures being made available online (this can be accessed by all cohorts). It is also common for over 25 tutorials to be offered with the addition of Caboolture and online-based tutorials. Thus, it is necessary for a combination of lectures, tutorials, audio/visual resources and online activities to service distinct physical locations while at the same time present a multimodal interface where students from various locations and modes of enrolment have similar/equitable assess to content and weekly assigned tasks. The following section unpacks several of the major design considerations that have sought to link pedagogy, technology and learner needs (Kim and Bonk, 2006) while at the same time addressing the challenges of quality (Ruth et al., 2007).

In 2007/2008, the Faculty of Education formed a LMS Working Group and discussed the issue of a standardized template for all QUT Blackboard sites. A key aspect of this template was a set of guidelines for using the left-hand navigation menu items and also guidelines for use of "selected Collaboration Tools as a means to promote structured engagement with the conceptual work of the unit" (Faculty of Education LMS Working Group, 2007). Given this policy, there has been a need to comply and work within a number of

set parameters when designing the EDB003 site. First, was a directive that the navigational structure of the site needed to consist of a standard left-hand navigational menu with a central space where content was displayed as well as a breadcrumb navigational trail displayed at the top of the screen. Importantly, there is a clear directive that detailed information concerning the unit should appear in only one place on the site. The menu options and explanation of each is now provided along with a graphic of the EDB003 homepage.

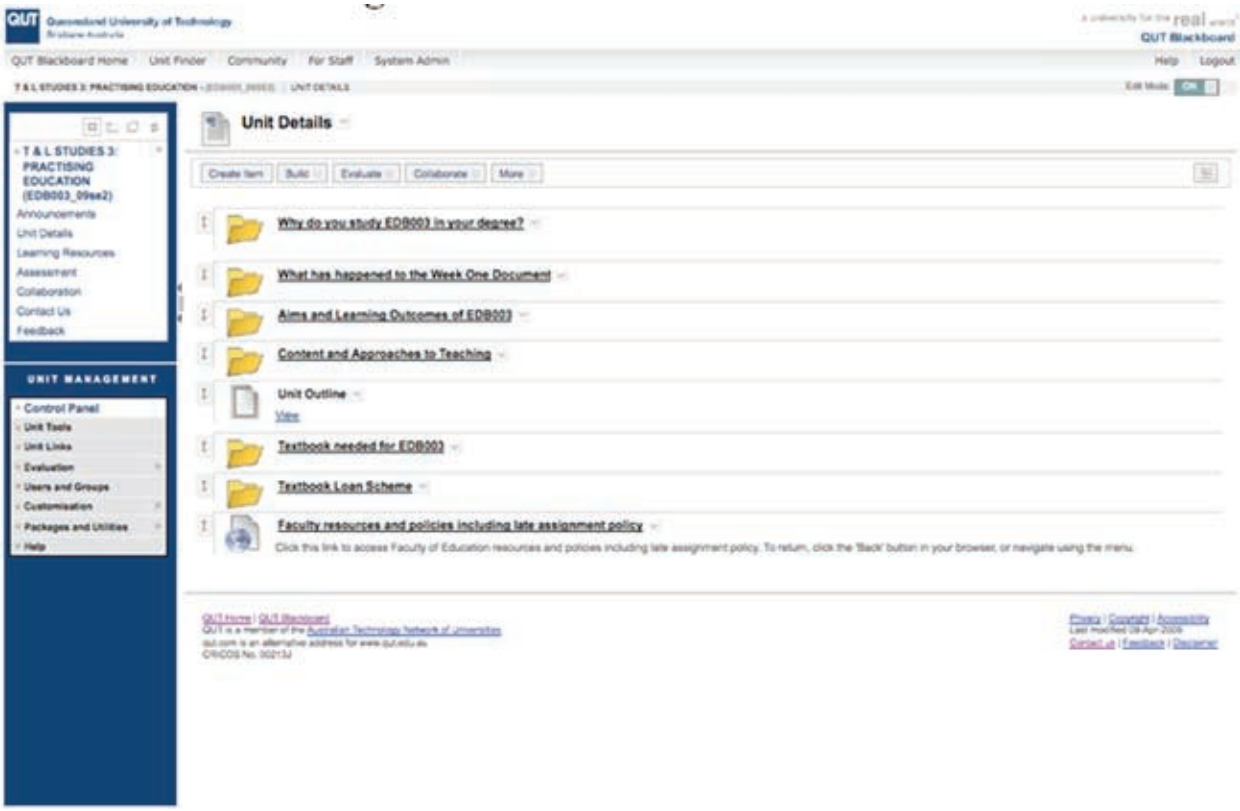
- ***Announcements:*** This component of Blackboard is commonly used to post general welcome messages at the start of each semester as well as a range of information related to enrolling in tutorials, commencement dates, times of lectures and due dates of assessment. The announcement section is the default section viewed every time students access the site. Students can opt to be notified by email every time a change is made to this section while the academic in charge of the site can check a box that enables all new messages to be automatically emailed to every student enrolled in the unit. Feedback from students indicates that there is a tendency in some blended learning sites for this announcement section to become cluttered and confusing as too much information is posted in a non-structured way (see for example Pfaffman et al., 2009). For this reason, this section of the EDB003 site is kept as orderly as possible with the number of messages kept to a minimum and previous messages deleted as soon as they are no longer required (Figure 3 – actual announcements have been removed).

Figure 3: EDB003 homepage



- ***Unit details:*** While clearly the overall aim of this webpage is to provide information about the unit, e.g. introduction to content, the importance of the content within the context of the students' studies is also linked to the aims and learning outcomes of the unit along with approaches to teaching (Figure 4). This section contains a default link to the recognized authoritative source of information about the unit (i.e. Unit Outline housed in a separate central university system). Feedback from students and data such as the number of times students visit this section indicate that information such as timetables, unit protocols, textbooks, etc. are predominately accessed at the start of the semester with many students not revisiting the section after the initial inspection. Within the EDB003 site, there has been an overt attempt to contextualize and locate the unit within the overall trajectory of the students' course progression, as it is critical for students to understand why they are studying particular content at this particular time. There was also a decision to provide links to equity initiatives such as the Textbook Loan Scheme and various faculty-based resources and policies.

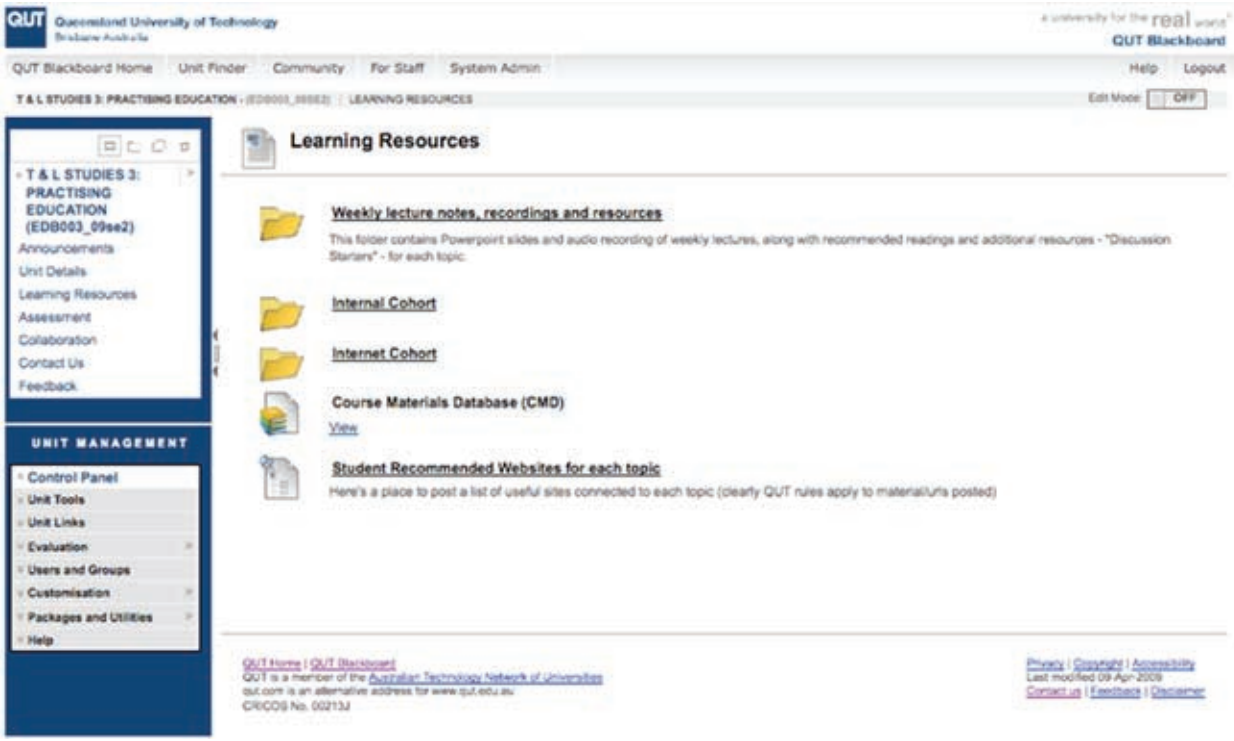
Figure 4: Unit details of EDB003



- ***Learning resources:*** This section (Figure 5) is clearly the most used/visited component of the site with the majority of students accessing information weekly. In general, it contains lecture schedules, lecture and tutorial topics, reading lists, student recommended resources and a link to the Course Materials Database (CMD), which targets copyrighted readings (the CMD is described in more detail later in this section). While the aim of the LMS working template is for all sites to retain a similar feel, it would appear that there is considerable diversity in how lecturers customize this segment of the LMS. It is evident from student feedback that students rely on this component to access lecture notes/ slides prior to the lecture being given and to explore the lecture topic in more depth using a range

of related content and links. Given the central role this segment plays, considerable thought and resourcing have gone into reviewing various components of the EDB003 learning resources.

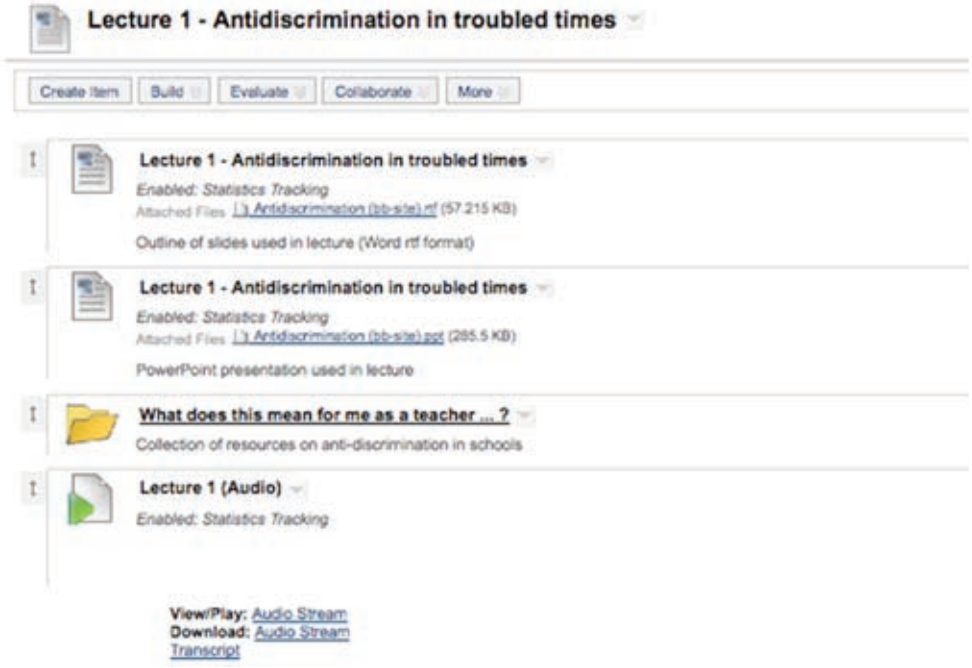
Figure 5: Learning resources of EDB003



Over the past few years, two distinct areas have been targeted for review in the learning resources of the EDB003 site. First has been an attempt to structure the site in terms of the aesthetics/navigation relationship and how to build in visual aids to enhance navigation across the various lecture themes/topics. Second has been how best to weave lecture content across tutorial activities and discussion starters that can be accessed equitably by both on-campus and Internet-based students. Audio of each lecture is recorded and provided in both streamed and downloadable formats. The newly released podcasting function of Blackboard has also been adopted and allows students to subscribe to podcast lecture feeds (i.e. the automated downloading of the most recent lecture audio) and have this available while undertaking the online activities. While not every lecture is videoed, all video files have been retained for future conversion into Vodcasts. The following graphics demonstrate how the lecture dealing with the controversial topic of antidiscrimination contains an evocative image linked to the theme (Figure 6) and an expanded view of what the student sees after opening the link (Figure 7).

Figure 6: Images from lecture on antidiscrimination

Figure 7: Details of lectures on antidiscrimination



The two figures show the overt attempt to link the topic/content within an overarching digital metaphor. This metaphor not only provides a powerful link that situates the topic, but also provides context as the topic is unpacked in more depth with a series of discussion starters and activities that are structured around the notion of Work Integrated Learning. The segment 'What does this mean for me as a teacher?' contains individual and group tutorial activities as well as field-based scenarios that link the topic to the student's field experience.

- ***Collaboration:*** This section provides links to many associated communication functions of Blackboard which include a sophisticated and ever increasing range of tools, not all of which are used in the current EDB003 site. For example, the *Chat Collaboration Tool* was trialled in EDB003 to allow Internet-based students to engage in text-based conversations in real time. While novel at the time, the pedagogical significance of this function, particularly given the large numbers of students enrolled in the unit, was questionable. In short, while using the chat function in past semesters, it has proved extremely difficult to structure any real discussion that engaged the lecture topic. Different typing speeds along with an unwillingness of some students to participate resulted in a fragmented and disjointed discussion. While clearly having benefits in small tutorial groups, a decision was made to discontinue the chat tool. Interestingly, the basic chat originally used in EDB003 has now been replaced with the ***Virtual Classroom,*** which is an expanded version of the chat application. The Virtual Classroom provides not only the standard text-based chat, but also additional features in the form of a communal whiteboard and group browser. The introduction in 2009 of *Elluminate* live has generated a great deal of discussion within the faculty as this application is a genuine attempt to bridge the gap between synchronous and asynchronous learning by allowing lecturers to schedule and deliver a number of recordings through the Blackboard site. Currently these features include voice over the Internet, video, shared whiteboards, instant messaging, breakout rooms, application sharing and PowerPoint. There were plans to integrate Elluminate live into the EDB003 site in 2010.

  The *Discussion Board* application has, however, been successfully used for several years within the EDB003 site predominately by Internet-based students to facilitate structured dialogue for each lecture topic. Importantly, it has been found to be critical in kick-starting discussion threads (particularly early in the semester) and to respond to posts as quickly as possible. While useful for Internet-based students, discussion forums in general have the potential to duplicate the dialogue from face-to-face tutorials and appear to be relatively unpopular with on-campus students. One of the most popular applications for students in the EDB003 site has been the *Wiki*, which has proved extremely useful in terms of group-based assessment tasks. The ability to set up a wiki for designated students working on a project or assessment task allows these students to add, remove and edit content, and is proving very successful in EDB003 as an efficient and pedagogically sound mechanism to enhance collaborative authoring.

- ***Assessment:*** Assessment within EDB003 is both formative and summative with the formative components provided through feedback, discussion and reflection either during tutorials and lectures, via online discussions or through written comments on initial assignment work. In general the QUT Blackboard Assessment space has been used mostly to provide students with a rationale for the types of assessment tasks and due dates which are linked to folders that contain information and an expanded outline of the actual assessment requirements. University policy dictates the use of Criterion Referenced assessment and thus there is also the need to provide copies of the Criterion Reference sheets used during grading. The EDB003 site includes crucial information about academic honesty

and provides a link to the QUT Academic Integrity Kit (an online Blackboard-hosted tutorial which all students are encouraged to undertake, usually in their first year of study). The usefulness of the Academic Integrity Kit has been found to be particularly powerful in addressing the issue of plagiarism. However, given that academic plagiarism constitutes only a part of an overarching notion of *academic integrity*, this online tutorial also addresses:

- what constitutes academic integrity.
- strategies to help students act with integrity while studying and in the workforce.
- the overall benefits of acting with integrity.
- QUT's policies on academic integrity.

Another link provided via the assessment section is to the QUT *Assignment Minder* service (*http://www.am.qut.edu.au/*). Assignment Minder constitutes a blended electronic and hardcopy assignment submission and collection service that has been developed by the university to provide security for student's assessment work while at the same time offering a streamlined collection and distribution procedure that benefit both staff and students. The service requires all assessment items to be submitted with an assignment submission form which the student completes online and where a barcode linking the item to the student is generated. The student then prints the form and submits it along with the assignment at any campus. The service has proven popular with both students and academic and professional staff for the following reasons:

- Students obtain a receipt of their submission thus gaining security in the case where assessment pieces are lost, and with central points of submission and extended opening hours, students save time and confusion looking for lecturer's offices or mailboxes when submitting assignments.
- Academic staff also benefit with batches of assignments delivered to the lecturer's mailbox along with a detailed list that documents the date and time of each student's submission.
- Professional staff benefit in that a considerable workload commitment is removed from the local administrative settings.

Within the assessment section is also a link that targets the correct forms of referencing and citation. This takes the form of an online tutorial housed within the overall *QUT Cite/Write* portal (*http://www.citewrite.qut.edu.au/*). This tutorial focuses on a recommended American Psychological Association (APA) style guide and introduces students to the standards developed and preserved by the APA and *published in their Publication Manual of the American Psychological Association* 5th ed. (2001). The Cite/Write site constitutes an online resource targeting the academic genre of writing while also targeting more generic academic skills such as note-taking strategies, the writing of reports and the structure formation of annotated bibliographies.

Finally, there is the QUT Blackboard *SafeAssign* which consists of a text-matching tool that recognizes potential cases of both plagiarism and imprecise citation. During 2009, SafeAssign underwent an extended pilot programme with the Faculty of Education to be used broadly across the faculty. It is important to note that unlike commercial 'originality checking and plagiarism prevention services' such as *turnitin* (*http://turnitin.com/static/index.html*), the QUT SafeAssign tool does not serve as a portal for the formal submission of student assessment. The purpose of the QUT SafeAssign is purely directed at educating and guiding students and its use is voluntary.

Other aspects of the blended learning environment

While the centrality of the LMS as a mediator of blended learning is clearly evident, blended learning within the QUT context cannot be adequately isolated solely within the conceptual framework of the single LMS QUT Blackboard. Rather, blended learning constitutes a combination of traditional lectures and tutorials complemented via a range of electronic services that are often, but not entirely accessed via the conduit of the LMS. For example, QUT's main personal web portal called *QUT Virtual* (*http://qutvirtual.qut.edu.au*) provides a central channel for many of the university's online services (only some of which relate to teaching and learning). Staff, for example, depending on their levels of approved access, can search for student or staff details, and subscribe to a range of teaching and learning related or general interest email groups. Staff can also access specific teaching data such as allocation of students to lecture rooms and tutorials. While QUT Virtual provides some access to blended learning functions, it is also the major gateway to many administrative functions such as payroll information, online parking applications and corporate business reports and data.

Blended learning also clearly overlaps with a range of information related services such as the *QUT Library* (*http://www.library.qut.edu.au*) which currently provides access to an extensive traditional repository of over 600,000 books as well as providing a range of multimedia and free student access to over 500 commercial databases, 64,000 full text e-journals, 15,000 e-books and a range of Internet resources. In 2000, the university negotiated a new licensing agreement with Copyright Agency Limited "that set a rate for the university to digitize 'reasonable portions' of printed copyright materials and make them online to students" (QUT, 2003, p. 14). This material is housed is in the CMD and has over the past ten years developed into a central component of the blended learning environment in that the majority of units use this portal to provide students access to electronic copies of book chapters, journal articles and other recommended readings. This is achieved by the lecturer notifying the CMD and requesting that certain materials be made available online via that lecturer's QUT Blackboard site. Importantly, CMD staff negotiate all copyright issues and it is possible for students to obtain access to, for example, electronic versions of book chapters and journal articles in full compliance with international copyright legislation and contracts. Housed with the QUT Library is the relatively new Digital Repository (*http://www.digitalreporsitory.qut.edu.au*) which comprises a collection of digitized research and collections that are freely available online to make the work of QUT staff accessible to researchers and the general public. Currently this Digital Repository includes: QUT ePrints & QUT Thesis (*http://eprints.qut.edu.au*) which are institutional repositories of books, journal, articles and theses produced by staff and postgraduate students. All material is available free of charge to provide open access and ensure broader dissemination and impact of the research of QUT staff while at the same time promoting the institution worldwide.

Policy implications: facilitating projects targeting staff engagement

One of the major issues with the transition from traditional face-to-face teaching and learning to a blended learning environment has been the necessity to engage the full spectrum of teaching staff with new system-wide changes. While centralized workshops and training models have been offered at the

institutional/university level, these services have historically been poorly attended. One of the most forceful recommendations stemming from this report are the benefits obtained when the Faculty of Education has overtly engaged and supported staff at the local level. During the late 1990s until 2008, these activities centred around the:

- Faculty Systems Group consisting of up to four IT specialists in dedicated non-teaching positions who provided technical support and advice for academics; and
- School Online Teaching Advisers (SOTAs) who acted as informal peer-level advisers.

While the Faculty Systems Group has subsequently been restructured into the university Technology, Information and Learning Support Services, the SOTA model is still in use within the faculty. It can be distinguished from centralized models in that it is much more localized and situated within each of the four schools which are contained within the Faculty of Education. It is important to stress the benefits that the SOTA model accrues due to the fact it functions relatively informally within the specific culture and set of disciplines contained within each school. SOTAs are academic staff who are technologically proficient and/or have a particular interest in blended learning. The role is voluntary with SOTAs receiving a small amount of funding that allows them to reduce their teaching load.

In general, the SOTA model has been extremely well received and can be recommended to other institutions because it is peer-based and located within the informal structure and geographical setting of the school. Since its inception in 2000, SOTAs have been responsible for organizing and running numerous workshops that target a specific aspect or requirement of the evolving blended learning environment. It is important to note that unlike the centrally provided professional development workshops and seminars, professional development provided at the local school level has resulted in better attendance. SOTAs also provide input for policy as each serves on the Faculty's Information and Communication Technology Policy Committee. The SOTA model has proven extremely effective in providing a variety of support roles and in general being allowed to establish and play-out roles that include helper, consultant and problem solver, experimenter, reporter, modellers, critical thinker, advocates and policy makers (for more details on this model see Hanrahan et al., 2000; Ryan, et al., 2000).

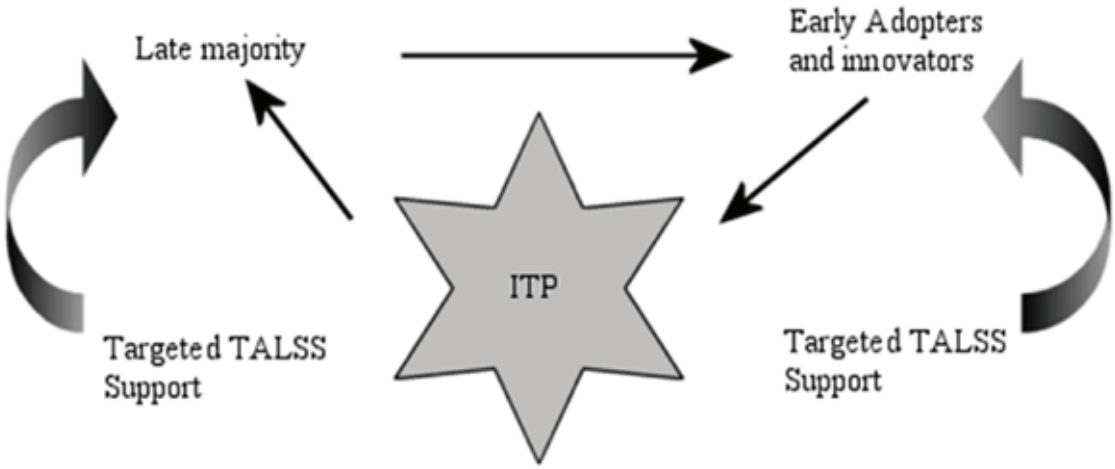
In 2004, the faculty chose to fund an explicit project that explored alternative pathways to encourage staff not currently engaged to become involved, or who felt for various reasons that they were marginalized or excluded from the blended learning environment. The Innovation, Technology and Pedagogy (ITP) project was conceptualized as a series of conduits or avenues through which both novice and more experienced staff could gain access to pedagogical conversations surrounding blended learning. While initially tailored to the existing in-house LMS (OLT), the model has been subsequently migrated to the current Blackboard system where it is now housed within the Learning Communities section of the LMS.

What distinguishes ITP from traditional 'training' projects or models is that ITP attempted to encourage conversations around common pedagogical topics and themes derived from traditional classroom frameworks. ITP then sought to restructure this dialogue so that the blended learning environment was introduced and spoken about in pedagogically-centred conversations that were familiar to staff. Thus, ITP was fundamentally different from most LMS training modules that are for the most part structured around introducing new tools and describing the functions of an LMS. Such traditional models have been critiqued along the lines that they are too dependent upon technical language that can in many cases be incomprehensible to less techno-literate staff (Burnett and Dawson, 2005; Birch and Burnett, 2009a, 2009b).

A key aspect of ITP was that in contrast to serving as a traditional model for training, ITP was seen as a "repository where such conversations could be shared and accessed, [and where] the ITP project would provide the scaffolding for late-adopters, while also allowing more techno-savvy staff to reflect upon their current online teaching practice" (Burnett and Dawson, 2005, p. 1).

Another key component of ITP that could potentially be used in other settings/institutions was the manner in which it functioned within a local faculty-based Community of Practice (COP), and that staff involved in the project needed to be well known across the faculty so that they presented a 'familiar-face'. This was done so the presenters could engage in a 'conversation' with those using the site and ultimately produce a co-constructed understanding of what blended learning within the QUT context actually meant and what was required to participate effectively. There was recognition that the project needed to direct staff to avenues of support within and beyond the faculty (particularly formalized structures such as QUT's TALSS where staff were able to access one-to-one support). Research into ITP at the time found that by fostering a COP within the local surrounds of the faculty, the formal support structures such as TALSS were able to personalize and much better target their blended learning development programmes within other faculties (see for example Burnett et al., 2005; Burnett and Dawson, 2005). Figure 8 (cited from Burnett and Dawson, 2005) illustrates how ITP can foster communication, training and the sharing of understanding of blended learning pedagogy.

Figure 8: ITP-fostered communication, training and sharing on blended learning



Recommendations for blended learning projects

The following section briefly discusses some lessons gained from running the ITP blended learning project to assist those planning similar projects.

a. Writing a targeted proposal

After an individual or organization develops an initial idea or concept for a blended learning project, a top priority must be for the project to have a clear and concise proposal. This is important at the conceptual level in that it forces a crystallizing of aims and how these are to be achieved. However, this is just as

important at a pragmatic level in that it allows supervisors or those in charge of blended learning in the institution to effectively evaluate the strategic importance of the project. In the case of the ITP project, a decision was made to write a proposal that overtly distanced itself from previous training programmes targeted at up-skilling academic staff or provided technological tool-based forums for familiarization of blended learning tools such as wikis, discussion forums, chat sites, quizzes and the like. The ITP proposal in contrast was based on the premise that the standard 'technological-tools' approach was not connecting with large groups of staff (particularly those in most need) and hence a better approach would be to move the 'training' back into a more familiar terrain linked to sound pedagogy. After outlining a justification of approach, the proposal requested a realistic amount of funding to allow for a small team of experienced staff to re-conceptualize and then build an online conduit where the broader faculty COP engaged in blended learning would be able to share their experiences via a series of narratives structured in pedagogical, not technical, terms. The proposal was presented to the Dean and subsequently approved with a call going out for *expressions of interest* for staff wishing to participate across the faculty.

b. Forming the blended learning project team

While the ITP project was funded by a single faculty within the university, the project benefited greatly from expanding the team and seeking additional members and support from other divisional structures such as TALSS who provided support via their Learning and Teaching Consultant. It is important to stress that both in terms of cost and gaining access to specialized technical knowledge, there are clear benefits for projects to draw upon existing institutional support structures. While most faculties have a number of staff who can be clearly identified as early-adopters of blended learning, the ITP project chose to include staff from across the full spectrum of online teaching and learning expertise. In combination to the call for expressions of interest was a process where the coordinator of the project spoke to and encouraged key members of staff who would add some critical element. In the end, the project team members came from a broad range of disciplines ranging from pedagogical theory, ICT education, film and media to sociology of education. The final working group consisted of eleven academic faculty staff, one staff member from the university library and one TALSS consultant – clearly including staff who were not experts in ICT or more generally experts in blended learning. In hindsight, this was extremely beneficial as it brought together a diverse group of skill-sets and a range of insights/perspectives. This diversity within a project team is highly recommended for it was drawn upon at different stages throughout the cycle of the ITP project.

c. Managing the blended learning project

The initial ITP meetings revolved around building consensus related to the overall aims and the agreeing on a set of achievable/deliverable outcomes. One of the most important aspects was an initial workshop to articulate the primary inhibitors that were preventing many staff from engaging with blended learning. Two main factors kept surfacing during the discussions. The first predominately centred on the increased workload and the second on a lack of technical literacy in relation to specific online or web-based tools linked to the LMS.

While the ITP project shared with many blended learning projects a desire to engage all staff, the ITP project was also different from the onset in the way it was conceptualized, constructed and implemented around notions of sound pedagogy, concepts that could be found in any 'good' teaching scenario whether it was blended or traditional face-to-face. The core or essential concepts/elements were always articulated without any reference to technical language. These concepts are available online via an intuitive and easily

navigable website. The intention was to provide these resources in template formats that can be inserted directly onto blended learning teaching sites. Finally, the site served as a 'just-in-time' resource for staff as they encountered specific problems/issues.

Regular meetings followed these preliminary discussions where dialogue revolved around a process of distilling a core set of key pedagogical themes that were shared across both blended and traditional learning environments. At the same time, the ITP team held numerous workshops that focused on how to locate and link these core themes within the existing LMS OLT which was at the time the default conduit for blended learning across the university. Given that members of the groups were from the Faculty of Education, it is not surprising that the process of actually refining a core set of components that constituted effective pedagogy was relatively straightforward. A more time consuming task however, centred on how these key components of effective pedagogy should subsequently be represented. After considerable deliberation, the decision was to use an intuitive hierarchical structure that would enable users to quickly find what they were looking for while at the same time promoting future investigation of the site. This model represented in Table 1 (Burnett and Dawson, 2005) was constructed around five main headings under which sat a series of secondary related themes. Importantly, each of these was concretely tied back to the LMS in non-technical language as it was critical that each heading be understood in lay terms by staff who were resistant to the traditional reliance on technical descriptions within blended learning environments.

Table 1: ITP project's major and secondary themes

Innovation Technology Pedagogy Home				
Getting started and policies/procedures	*Enhancing communication*	*Managing materials and content*	*Improving student reflection*	*Encouraging students to work together*
How will OLT support my teaching?	Structuring individual/ group reflections	Sharing resources, ideas and content	Facilitating engagement	Establishing and managing group work
Accessing help and support	Real time chat	Video to complement lecture content	Unstructured student initiated discussion	Peer communication
Student evaluation/ feedback (SET/SEU)	Group work	Providing lecture notes and slides	Structured student initiated discussion	Assessing group work
Email and voicemail guidelines	Community development	Managing assessment	Collaborative activities	Promoting shared resources
Online learning and teaching policy	Engagement and discussion	Checking for understanding	Evaluating performance	Facilitating group cohesion
Business continuity plan				

Once consensus was reached in terms of the major and secondary themes, the team then began to develop an accompanying series of templates and easy-to-follow explanations of the actual functions and tools located within the LMS that in some way enhanced the blended learning environment. At this stage, the members split into smaller groups that worked on a particular theme each. Each group then designed examples of how the theme could be applied within the blended learning setting while ensuring that no technical jargon was used. Far from simply 'dumbing-down' content so that staff with minimal technical literacy would not switch off, each team spoke with consistent 'feel' that drew on a specialized pedagogical discourse clearly understood by Faculty of Education staff. This process had its problems because some

components, such as video-streaming, simply could not be spoken about in totally lay terms. Nonetheless, overall the teams succeeded in keeping technical jargon to a minimum (or at least in the background) and each team produced a coherent and uniform series of non-technical narratives specifically related to a nominated key aspect of blended learning.

d. Disseminating the project

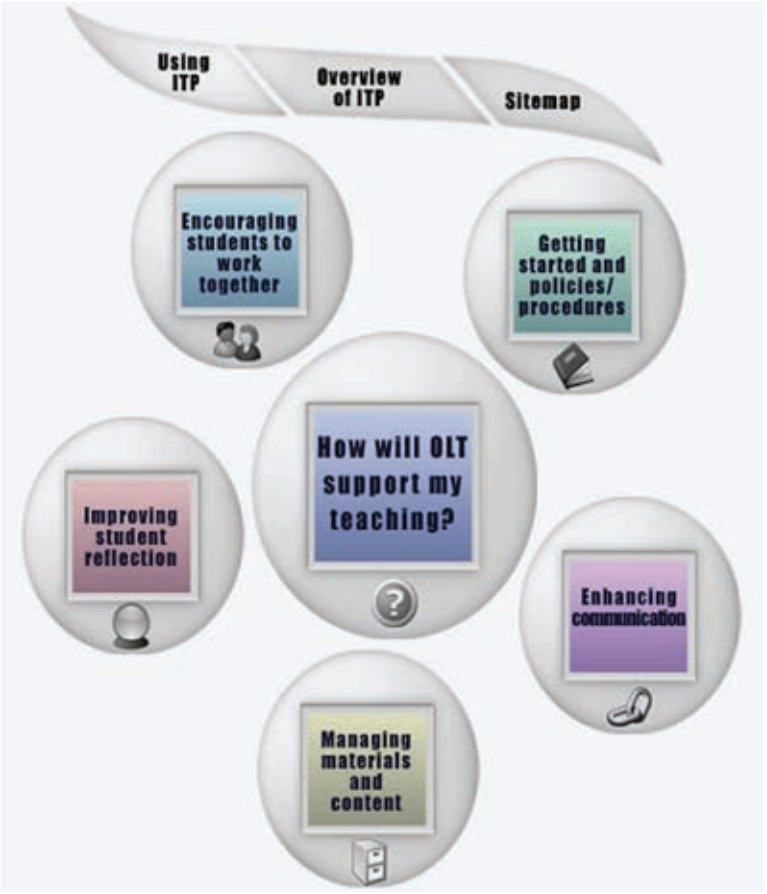
The final aspect of the project required professional videoing of a short explanation of each of the nominated aspects. Each team or individual who had developed and refined the narrative provided an explanation with minimum reliance on technical description as far as possible. The teams aimed for a personal conversation that touched upon a shared and easily accessed underlying pedagogical theme. Importantly, each of the people involved was known throughout the faculty and therefore was readily available for later feedback. This proved to be a critical factor that enabled greater engagement from those who used the site. Each segment was then embedded within the overall navigation structure. Once accessed, it was possible for staff to not only watch the video/narrative, but also assess readymade templates that could be implemented immediately in the LMS environment.

Of equal importance to the production of explanatory narratives was also the issue of how this material should be represented online since the project aimed to provide easily understood accounts and minimize the visibility of technological tools. At this final stage for dissemination, it was necessary to return to the original goals of the project to ensure that the ITP narratives were graphically represented enough for three purposes:

- Provide an intuitive and smooth navigation of the site.
- Retain an overall focus on pedagogy.
- Contain easy to understand explanations along with pre-developed templates.

The final design of ITP (Figure 9) used a series of expanding wheels that began with five initial starting points from which users were able to navigate to the next level, each of which contained a further series of expanded categories. For example "'Enhancing communication' contained another expanding wheel of sub-categories that included: Structuring individual/ group reflections, Real time chat, Group work, Community development and Engagement and discussion. At the granular level, the site contained current exemplars detailing the pedagogical rationale for implementation and links to specific designed templates mimicking the stated examples" (Burnett and Dawson, 2005).

Figure 9: Representation of the ITP site design



Conclusion

The manner in which institutions successfully engage, promote and support blended learning is a major consideration that entails reflection across a variety of stakeholder perspectives. At the national level, this has been recognized in a recent Australian Learning and Teaching Council commissioned review of strategies to promote *Technology Supported Learning Design* (Oliver, 2008). This report not only encouraged institutional policy frameworks but also encouraged the development of institutional structures that target the maintenance and support of blended forms of technologically enhanced teaching and learning. For the past decade, institutions have struggled to strike the right balance that links technological support structures within appropriate pedagogical frameworks. While this process has produced a new staff profile of 'learning designers', there has always existed an underlying tension among the promotion of new technologies, existing curriculum design policy to support student learning, and desired learning outcomes at the local course or unit level. The emergence of blended learning provides institutions with a much broader matrix to conceptualize the manner in which student learning outcomes can be facilitated and encourages a balance across a range of technologically enhanced and traditional formats.

Clearly, blended learning has an impact on existing support structures, business models and attendance modes. It is, therefore, necessary for institutions to conceptualize blended learning in more holistic terms beyond a mere understanding of what constitutes blended learning, but should include a policy that guides a range of associated protocols for academics engaged in teaching and learning. Such policy should encourage innovation and not simply address compliance for this tends to stifle creativity. While there clearly should be an institutional strategy or framework that minimizes risk, there should also be a policy that allows for flexible pedagogical considerations specific to particular courses. Issues of access and equity must remain a high priority along with the need to understand how learners (and staff) work the blended learning environment and build support structures around these new understandings.

Interestingly, the impact of these changes across the institution can in part be seen in the university's Department of Teaching and Learning Support Services being renamed in January 2010 to eLearning Services to better reflect the changing role and emphasis that now include QUT Blackboard, ePortfolio support, learning design, TV and media development staff.

This report has touched upon the many 'drivers' of change associated with blended learning. Advances in ICT and their applications are highly visible and often most widely talked about. It is likely that educational institutions worldwide will continue the trend of an increasing dislocation from traditional modes of student engagement. However, it is important to stress that sound pedagogy must never be lost. Blended learning provides a window for paradigmatic shifts in pedagogy and technical orientation within the academy. While such shifts are encouraged, there are sufficient examples that demonstrate instances where blended learning is not appropriate. This report has highlighted the dangers of merely reacting to distinctive economic and market-driven adjustments that potentially risk placing blended learning within a model of higher education driven by cost, flexibility and, ultimately, the market.

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Highly Engaging Learning Pedagogy (HELP) blended learning model of Nanyang Technological University, Singapore

Daniel T.H. Tan, K.V. Ling and Kenneth J.L. Tan[18]

Introduction

The learning environment has evolved. It has been greatly influenced by prevailing and emerging technologies that have penetrated into almost all aspects of professional and social life. In many economies, access to the Internet creates the seeds of technology and innovation. Such access sees an increasing number of users, spanning young students in primary education to senior citizens. In Singapore, according to the Infocomm Development Authority (IDA), the household broadband penetration rate at December 2009 stood at 136.9 percent, compared with 50.8 percent at the end of 2005 (Infocomm Development Authority of Singapore, 2010a, 2010b)[19]. This suggests that as a nation, households are very well connected to the information superhighway.

Social media like Facebook, Flickr, and YouTube have become an integral part in the life of the Generation Y (Gen Y) (those born between 1977 and 1997). The Gen Y population has been characterized as being technology savvy, having a short attention span, cosmopolitan/diverse and pro-consumerism. They have been raised in a world where information is easily available (but not always reliable) and yet this information is dynamic, evolving and multiplying. Much of the time, the Internet has replaced the library as the main, if not the first, source for information.

This paper introduces the Highly Engaging Learning Pedagogy (HELP) blended learning model adopted by the Nanyang Technological University (NTU). The HELP model leverages on current info-communication technologies and is compatible with the socialization experiences and learning behaviour of Gen Y students. The paper also presents the key principles that guide lesson designs, provides examples of the online activities, and describes how students and faculty have responded to this blended learning model, shedding some light in the learning process, and the effectiveness of the HELP model. In addition, areas that require review and re-design are also discussed.

18 Nanyang Technological University, Singapore.

19 Household penetration rate is computed by dividing the total residential subscriptions by total households, i.e. the total number of residential dwelling units in Singapore.

Definition of blended learning

For the purpose of discussion, blended learning is teaching and learning approach which harnesses the benefits of face-to-face (F2F) and multiple technologies to deliver online content and instruction. This paper focuses on the online aspect of the learning environment.

The pedagogies involved in F2F instruction and online learning share many commonalities but also differ in some ways. While the F2F environment benefits from social interactions that occur in the classroom, the online environment benefits from the delivery flexibility and high availability of the course content. NTU's blended learning strives to achieve a harmonious balance – the balance of instructional strategies that is customized specifically to improve students' learning (Osguthorpe and Graham, 2003). By using an Internet connection, students benefit from the flexibility to learn when they want, and from where they are. In many ways, the support systems inherent in F2F situations (e.g. feedback) can be replicated in the online environment, either synchronously or asynchronously. The HELP blended learning model created by NTU is pedagogically-driven. At the heart of this pedagogy is effective learning engagement (Osguthorpe and Graham, 2003) based on the guiding principles articulated later in this paper.

Background to NTU's blended learning situation/ context

NTU (*http://www.ntu.edu.sg*) is a research-intensive tertiary institution with an enrolment of over 21,000 undergraduates and 9,000 graduate students, with international students making up approximately 20% and 45% of the undergraduates and postgraduate populations respectively. There are four colleges (Engineering, Science, Business and Humanities, Arts & Social Sciences) making up thirteen academic schools.

Recently NTU embarked on a "Cool Campus" initiative. Its aim is to establish a technologically advanced campus environment for students, faculty and staff. It will create an environment that innovates on the processes of communication, connection, community, collaboration and knowledge creation. Central to its successful outcomes is a robust and reliable infrastructure that is able to support anytime-anywhere learning via a high-speed broadband wireless network.

For learning to be effective, online learning must support interactions which can be referred to as a reciprocal communication process between human and human or between human and machines. In technology-mediated or online learning, the interaction between learner and interface should be considered as a critical component (Hillman et al., 1994). Hence, online lessons must be populated with relevant, interesting and interactive content/activities. These lessons can function as pre-F2F activities, supplementary resources or follow-up activities to F2F lessons. Providing students with such content also leads to these benefits: (1) students can access the activities at their own time and convenience; (2) students can benefit from the multimedia experience that the online environment offers, and (3) instructors

can reduce time spent in content delivery during F2F lessons by putting lecture recordings online, and maximize the F2F time to interact more with the students.

At the heart of NTU's eLearning initiative is the edveNTUre eco-system (*http://edventure.ntu.edu.sg*) using a Learning Management System (LMS) from Blackboard (*http://www.blackboard.com*). All courses in the University have an active presence in edveNTUre, with all students automatically enrolled in their respective courses for each semester.

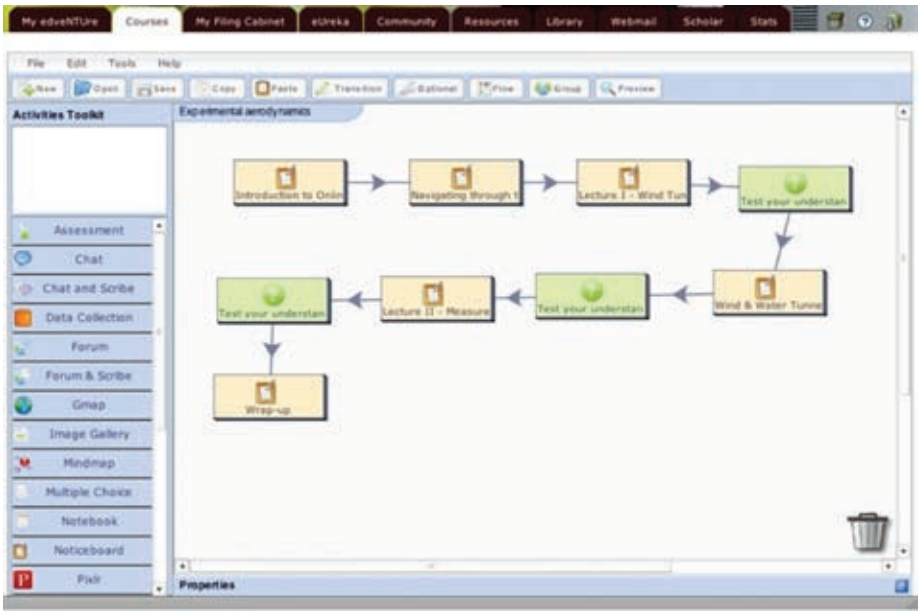
Congruent with the observations made by Connolly et al. (2007), most professors at NTU also "focus on content, are experienced in face-to-face teaching, have little pedagogical training and experience of facilitating learners online". The early years (edveNTUre was launched in May 2000) saw the first forays into eLearning mainly involving uploading of course notes, presentation slides and online quizzes. These materials tended to be instructor-centric and static page turners. Today, with over 9 million page-views per week, students enjoy a learning environment that supports lecture recordings, rich media content, online forums, blogs, wikis, project work, social bookmarking and other Web 2.0 experiences.

The heart of the HELP blended learning model is the open-sourced Learning Activities Management System (LAMS – *http://lamsinternational.com* developed by Macquarie University) as the platform for building online content. For this purpose, LAMS has been integrated with edveNTUre to facilitate ease of use and seamless integration with the Blackboard LMS platform.

It should be noted that besides LAMS, other tools are also used for building online content. LAMS is a cost-effective (almost free) platform for content creation and integration. It features various learning activity tools, with strong support for interactive pedagogy. In addition, LAMS can also be integrated with other LMS (including Moodle and Sakai).

LAMS, with its pedagogically driven and easy-to-use drag-and-drop feature allows the instructor to quickly plan sequences of activities. Activity types are selected and dragged from the left panel, and dropped into the Authoring Space (see Figure 1). Creating each activity in LAMS does not require professors to know html scripting (even though it does accept html codes if the professor or designer wishes to have more control over the design elements). Sequences are formed by linking the Activity types to form a chain. Once the sequence of learning activities has been developed, it can be easily deployed into their respective course sites.

Figure 1: Screenshot of LAMS, showing the user-friendly drag-and-drop interface in the LAMS

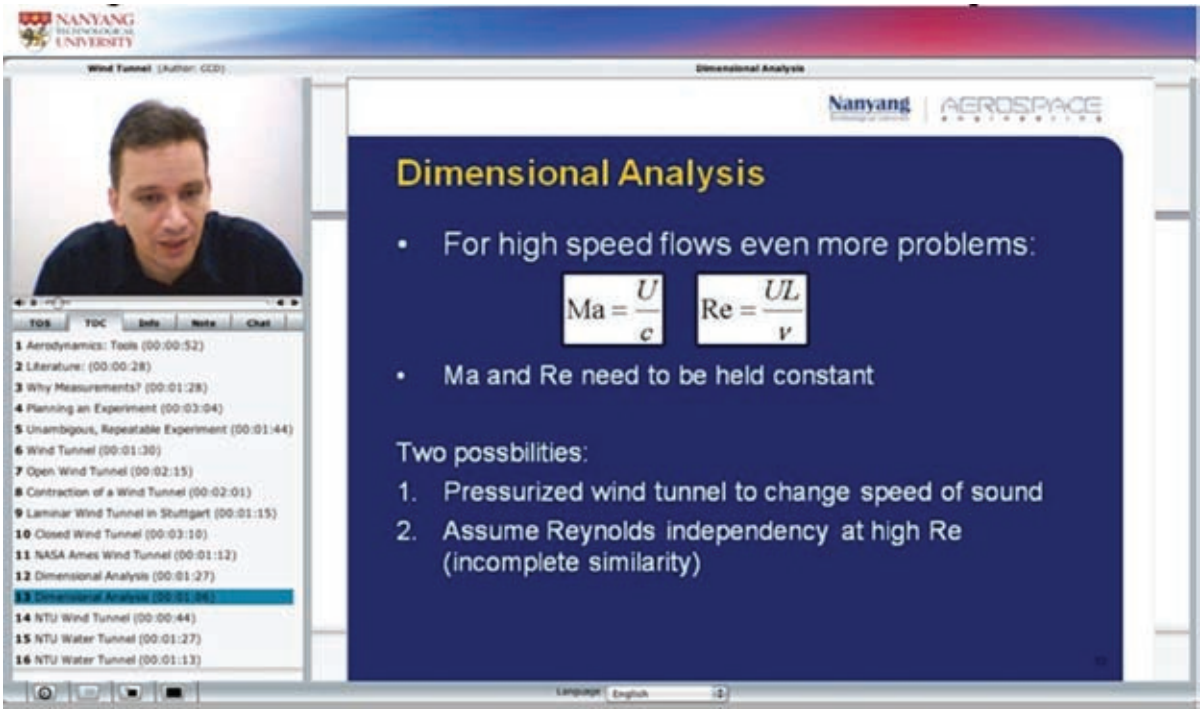


In addition to LAMS, another creation tool widely used is acuLearn's acuStudio (termed "PreseNTUr" in NTU) (*see https://www.aculearn.com*) which allows for live recording of lectures and fast availability of slides-synchronized lecture recordings streamed for online viewing.

To make it easy for students to access the myriad of eLearning tools on different servers and platforms, all the eLearning applications used, as well as their finalized products, are housed in the edveNTUre portal. This approach is beneficial as it allows for a single entry point for students, and greatly improves usage, access and learning efficiency. In this case, the products of preseNTUr (live lecture recordings) and LAMS (for learning activities and pathways) are integrated within the edveNTUre portal.

PreseNTUr allows the instructor to quickly record a lecture or presentation, with the inclusion of synchronized slides from a personal computer connected with a commercial video camera, or from a notebook PC with a good webcam. The final lecture recording product can be published after the presentation is done for post-processing. This will stitch the video to the respective presentation slides automatically, and thereafter push copies of the presentation product to multiple edge video servers located remotely at school buildings, halls of residence and other strategic locations. This post production process takes no more than 15 minutes for a lecture of an hour. Thus, a live lecture can be published to its course site minutes after it has been delivered. An example of the final output of a recorded lecture is shown in Figure 2. Students are able to see and hear the professor while the slide being discussed is shown on the right.

Figure 2: A screenshot of a recorded lecture done in presenter



A blended learning lesson may start off with an announcement (stating learning objectives, course objectives, etc.). This can then be sequenced with reviewing a video lecture. Other learning activities (like review question, quiz, etc.) can be added to facilitate student participation. Such quick and timely interactions will enhance and reinforce learning by engaging the students immediately.

Guiding principles in designing online learning content

The principles that govern the design of online learning content in the HELP blended learning model are as follows:

- Sound pedagogy and high learning quality
- Affordability
- Ability to leverage on existing infrastructure and resources
- Interactivity and sustainable student participation
- Re-usability
- Rapid course development
- Web usability

This section outlines the importance and application of each of these principles.

Sound pedagogy and the dimensions of quality

At this juncture, it would be timely to deliberate the issue of quality. There are various dimensions of quality in the context of education. The first domain is the quality of course material. Well designed and organized course material will facilitate learning. The second domain is that of the quality of teaching. This looks at the delivery and teaching competencies of the instructor. Faculty are often rated by students in teaching quality, the teaching effectiveness and rapport of the student-faculty relationship in a learning space. While many studies have been done on these two quality domains, another significant domain became apparent in the course of developing the HELP model. This is the quality of learning.

While the first quality domain focuses on the course material and the second on the teacher, the third quality of learning is directed at the learner. In the context of the HELP model, learning quality looks into the effectiveness of the learning experience that the student achieves, which can overshadow the quality of the material and the teacher. This is because the learning design in the HELP model facilitates (or some would argue, compels) high student participation. This leads to clear quantitative benefits of peer-to-peer learning and teaching. Qualitatively, high student participation levels remove social isolation, and encourage better student preparation and higher learning engagement. The greatest benefit is the ease, cost and speed of developing such learning designs.

Central to the design and creation of online content is a sound pedagogical foundation. Technology is appropriately exploited to best meet the desired outcomes of each lesson. In that regard, there is no rigid model or template that is adhered to but rather, a dynamic model that is student-centred and instructor-supported is adopted. The lesson design is based on an appreciation of different learning styles, learning outcomes and available technologies.

For instance, in a particular lesson, the professor may only need students to ***understand*** a certain concept, rather than to ***apply, analyze*** or ***evaluate*** it (to use Bloom's Taxonomy). The lesson design could involve little more than an explanation, with relevant examples, culminating in a carefully crafted quiz designed to test for understanding. As the skills in the cognitive domain move to the higher order (i.e. application, analysis, synthesis and evaluation), then more complex activities may be included.

Affordability

Producing high quality digital content can be commercially expensive in terms of time, effort and resources. Compounding this challenge is the need to be able to edit, modify and update material from time to time, thus adding to the development cost. Given the vast number of courses and lessons that are offered in the University, dependence on commercially produced content would be challenging. Purchasing off-the-shelf content has many limitations. Chief among them is that the material is not customized to the specific needs of the professor and the lesson's objectives.

Affordability, therefore, includes not only the cost of producing the content (the product) but also its re-use and re-purpose. It needs to consider the resources required to design and produce the content and to update and maintain them.

Leveraging on existing infrastructure and resources

The University today has a robust and well established network infrastructure to support online learning. With an extensive wired and wireless network across the campus (including the halls of residence), students and faculty have easy and fast access to a host of eLearning tools and collaboration media.

In adopting a model for online content development, eLearning tools were evaluated to best suit the specific needs. The selection of tools must correspond with the other guiding principles of content design and development.

Interactivity and sustained student participation

Research on the effect of interactivity on learning suggests that interactivity does positively influence learning efficiency (Stoney and Wild, 1998; Yacci, 2000). Here, interactivity refers to the cognitive engagement experienced by the student as he or she navigates through the lesson. Interactivity can also be defined by the extent of control the student has over the pace and the choice of options (within limits). High levels of meaningful interaction will lead to a deep sustainable learning engagement.

Teachers differentiate between "thinking we have learnt something" and "knowing that we have learnt it". What is taught is not necessarily learnt. You may have taught them, but have they learnt? These questions cannot be answered by the famous last words of the teacher at the end of the lesson "Class, any questions?"

A useful way to determine if learning has occurred (or how much students know or understand the material) is to conduct some form of feedback, assessment or test. However, this tends to occur towards the end of the course and is usually summative in nature. It is also "costly" if conducted during normal class-time as it takes away teaching time. Also, due to constraints of time, resources and opportunities, it is difficult and time consuming to garner thorough feedback from students during class-time, where shared feedback can benefit the whole class. This results in even less time for teaching. Certainly, more can be done to benefit the students through self-assessment of their own learning and relating their past experiences/prior knowledge with new materials throughout the course. This would be even better if feedback can be done not just by and for themselves, but for and with fellow students.

There are many strategies for doing this. Starting a lesson by getting students to evaluate their prior knowledge of a concept or topic is effective yet simple. This strategy forces students to reflect upon the previous lesson and to evaluate their understanding. It also forms a bridge to the new lesson. This process helps students to identify gaps in their understanding.

Use of simulations is another good interactive strategy. It allows "what if" scenarios beyond examples given during the lesson. Seeing a response output provides an effective method to understand relationships of cause-and-effect.

Interactivity can also include control of the pace of learning by the students. This includes the play-stop-review-forward control of viewing a video. This form of interactivity is useful for students to decide whether they wish to review or skip certain portions of the lesson. Interestingly, it has been observed that in spite

of the availability of a recorded lecture, the impact on attendance has been minimal. In fact, the recorded lecture initiative has been very successful based on the total viewing time registered (about 14 to 40 to 55 years of viewing time recorded for the academic years 2004, 2005 and 2006 respectively) coupled with feedback from students. Students regularly view and review the recorded lectures, often navigating to specific and selected points in the recording.

Content re-usability

Content should be created for re-use so that it can be re-purposed for different use. For instance, a recording of a lecture is a piece of content that can be used in a variety of ways. In its most static form, it can be used to merely playback the original lecture presentation for the convenience of students who have either missed a lecture or who want to review certain portions of it. However, that same lecture recording could also be re-used, or more accurately, re-purposed as part of a learning activity. For example, the hour-long recorded lecture can be chunked or modularized into shorter segments, based on concepts or topics. This can be coupled with different learning activities (e.g. forums and questionnaires) to help students participate and understand concepts better.

With the increasing use and ownership of mobile technology, it would be helpful to deliver content that can be viewed on mobile devices like the iPhone and other smartphone models. Figure 3 shows an example of how a set of instructions for a lab experiment can be converted into a vodcast and played from a student's iPhone. In this instance, the student is able to familiarize him/herself with the experiment along with a laboratory safety briefing before entering the laboratory. During the actual experiment, should the student need to recall a step, it can be conveniently referred to in the vodcast on his/her iPhone.

Figure 3: An example of a vodcast where lab processes are demonstrated and explained

Digital media has the advantage that it can be easily stored, categorized and edited to suit various situations and purposes. Packaged as learning objects, they can be re-used and re-purposed for different learning contexts. For instance, in a French language course, an interview with a native French speaker was video recorded. This video recording offered a variety of applications. It was used at the beginner's level to test students' listening skills as well as increasing and testing their vocabulary. In addition, the same video segment can be utilized for building learning activities for students studying French at higher levels (intermediate and advanced). Different activities can be designed based on the level of difficulty and complexity. At the basic level, it can serve as a model for asking questions appropriately, introducing oneself and so on, while at higher levels the same video clip could be used to discuss choice of words and tone. Such re-usable content offers instructors and developers a wider pool of resources to draw upon when generating online content.

Rapid course development

Instructors plan and execute lessons daily. Lessons conducted are often reviewed, modified and fine-tuned for effectiveness. The same exists for online learning. Resources and activities developed in one semester may be refined for re-use in the following semester.

A valuable by-product of this rapid development criterion is the use of the process to respond to emergencies quickly. For example, consider the recent threat of a pandemic outbreak of severe acute respiratory syndrome (SARS) in 2002-2004, and the more recent H1N1 flu virus. In the event of a need to close the campus, the eLearning infrastructure and processes will allow faculty and support staff to rapidly design, develop and deploy online resources and learning activities to support learning continuity. The content development tools adopted and discussed in this paper will facilitate rapid, ad hoc, highly engaging blended learning content development by faculty.

Web usability

It should also be noted that sound pedagogy for today's learning designers also entails an appreciation of usable web designs. Long, chunky texts affect readability. Website navigation needs to be kept simple and obvious. Content should be accessible in a few mouse clicks and presented in bite-sized chunks. On the average, it takes about 25 percent longer to read a piece of text from a computer screen than it does to read from a sheet of paper. To help students identify and digest information more effectively, the content must be presented concisely and clearly, particularly when it is for teaching, learning and knowledge creation.

Herein lies a paradox: to present information clearly for teaching purposes, it is necessary to be explicit and complete with the inclusion of examples and sufficient detail. This counters the conciseness of information. A fine balance must be struck between being concise, being complete and being clear. The learning designer and the course instructor (i.e. the professor or subject matter expert) must constantly be aware of the relevance of the presented information to the desired learning outcomes. In addition, strategies to reduce word count (less is more) with the use of hyperlinks to other pages/sites for more details, incorporation of rich media content (e.g. animations or video to show rather than tell) can help enhance understanding.

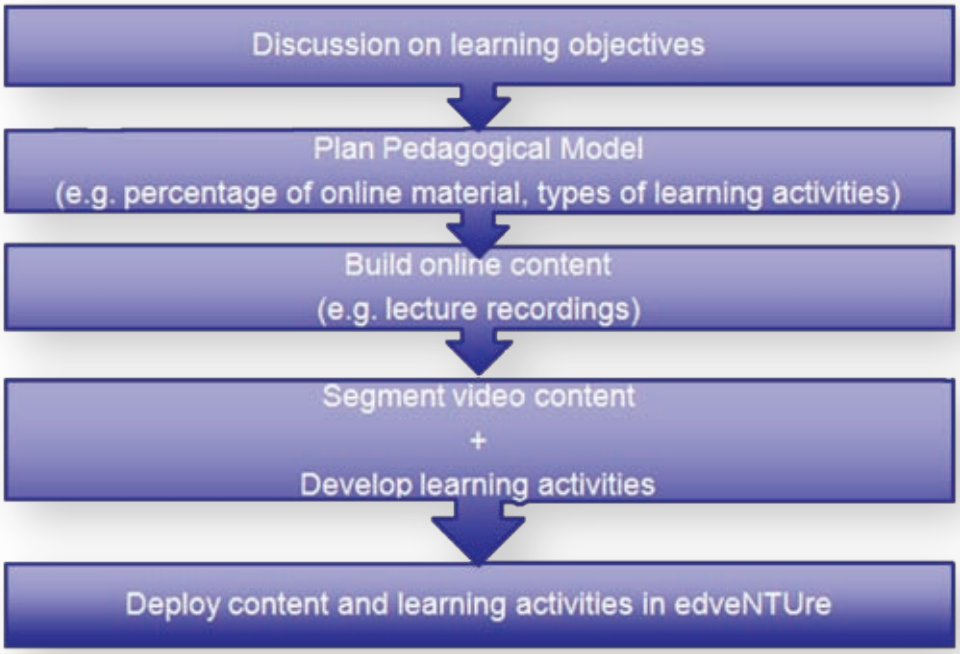
Bearing in mind that the multi-tasking Gen Y student has a short attention span and is comfortable with web technologies, social networking and hyperlinking to other websites, online content and learning design has to reflect an appreciation of this. Using videos of lectures to carry content appeals to students used to YouTube. Embedding video content and segmenting it into logical digestible chunks will enhance better understanding and learning, strategies used in the HELP model.

Developing the online content

While some faculty are comfortable creating their own online content independently, others turn to the Centre for Excellence in Learning and Teaching (CELT) for support and assistance. Those who seek the help of CELT usually do so for both pedagogical and technological (including multimedia creation, storage and delivery) support. Here we discuss the process flow from the initial contact to the operational deployment of the online learning activities in the edveNTUre eLearning portal.

The entire process can be simplified into five steps as illustrated in Figure 4.

Figure 4: Process flow for content development between professor and learning designer



Discussion on learning objectives

The content development process starts with a discussion between the instructor and the learning designer on the desired learning outcomes of the lesson. The professor, as the subject matter expert, defines the learning outcomes for the lesson. A lesson can vary in length, duration and concept complexity.

Sometimes, a lesson has several learning objectives and students are required to show degrees of competency at various stages. These various stages, along with the desired outcomes for each of them, are clearly highlighted and mapped.

At this stage, it is also important that the learning designer be aware of what has occurred during the corresponding F2F lesson (if any). This will allow the designer to build on the F2F lesson and avoid activity duplication. This applies in a blended learning environment where students attend an F2F class and then go online for supplementary learning.

Plan pedagogical model

Once the lesson outcomes have been established, the next step is to determine what activities can or need to be done online. The learning designer will determine, in consultation with the professor, the resources to be built, the number of discrete activities to be designed, the types of learning activities desired and finally, how to determine if the students have learnt successfully. A profile of the students would be useful as it can be considered in the content and activity design.

Through this discussion, options will be finalized, including all the inputs that will be needed from the faculty instructor, the tools to be used to build the content and activities, and the agreed timeline for deliverables. Based on the experience of the learning designer, several pedagogical models can usually be proposed. For example, a pedagogy model can be 70 percent asynchronized learning with 30 percent synchronous sessions. These candidate models serve as good starting points for discussion. Showing examples of previous work done in similar situations gives the faculty instructor a clearer picture of what the final product can look like.

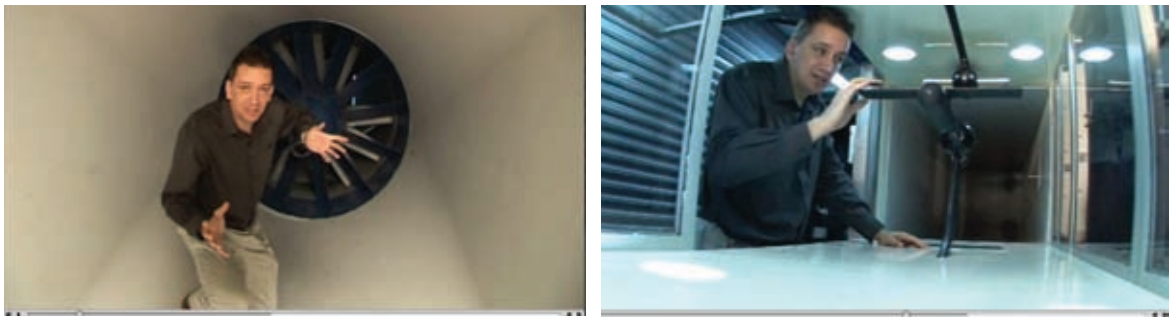
Build online content

With the pedagogical model and the types of learning activities agreed upon, the learning designer next embarks on building the course module. Regular meetings with the instructor ensure that the course module development stays on track, and that the instructor is involved and clear about each activity being built. Feedback, comments and critique from both parties ensure rigor in learning design. A multimedia designer is sometimes engaged to support packaging of the content and adding an aesthetic and professional touch to the final product.

As an example, a faculty sought CELT's expertise to build online learning content for a course on experimental aerodynamics. In particular, he was interested in developing a package that would help his students better understand how wind and water tunnels work. The drive for this lesson was practical: the School of Mechanical and Aerospace Engineering has a wind and water tunnel facility, but it cannot accommodate the 140 enrolled students. Previously, the professor briefed his students as they squeezed into the confined space of the tunnel. He had to do this a few times with small groups. The more effective approach was for the professor to create a documentary-style video where he would introduce his students to the various parts of the wind and water tunnels. To produce the video, the professor became the host presenter with the multimedia crew recording his 'tour'. The video can zoom into various subsystems and components with clear audio presentation. After post-production video editing and review, the video is put online in the edveNTUre course site.

Today, students are presented with the "best view" as they are hosted by the professor to a personal tour of the inside of the wind tunnel via the video documentary. This more effective approach also allows students to view the video prior to and during class. This allows them to recall and relate what they see on the video (see Figure 5), with the equipment that they will be using. Such "just-in-time" delivery provides the right information at the right time.

Figure 5: Snapshots from a video of a professor explaining the workings of a wind tunnel



To further enhance an understanding of wind tunnels, the instructor added a recorded lecture on concepts and calculations related to wind tunnel testing (see Figure 2). Thus, from one screen, the students can connect theory and practice and see that what they are learning has a relationship with the real world.

Video segmentation and develop learning activities

Unlike movies with exciting plots and casts, lectures do not usually have the same appeal to sustain attention. Watching a lecture (typically an hour) on a computer screen can be challenging. Students may lose concentration and miss out on important points from a presenter without the looks, voice and style of Oscar winning actors and actresses.

To counter this and to help students manage their learning experience on an online medium, the typical hour-long lecture is logically segmented based on the concepts presented. This is done in consultation with the subject matter professor. Doing so is a deliberate step to provide high learning quality when the students peruse the course module.

In addition, the process of video segmentation forces the professor to consider the lecture structure, drawing lines where the presentation of a concept ends and another begins. As an overall guideline, each video content segment is typically about 20 minutes, coinciding with the period of the typical human attention span.

Thereafter, learning activities can be crafted for each video segment. Many tools are available in LAMS. The professor may decide that the learning activity involves students watching the video, followed by them reflecting on what they have watched. The use of open-ended questions facilitates this. Students make sense of what they have learnt and summarize in writing what they think they know. After submitting their individual responses, students can see the inputs of their classmates. In a way, the students now learn the same concept many times over, often expressed in slightly different ways. Interestingly, beyond learning multiple ways of expressing the concept, the students have also become a judge and critique of the various inputs. As they review their fellow classmates' responses, there are some important benefits:

A. They learn multiple ways of expression, often presented at the level of, and with the language of, a fellow learner. Such peer-to-peer learning of bite-size information can fill in knowledge gaps that sometimes occur. Often, they get a better understanding of the question based on the range of answers from the class. The students now learn, and re-learn as many times as there are student responses.
B. They compare their responses to those of other students. They develop an awareness of different ways of expressing a response to the same question. The students analyze and develop the ideal solution to the question.
C. Following this, the students, in reading and then comparing the different responses, develop judgment on response quality. They now become a critic of not what is right or wrong, but what is good, better and best.

Deploy learning activities in edventure

Deploy learning activities in edveNTUre

The final stage of the content development process is to deploy the lesson module in the edveNTUre eLearning portal for use by students. Some considerations need to be adhered to:

A. Instructions to students should be succinct, clear and unambiguous. Expectations and timelines must be stated. This will facilitate focused responses completed within a stipulated time.
B. The link to the activities must to be easy to find. Students should be able to access the material easily without having to constantly download plug-ins and client software. Errors of wrong navigation (like pressing the wrong link or button) must be checked through user experience tests. This can be achieved by doing usability studies.

Findings and observations

This section discusses some of the observations and key lessons learnt from the use of the HELP blended for teaching and learning.

Quality of learning

In education, we speak of various dimensions of quality:

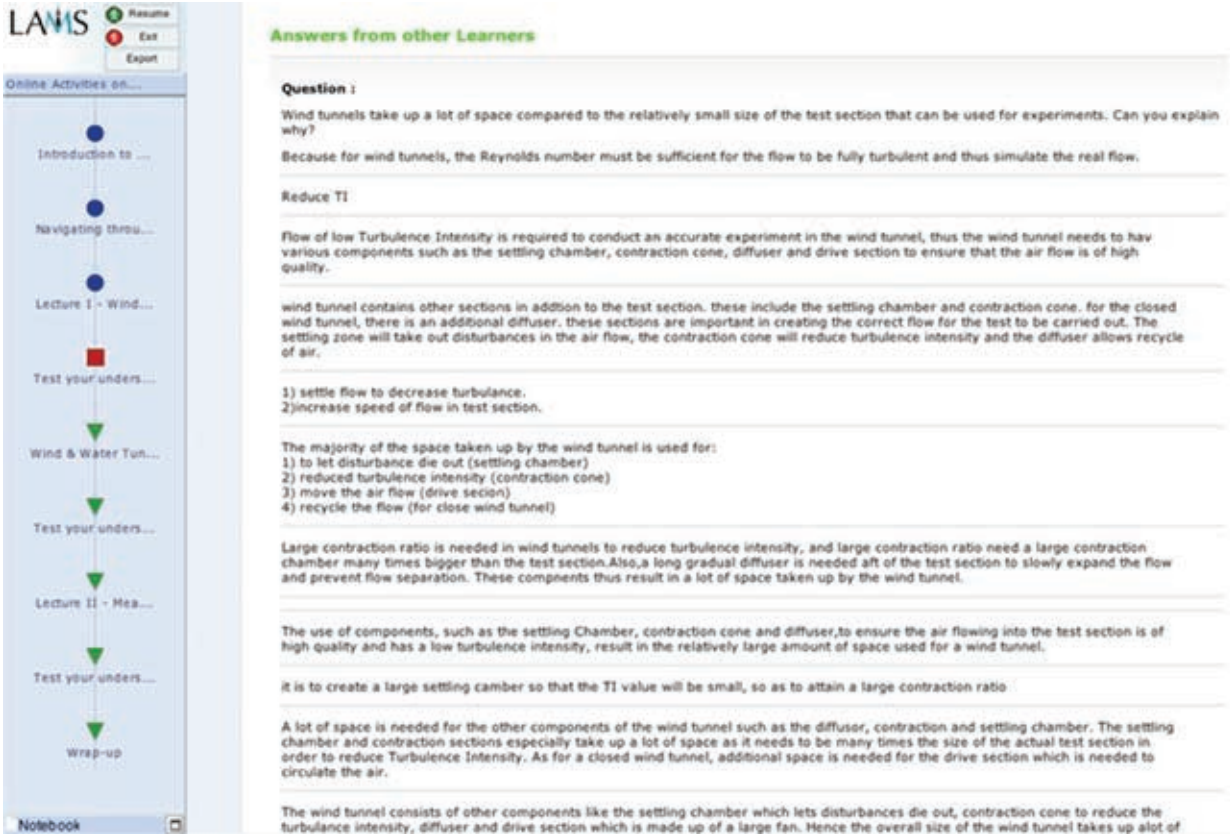
A. Quality of course material: good course materials are well organized, concepts are well presented and help maintain the interest of the learner.
B. Quality of teaching: the teacher presents knowledge, insights and understanding to the learner. A good understanding of knowledge, teaching experience, strong presentation and delivery skills helps the quality of teaching. Often, students are asked to evaluate teaching quality.
C. Quality of learning: this is achieved when the learner interacts actively and engages with the course material and sometimes with the instructor. Learning can also be enhanced when students learn from the responses of other students. It gives them the opportunity to see where they stand in relation to their classmates, as well as how other students' views and thinking differ from their own.

Interestingly, learning quality can be independent of quality material (imagine learning from an archaeological site hundreds of years old, or reading original incomplete ancient manuscripts, and from thence, making discoveries) and teaching quality (learning can still take place from independent self-study). Of course, both qualities can enhance the learning quality experience of the student.

Segmentation of video course content packaged with interactive learning activities engages the students more effectively than merely providing them with downloadable documents. The senses of sight and sound coupled with participative learning activities enhance the cognitive, learning and understanding processes. When students respond to a question in a learning activity and their responses are thereafter seen by their classmates in the LAMS environment, they move from being passive learners to being active participants, then learning collaborators and ultimately critics. The good critic is one who knows more than superficial knowledge; he/she becomes discerning and aware of multiple and alterative viewpoints, strengths and weaknesses of arguments, and often identifies his/her own knowledge gaps. This represents a very high form of learning from instructors, to peers and then to self-direction. The awareness of such peer review promotes self-motivation and effort during the course.

Many instructors using LAMS for the first time have been pleasantly surprised by the responses of students to their questions and learning activities – both quantitatively and qualitatively. Some have remarked on how they have acquired a new awareness ("never before in all my years of teaching in the university") of how and what ***all*** their students were learning. Instructors not only noted the high participation rates, but often the quality (and frequently, the simplicity and innocence) of the responses. They also noted that students put in more effort by providing well considered answers even though they were not graded (see example in Figure 6). This may be due to students' awareness that their responses will be viewed, compared and critiqued by fellow students.

Figure 6: Screenshot of some responses to open-ended questions



From these student inputs, professors are better able to quantitatively and more objectively assess if students have understood the lesson. In previous F2F sessions, the best an instructor can do to amass high class response rates is to get students to respond with a show of hands or perhaps through the use of audience response systems (where students respond to multiple choice questions using electronic response devices). However, these response systems do not provide a comprehensive and in-depth evaluation of what the students know. They merely look at the percentage of students choosing different options. With open-ended questions in an online environment, professors are now able to get a more complete picture of what was well received by the students, as well as what they found difficult.

Some professors, at the end of the online lesson, have also taken to asking students to post "burning questions" that they would like addressed in future classes. Such invitations have resulted in a higher number of better crafted questions. Students appear to be more comfortable asking questions behind a keyboard than in a F2F encounter with the instructor. Often, the maxim "you know when students have learned not by the answers that they give but by the questions that they ask" rings resoundingly true.

Sustaining student motivation

In some instances, student responses and participation in the online learning activities waned as the semester progressed. There are, perhaps, two possible explanations for this.

The first involves feedback (or lack, thereof) from the professors. If students perceive that the instructor is not responding to their inputs and comments, they tend to stop providing them. While they value seeing the multiple responses by classmates, it seems that the inaction and disinterest of the instructors can trigger passivity among students. Probing further, the problem seems to be that some instructors are more comfortable with the F2F session. In those cases, little real effort was made for online activities, giving the impression that online activities were only supplementary. Alternatively, the instructor focused only on the F2F session and left online activities as unattended self-help for students to do in their own time.

To counter or prevent this from happening (recovery usually is non-trivial), instructors must be prepared to treat the online learning activities as an integral and central part (vs. peripheral or non-supplementary) of the programme learning experience for their students. Online activities need to be, and must be seen to be part of, course content delivery as well as an invaluable tool to gather feedback of student learning.

The second possible reason for participation decline is burn-out, usually of the instructor first, and perhaps later, the student. When a class is large, the volume of responses can be multiplied many times; every question asked results in a student response. Managing such a large volume of responses can be challenging. Depending on the individual instructor, there is a tipping point where the volume of student responses to be managed crosses a threshold resulting in diminishing returns.

An effective response to this situation is the introduction of peer ratings of student responses. Students can rank responses of their peers along a 5-star scale, with more stars being given for better answers. Students become critics and rate the responses accordingly. Better responses will float to the top while those with little or no star ratings will sink to the bottom. In a sense, this peer rating process filters the quality of responses and helps the instructor to look at the top (i.e., generally well-received) and bottom (i.e., potentially problematic) of the heap for future reference and discussion points.

From the point of peer evaluation, students with better responses can, if desired, be rewarded with higher class participation assessment marks. This process of peer rating not only makes it easier for the instructor, but also for the class to identify the better responses, and perhaps suggest how some poor responses can be improved.

Students can also suffer from burn-out. This can arise if the student participates in many courses with strong learning activities. Sometimes, something gives, and the student might choose to participate more actively in a selection of his/her courses.

Supporting online learning

As with all technological systems, there must be confidence in the availability and quality of technical support. Much has been done in the University campus to ensure that online activities are delivered smoothly without due delay. The University has a robust infrastructure and network that can deal with heavy loads on the servers. However, there might still be some user-related issues in accessing the course material such as connectivity, browser or operating system compatibility. The University provides comprehensive support for both faculty and students. These include online help, phone support, and walk-in support.

Keeping the online lessons simple tends to reduce the number of potential problems that can arise. Most learning activities are text-based, requiring students to provide a text response after reading a question, viewing a video or looking at a diagram. The use of more sophisticated and advanced applications coupled with complex coding and scripting can sometimes lead to problems. In designing effective online content and activities, one should weigh function over form, and keep the design simple.

Confidence in the technology is also increased when instructors are familiar with it. Workshops to support instructors in the use of different software applications and tools to build online content and activities are conducted frequently.

Review content regularly

Information and technology have been evolving at a rapid pace since the World Wide Web was introduced in the mid 1990s. As online content is created and then re-used in semesters to come, feedback is gathered from students on the usefulness, effectiveness and ease of use of these learning activities. Faculty members can share ideas with each other on how to create good, sound, engaging and purposeful lessons.

Survey results

Surveys were done on the HELP model for pilot online courses in 2006-2008. These courses were done completely online without students coming to the campus. Video of the previous years' lectures were used to create the online course for the participating cohorts. The results are shown in Table I.

Average class size was about 50 students per course. Typically, for a semester, the postgraduate students are required to take five subjects of which four were done via F2F sessions, while their fifth was piloted as a totally online course. The class met just once at the beginning of the semester. At the end of the semester, students were required to take a paper examination just like their other subjects. In addition to the online learning activities, students also came online for synchronous sessions. Such sessions could have been formal and structured, while at least one was a free format "burning question" session in which questions raised by the students were discussed by the instructor.

There was strong broad agreement on the effectiveness of the HELP model. With a well designed course site (95 percent for Question 1), students generally found this approach beneficial, adequate and effective (over 75 percent for Questions 2, 4, 11). The infrastructure and robust system stability helped enhance the learning experience (over 80 percent for Questions 4, 7, 8). Support was also important especially for synchronized sessions (91 percent for Question 6) when students were remotely online and many were new to this mode of learning. There were some mixed responses regarding the differentiation of the online course and the F2F counterparts (66 percent for Question 9) with some (66 percent) attributing it to the lack of a personal touch (Question 10). Students (76 percent) enjoyed the flexibility (Question 11) and more than half said that they worked harder (perhaps, more participative) for the online course (Question 13). Overall satisfaction was high for the course, instructor and course content (over 80 percent for Questions 14, 15, 16) with 68 percent saying that they would be willing to do more online modules (Question 5).

Table I: Survey results of HELP model courses

Summary		M6102-M7102		M6426		EE6403	Average
No.	Question	2007	2008	2006	2007	2006	Agreed
		Agreed	Agreed	Agreed	Agreed	Agreed	
1	The course site is easy to use	94%	92%	100%	97%	94%	95%
2	This online course is a useful way to learn the target subject matter.	80%	62%	89%	89%	87%	81%
3	As a result of my experience with the course, I would like to take another distance education course in the future.	61%	50%	75%	76%	80%	68%
4	I am comfortable with electronic media to access course materials or complete assignments.	84%	77%	89%	95%	83%	86%
5	I would recommend this course to others.	73%	62%	89%	87%	89%	80%
6	I am satisfied with the support available for this course.	86%	90%	94%	97%	89%	91%
7	The online system is technically reliable.	80%	85%	86%	76%	83%	82%
8	The university provides satisfactory technological resources for me to complete this online course.	86%	94%	100%	94.6%	93%	94%
9	Distance education and lecture presentations can provide me with similar levels of information and experience.	61%	48%	69%	73%	80%	66%
10	Distance education course seems to lack a personal feel.	71%	79%	61%	65%	52%	66%
11	Distance education course is more flexible than a face-to-face course.	80%	69%	69%	87%	76%	76%
12	I can use the skills and knowledge learnt from this course on my job and real-world tasks.	88%	92%	89%	95%	91%	91%
13	I have worked harder for the distance education course than face-to-face traditional courses.	61%	83%	53%	62%	50%	62%
14	Overall, the course materials met my expectations.	90%	89%	83%	97%	85%	89%
15	Overall, the instructor(s) for this course met my expectations.	86%	83%	95%	95%	94%	91%
16	Overall I am satisfied with the distance education course.	73%	64%	86%	95%	89%	81%

Note: M6102-M7102: Advanced Materials Engineering;
M6426: Management of Technology and Information;
EE6403: Distributed Multimedia Systems

Conclusion

The use of technology for teaching and learning has certainly come a long way. With the introduction of keystone technologies like rich media, hyperlinks and the World Wide Web, the benefits to classrooms, teachers and students are clear to see.

In a similar trend, distance education also saw changes with the use of technology. From learning via correspondence, convergence resulted when the Internet became widely available. While these combined to bring learning and teaching supported by advances in technology, there arose the challenge of engagement and active learning in a networked environment.

Against this backdrop, NTU experimented with the HELP blended learning framework using LAMS and video recordings of lectures. Gen Y students familiar with cyberspace are now able to learn the course content and interact with classmates. Not only do they participate actively, the contributions of learners are open for all to see as fellow learners, reviewers and critics. Peer-to-peer learning occurs at a deep and wide level as students of similar levels of understanding share their understanding, knowledge and often, sympathetic support of fellow knowledge travellers. The HELP model has certainly enhanced the learning quality, outcomes and experiences of not only the students, but the instructors as well.

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The use of ICT for administration and management at the University of Hong Kong

Allan Yuen, Bob Fox and Jae Park[20]

Introduction

The impact of computer and Internet technologies on core operations as well as strategies of organizations has become more important, and the fast evolution of technologies demands a change of approach to corporate technology management (Applegate et al., 1999; Applegate et al., 2004). Using ICT in higher education administration is fundamentally about harnessing technology for better planning, setting standards, effecting change and monitoring results of institutional core functions. Thus, more and more universities are looking into developing ICT applications that can improve the quality and capacity of management to support strategic decision-making and policy implementation (UNESCO, 2009). In the midst of increased accountability, universities develop strategic plans and invest into ICT systems. This chapter explores the role of ICT in administration and management in higher education institutions using a case study approach on a single institution: The University of Hong Kong (HKU).[21]

Numerous studies of technology implementation in organizations in the 1950s were followed by a number of policies on information and communication technology (ICT) in education in many countries (Pelgrum et al., 1999; Yuen et al., 2010). The early 1970s were marked with higher education institutions' engagement in ICT-mediated administration and management in areas such as "student admission and records, examination results and transcripts, finance database, human resources database and management information" (UNESCO, 2009, p. 26). For example, Hosie (1995) describes a quality framework applicable to higher education and examines factors governing the acquisition, storage and retrieval of data pertinent to a human resource information system. He argues that a human resource information system enables an institution to format a profile of its staff in terms of strengths and weaknesses, and thus "the right people will be in the right place at the right time" (p. 35). McClea and Yen (2005) propose a framework for utilizing ICT in university admissions and seek to achieve the improvement in the general admissions process.

Over the years, HKU has developed a home-grown ICT system for general university administration and management. The system is decentralized and modular in data management, yet highly functional and user-friendly. Despite this, HKU is undertaking a major ICT system upgrade and migration to be completed

20 Faculty of Education, The University of Hong Kong.

21 HKU website: *http://www.hku.hk.*

in the 2010/2011 academic year. This new system will be fully functional by 2012, coinciding with the final phase of a major educational policy implementation in relation to the new senior secondary (NSS) curriculum and the four-year undergraduate curriculum reform in Hong Kong.[22]

This chapter offers a 'work in progress' narrative, with the main focus on the people and institutional requirements rather than on technical implementation details of an ICT system. The case study was guided by the following questions:

- What kinds of problems are being addressed?
- What are the issues encountered in solving them?
- What could be the criteria for successful implementation?
- What are the good practices of ICT-supported university management and administration systems?

ICT for administration and management in higher education

Universities are caught in a time of rapid political, socio-economic and technological change. The numerous internal and external pressures on them demand a careful examination of educational practices from a new perspective to face challenges that lie ahead in knowledge-based societies (Pittinsky, 2003). These pressures include a greater number and variety of higher education places without corresponding increases in funding (Phillips, 2005); a large population of learners from varied backgrounds, needs, motivations, abilities, learning preferences, time availability and course content requirements (Bates, 2000); a demand for more 'client' responsive and flexible courses (Ryan and Stedman, 2002; McInnis and Hartley, 2002); and the drive to use ICT in teaching and administration (Challis et al., 2005). In facing such challenges, higher education needs to rethink organizational structures, operational strategies, and policies appropriate for the ongoing digital age (Duderstadt, et al., 2002).

This case study focuses on two areas of ICT applications at HKU, namely, the student information system (SIS) and the human resource information system (HR IS) since these two systems interact and link with all other areas of administration and management in a tertiary institution. The SIS manages student data, providing capabilities for entering student records, assessment scores, and managing many other student-related data needs including student admissions. The HRIS (currently named the Human Capital Management (HCM) system) supports the processes, practices and needs of human resource functions, such as staff selection, recruitment and appointment, performance management, staff development, and career progression and development. The following topics, raised in related literature, are discussed in this case study, including history and development, rationale and benefits, planning and challenges, implementation strategies, cost analysis, and sustainability and further planning.

22 A change of the academic structure of senior secondary education from 2+2 to 3 years commenced in 2009, and first degree programmes in universities will change from 3 to 4 years in 2012 (Education Commission, 2000).

Case study background

Established in 1911, HKU is the oldest tertiary education institution in Hong Kong. HKU has been identified as a high ranking international university with over 20,000 students in 10 faculties (Architecture, Arts, Business & Economics, Dentistry, Education, Engineering, Law, Medicine, Science, and Social Sciences). Fifty-five per cent of the students are undergraduates and around 4,500 students are 'non-locals'[23] with 1,400 from countries outside Asia. The university has a long history of using technology for administration and management.

HKU has developed from a teaching to a research-oriented university. Its current mission and vision have undergone an evolutionary process and brought about adaptive strategies and changes. This case study of HKU was conducted to provide insights into practices and issues in administration and management. It takes an exploratory approach to case study (Stake, 1994). Its main aim is to learn from the rich and complex experiences of the administrators, teachers and students. Accordingly, the following data were collected: documents containing information about the institution and faculty background and history; documents about ICT implementation strategies and policies, resources and infrastructure; administration and management systems; and semi-structured interviews of stakeholders at various levels.

Major issues in the case study

The project of implementing a new SIS/HRIS started in 2007 to meet the demands of the new academic structure (the four-year undergraduate curriculum to be introduced in 2012). The new SIS was expected to be launched in 2010. As pointed out by a senior administrator, "With the advancement of ICT, we are able to offer much better service nowadays. In the past, students had to copy information by hand, their timetable, examination dates and so on. Now all this information will go into the student portal offering an all-in-one online solution." The same administrator outlined reasons for a new SIS:

> *"The old system was developed piecemeal and has been in place for more than 10 years. Although it still provides the services required, it's now starting to show major areas of weakness … The key decision was whether we should go for a new in-house-built system or to buy a ready-made system. We decided to go for a vendor solution. The reason why we did this was longer term sustainability and system upgrades into the future … If we continued with an in-house system, after a few years, we would need to develop new patches to satisfy changing needs … an in-house-built system (here and at other institutions too) usually pays little attention to documentation, and this is also our problem. Without detailed documentation, we currently rely on individual staff members but once these people leave, there will be problems … unlike a vendor system where everything is usually clearly documented.[24]"*

In tailoring systems to suit specific needs, not all internal changes made to the systems have been recorded in detail. This complicates matters further when new updates to the various systems are required and staff involved in the updates have either left the institution or changed roles within the organization or forgotten the changes they had made previously. While this has not created serious problems in the past, the new challenges outlined at the start of this chapter demand increased accountability that requires efficient links

23 'Non-local' – students whose home is outside Hong Kong.

24 All quotes in this chapter are kept anonymous.

between and across various systems. For example, in the new HCM system, this has resulted in a major rethink of how staff data are collected and shared within Human Resource and between Human Resource and other sections of the university. The rationale behind this major top-down decision made by HKU is that the new system should provide:

- A system that integrates all major sections of the university administration;
- The ability to streamline different processes and workflows and avoid duplication of data;
- The ability to easily share data across various sectors of the university, both academic and non-academic, human and financial, etc.;
- Improved efficiency and productivity;
- Improved tracking and forecasting;
- Lowering of costs by integrating systems and creating streamlined data input;
- Improved customer services; and
- Increased transparency in administrative processes.

To address these needs, the university chose an Enterprise Resource Planning (ERP) system, "a way to integrate the data and processes of an organization into one single system. Usually ERP systems will have many components including hardware and software. In order to achieve integration, most ERP systems use a unified database to store data for various functions found throughout the organization."[25] What was clear from the outset was that implementing a fully integrated ERP system would not be an easy task. ERP systems developed for general organizational purposes require a score of adaptations to meet the needs of a specific organization. This is particularly true in adapting ERP systems developed overseas into the highly specialized higher education environment in Hong Kong. As one project manager from HKU stated:

> *"When searching for appropriate ERP systems, most cannot handle Chinese characters … [nor] any Asian languages, so instantly … [those] systems were discarded. Other ERP systems reviewed were discarded because they had a small number of users, about 100 institutions around the world … and to maintain this product is very expensive … how can the system owners properly support these institutions … each with their own special adaptations."*

This in turn limits the choice of which system can be selected. Long-term planning and broad consultation both within and beyond the institution was recognized as essential. At HKU, "the process of investigating the new ERP system was initiated over two years ago … and the process will go on for another 18 months" the project manager stated. However, "all three research-led universities in Hong Kong have independently agreed to adopt a particular ERP system." Perhaps this can be explained because all three research-led universities have similar kinds of educational practices while "implementing ERP systems frequently requires organizations to change their existing business practices to fit the new system" (Yakovlev, 2002, p. 52).

25 http://www.tech-faq.com/erp.shtml, accessed August 2010.

The project: Use of ICT for administration and management

The following section describes an ongoing project of migration from an existing in-house built administration and management system to an ERP system at HKU with a focus on the SIS and HRIS.

Student information system

Since the academic year 1998-1999, HKU has introduced an online SIS named Student Connect. It provides real-time information regarding student registration, personal particulars, courses enrolment, and examination timetables. Once students are enrolled in the system, they can navigate through a series of screens to find the information they need. Figure 1 is the start-up screen of the system. Students are able to update their information whenever necessary on the Student Connect system without the need to fill and or submit any paper forms.

Figure 1: Start-up screen of Student Connect

Student Connect is an in-house system which is fully web-based. The development of Student Connect started in late 1997 and it was launched one year later. It was a result of the move from the British curriculum system to a credit-unit system. The first system modules were on registration and course enrolment. Other modules were added one by one. The Student Connect currently covers all the major activities from admission to graduation.

Student Connect also includes a student admission system that connects to and takes care of both Joint University Programmes Admissions System (JUPAS) and non-JUPAS[26] prospective students in their registration, enrolments, course selections, and other information related to academic advice. This system also calculates standard scores of the exams, analyses the results and manages the transcripts. In other words, it works from day one of the admission of the students to the day they receive their transcripts upon graduation, and includes the following services:

For prospective students

- Undergraduate admissions homepage;
- Preparatory guide for international students; and
- HKU maps.

For newly-admitted full-time undergraduates and postgraduates

- Halls and accommodation information and application for current students;
- Halls and accommodation information and application;
- Student records (e.g. transcripts, personal information);
- Student registration cards; and
- Certification and diplomas.

For faculty and staff

- Centrally timetabled classrooms (from Examinations Unit); and
- Links for faculty.

For graduates

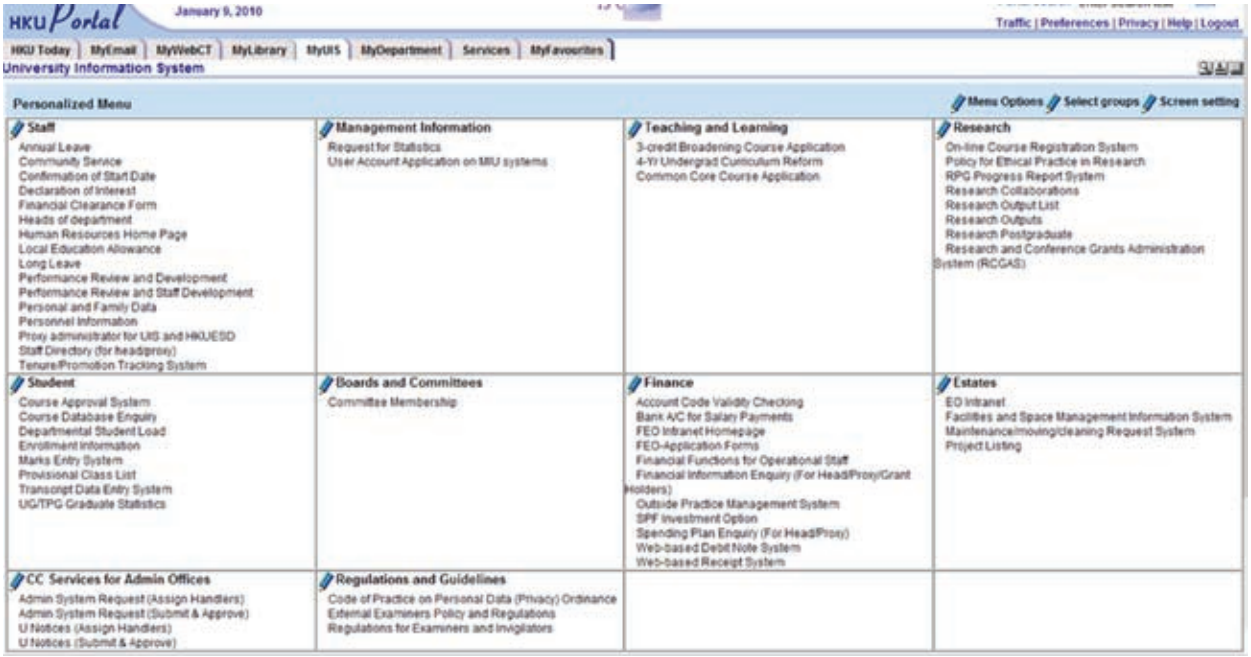
- Student records (e.g., transcripts, personal information); and
- Application for replacement of degree certificate.

26 The Hong Kong inter-university system of admission called Joint University Programmes Admissions System (JUPAS) was set up in 1990. For the 2008 exercise, 35,176 applicants registered in the JUPAS system from 478 secondary education centres. It has several modalities of application, namely, the Main Scheme, Self Recommendation Scheme, Early Admissions Scheme for Secondary Six Students (EAS) and Sub-system for School Principal's Nominations (Source: http://www.jupas.edu.hk/jupas/content_stat_application.htm#spn, accessed August 2010). Student intakes outside JUPAS are called non-JUPAS, inter alia, international applicants.

There are a number of functional modules accessed through the university web portal (see MyUIS in Figure 2) for administrative staff to use in handling academic/student matters, such as:

- Course approval system;
- Course database enquiry;
- Departmental student load;
- Enrolment information;
- Marks entry system;
- Provisional class list;
- Transcript data entry system; and
- Undergraduate/taught postgraduate graduate statistics.

Figure 2: HKU information system



Another development was the launch of a new online undergraduate admission system for mainland Chinese applicants developed in collaboration with the China Affairs Office.[27] This system has improved the operational efficiency of the China Affairs Office in handling student admissions. It provides a convenient platform for applicants to check their application status and interview details, agree to an interview, submit examination results and accept offers through the system. The system shortens the processing time for admission but also reduces the workload required in supporting the admission of mainland China students significantly. Positive feedback has been received from the China Affairs Office. Other systems and enhancements developed include the Student Exchange System for the Office of International Student Exchange,[28] new features to support the Academic Services Section[29] on JUPAS admission, a new

27 *http://www.tech-faq.com/erp.shtml*, accessed August 2010.China Affairs Office of Academic Liaison Section of Registry was established to maintain closer communications with Mainland China for student exchange, academic collaboration and cultural activities.

28 The Office of International Student Exchange is responsible for developing and enhancing international relations with overseas institutions by establishing joint student mobility programmes and through other academic collaboration.

29 Academic Services of the Registry includes two major sections: the Academic Development and Quality Assurance Section and the Academic Support and Admissions Section.

system to monitor the intake for the taught postgraduate curriculum, new services for issuing certificates of graduation, expediting the reactivation of the Student Connect service when suspended because of outstanding payments, and modification of the Student Connect system to change the second login requirement as an option.

The current Student Connect system is mainly a group of related web-based applications for student administration but they are not totally integrated. In light of the changes expected to arise from the curriculum reforms, and recognizing the importance of ICT in supporting student administration operations, the university decided to look for an ERP solution to replace the current legacy systems. As stated in the SIS and HCM project website,[30] the new SIS is expected to provide the university with benefits including:

- Better support for curriculum changes. For example, SIS will provide better guidance to students for course selection.
- Better integration between functions within the SIS, and between administrative sections of the university which will help to improve efficiency and eliminate errors.
- Comprehensive reporting and timely availability of management information.
- Improved accessibility to information. With the new system all authorized users will be able to access relevant information online.
- Better support for students, including the availability of student self-service. For example, the new system will provide more course information to students, such as lecture venues, learning outcomes, and assessment methods. Students will also be able to view online or print their own unofficial academic transcript and debit notes from the university.
- Easier system maintenance and upgrade, due to use of a packaged software product.

Human capital management system

HKU employs around 6,500 full-time staff (about 1,000 teachers, 2,000 academic-related staff, and 3,500 non-academic staff inclusive of technical staff supporting the research and teaching functions). In addition, over 6,000 visiting scholars and part-time staff with written contracts are employed annually. All require processing through the university's Human Resource section.

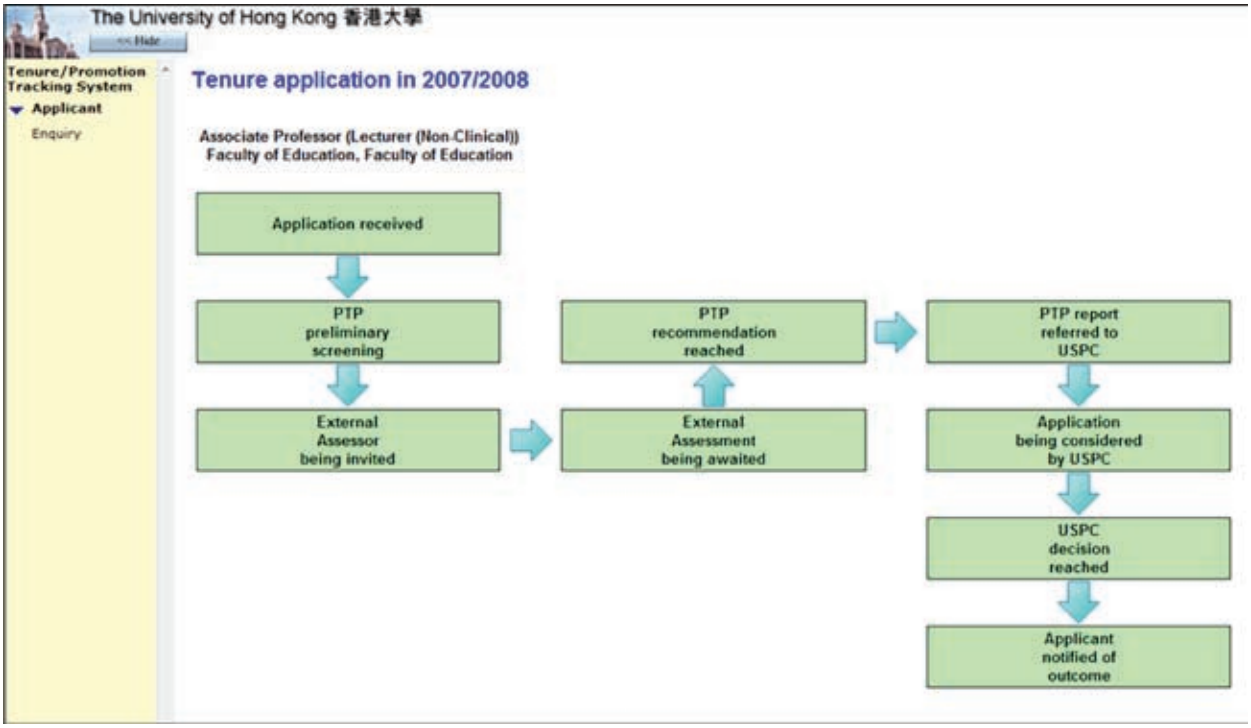
Human Resource at HKU, like similar sections in other universities, has primary responsibility for dealing with recruitment and retention, career progression (including tenure/substantiation, promotion), employee relations, contractual agreements, record-keeping of personnel documents, leave arrangements, reward systems, employee benefits and compensation, confidential advice in relation to problems at work, competency mapping of individuals, and performance appraisal. The section is divided into three units: Appointments, Personnel and Staff Development.

Management in human resources is concerned with the process of getting things done as effectively and efficiently as possible with and through people, applying equal opportunity principles in all human resource policies to achieve the objectives of the university. Increasingly, Human Resource is called on to contribute to cross institutional strategic initiatives and policies that have a more cohesive impact on the organization's operation and future planning. This demands a more coordinated, integrated and shared system that enables different and selected stakeholders across the university to access human resource data and knowledge.

30 SIS and HCM project website (*http://www.hku.hk/reserved_2/sisandhcm/*), accessed August 2010.

This section on Human Resource outlines some weaknesses of the existing systems and explores the challenges and potential benefits of developing an integrated cross-university system. HKU's HCM has evolved based on different demands that have required the development of information systems to cater for immediate and specific needs. For example, the establishment of the Tenure and Promotion Tracking system enables the review committees and selected internal staff to identify where applications are in the review process (see Figure 3). This process normally takes around 12 months to complete. Access to these systems is available via a centralized university portal system (*https://hkuportal.hku.hk/login.html*). Figure 3 also gives an example of the information system individual staff have access to, showing the variety available.

Figure 3: Tenure and promotion tracking



Application received on	02/11/2007
All application materials received on	02/11/2007
PTP screening date	13/12/2007
External assessment	Yes
No. of reports received	7
PTP meeting/circulation date	22/05/2008
USPC referral date	27/05/2008
PTP report received by HRS on	27/05/2008
USPC circulation date	27/05/2008
USPC decision	Tenure approved
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The development of new systems has been a mix of in-house and 'buy-in', employing outside experts as needed to help establish new systems, which are then handed over to in-house staff who often need to

adapt these systems over time to suit tailored and niche needs. Demands from Human Resource clients have led to pressures for improvements to the systems. This in turn has resulted in ad hoc developments and improvements driven by bottom-up demands with limited holistic planning for future demands or requirements for more integrated systems. Unfortunately, ending up with discrete databases that do not link to each other only complicate matters, as noted by one administrator:

> "… when faculties recruit new staff, they contact us [Human Resource]. We provide the forms and processes necessary … this includes contacting the finance section to ensure departments have sufficient funds to cover staffing costs for the duration of the contract. …there's normally some to-ing and fro-ing before we can confirm arrangements. …this all takes time, staffing and effort. … we need to streamline the process."

Thus, the new HCM project is intended to provide the university with long-term sustainable benefits. The benefits and how they will be achieved are summarized in Table 1.

Table 1: Benefits of the HCM system

Benefits	How will these benefits be achieved?
1. Improve the efficiency of the HR and Finance and Enterprises Office (FEO) operation and minimize errors	• Introduce staff self-service capability • Eliminate duplicate handling of data • Data are captured and verified at source with inbuilt data validation tools • Well integrated and supports interfaces to other applications at the university
2. Improve quality and timeliness of HR, budgeting and payroll management and operational information and reporting	• All data are maintained in a single integrated and trusted database for use by all applications • Inbuilt data validation techniques • Easy and ready reporting
3. Apply best practice operations, now and into the future	• A packaged solution that will keep pace with industry's best practice and is easy to maintain now and in the future
4. Improve transparency, user experience and understanding	• Information provided by the system will be accurate, relevant and readily accessible • The interaction between HR and FEO will appear seamless to the user of HR services • More self-service functions will be available to managers, staff members and job applicants
5. Reduce the use, physical flow and storage of paper	• Hard copies will be eliminated and replaced by computer-generated email notifications • Benefits applications can be submitted and handled online • The electronic database that captures personal and employment records can be easily accessed by authorized persons

Needs assessment

The focus of development related to Academic Services during the year 2007-2008 was the SIS Project for the four-year undergraduate curriculum. A project team was formed in mid-2007 comprising representatives from the Registry and Computer Centre. Development during 2007-2008 was concentrated on the tendering and evaluation process of the project.

In 2007, the project team explored key options, namely to upgrade the existing Student Connect and to identify an ERP product from the market. The team visited several universities in the USA and attended presentations of various ERP products. Three main ERP products were reviewed: two from the USA (Oracle's PeopleSoft[31] and SunGard's Banner[32]) and one from Germany (SAP[33]). As an initial observation, it was considered that PeopleSoft is more appropriate for research-led universities and Banner is more for American colleges, whereas the SAP appears less popular amongst academic institutions.

A request for information was issued to the three selected vendors – SAP, Oracle and SunGard – in November 2007. The vendors were asked to provide details on the following: a general description of the proposed solution, a proposed implementation schedule, advice on the staffing for the project implementation, and indicative information on licensing and costs. The responses were studied by the HKU project steering group and an official tender document was prepared. After evaluation and deliberation, the university decided to adopt an ERP product and chose PeopleSoft.

Three universities in Hong Kong have adopted PeopleSoft, including HKU, whereas four other universities are using the Banner system. As one HKU administrator noted:

> "It is mainly the type of data management that's important … the more teaching-oriented a university is, the less the amount and complexities in information management. PeopleSoft appears as the only available worldwide solution for research-led universities at the moment..."

The administrators thought they would "run the two systems, the old and the new in parallel. The old system may be considered as a backup and offer a contingency plan … just in case..." However, all three vendors advised that running two parallel systems would not work well:

> "It is not possible to run two systems in parallel as the database will become 'confused'. You can test, clean and if you are confident you can move into the new system, but you cannot have the real data in two systems at the same time."

31 Oracle's "PeopleSoft Enterprise campus solutions" is a comprehensive suite of software specifically designed for the changing needs of higher education institutions. PeopleSoft Enterprise campus solutions is the world's leading student system and alumni development solution for higher education and is being used at over 800 campuses in more than 20 countries, *http://www.oracle.com/applications/peoplesoft/.*

32 SunGard's "Banner® Unified Digital Campus" is the world's most widely used collegiate administrative suite of student, financial aid, finance, human resources, and advancement systems. It is a tightly integrated suite of proven, scalable, enterprise-wide applications on a single database, designed to support institutions of all sizes and types. Banner runs on the Oracle RDBMS, *http://www.sungardhe.com/.*

33 Headquartered in Walldorf, Germany, SAP is the world's largest business software company. The SAP ERP application supports the essential functions of business processes and operations, *http://www.sap.com/.*

Project management and impact

"Project management is very tedious but we need to pay a lot of attention to it," commented by a senior administrator. A steering group comprising senior administrators from the Computer Centre and the Registry Academic Services Section was formed. The group was supervised by a task force from the university senior management.

The university issued a tender document in April 2008. The project group had not only studied the options for about one year, but they had employed an external consultant, Oakton,[34] to evaluate the available products. When the university made the decision to go for PeopleSoft, the same consultant was appointed, through a tendering process, to perform 'health-checks' on the project development from time-to-time. The consultancy work has proceeded slowly but with rigour to ensure progress. As one of the steering group members indicated: "This consultant said that the frequency of the steering committee's meeting every 4-6 weeks is not enough. We now meet monthly. Later, the consultant said that in a more advanced stage, a monthly meeting won't be enough. More meetings will be needed. There are a lot of demands in reporting; they measure the progress compared with the original schedule."

Employing the services of an external consulting company makes the processes more transparent besides their responsibility in alerting the university to possible problems in the planning and implementation of the project. The cost of human resources is a major issue. Budget control is therefore a priority and risk management plans need to be in place. As in most cases, major changes to any systems that are likely to affect end-users need to be managed carefully to minimize unrealistic expectations or negative responses. Users will also need to be reassured of minimal technical glitches or downtime during the transition period. This means input and feedback from users, particularly staff and students, will have to be sought and incorporated right from the beginning to ensure that the new system will be able to meet their needs, or is flexible enough to be adapted to do so.

Challenges

Oracle has sent a large number of people to work on the new ERP project since this is quite a new type of challenge for them. The complexity of the new system's development also creates challenges to the university administration because the ERP system means more than mere a technical change; it also requires a change in concept as well as administrative and academic practices. For example, faculty staff have their own unique ways of grading which do not conform to the grading system embedded in PeopleSoft. Clearly a solution will have to be worked out to resolve the differences. As a short-term measure, HKU's Marks Entry System (MES) will still be in effect as the new interface is being developed. Similarly, the Learning Management System (LMS) will need to be compatible to common devises such as the Blackboard or WebCT.

Critically, the new SIS implementation will affect the practices of the campus community including students, teaching staff and administrative staff. As summarized in the SIS project website, students will enjoy a new self-service portal that organizes online services available to them. Since the new SIS is entirely browser-based, students will be able to access information and services more efficiently from any internet-

34 Oakton is one of Australia's leading technology and business consulting services companies. For over 20 years Oakton has delivered IT strategy, solutions design, custom development, packaged software implementation, information management and system integration solutions. They also fully manage their clients' operational systems. With over 1,150 employees, Oakton has offices in Melbourne, Sydney, Canberra, Brisbane and Hyderabad (India), *http://www.oakton.com.au/.*

connected computer. In addition to being able to enter students' grades online, teaching staff will also be able to pull rosters for their classes during the semester and during various registration cycles using their browser. Teaching staff will also be able to access the relevant academic records of their students. Administrative staff will be able to get data more accurately. They will receive training to learn to use the sophisticated integrated databases in the ERP system to extract the necessary data from other systems. Training will roll out before each new functionality is needed, with opportunities for administrative staff to experiment with the software from their own desktop, view online documentation, call for support, or to refer to manuals and job aids.

However, the new system will not be fully automatic and staff may be required to tweak parts of the system to meet their individual needs. For example, a timetabling system will not be available. Instead, Oracle will provide an interface that is compatible with other commercial products. Document management is another area that the ERP cannot handle and solutions must be found for this crucial function. Another major concern is the high cost for creating the ERP system, not just for the system itself, but also for the numerous consultations among the various stakeholders and implementation process. Furthermore, implementing the new ERP system will require significant changes to work practices. Staff will need to be re-trained and new staff employed to take up positions that HKU does not currently hold. Other key management, administrative, financial and technical staff will have to be involved over and above their regular responsibilities to ensure a smooth transition and to increase their sense of ownership in the project.

The change process occurring within the Human Resource section also needs to be considered in its relationship with partner administration sections, such as the Finance Office and the Computer Centre. The additional online services and automation provided by the new HCM system will ease the workload of Finance Office staff, improve their efficiency and increase the accuracy of financial information. The Computer Centre staff are expected to be even more intensely involved in the implementation of the HCM system. For example, the Administrative Application Team will have to work on the system design, data conversion, data verification, user acceptance tests, stress tests, system integration; interface with legacy systems; and assist users in data cleansing. The Infrastructure and Operations Team will be required to monitor and support additional servers, storage and network hardware and there will be added demands on the helpdesk service during rollout of the HCM system.

The system vendors have from the beginning stated that adaptations should be avoided. The strength of the system is standardization. This allows for straightforward updating and upgrading through the years. The impact of this standardization requires staff to be un-skilled before being re-skilled on new processes and practices. The requirement to accept the system as it is and not allowing customization has resulted in a degree of discontent among some staff members. This tension between standardization and customization does raise a major concern about 'fit-for-purpose.' What is appropriate in one organization is not necessarily appropriate in another. To what extent should higher education institutions fit the same mould and follow exactly the same process, especially as the process is developed in one culture and being adopted by another?

Future plan

The ERP project entails considerable concerns for the future. The first is staffing. The university has established a team for the new SIS/HRIS who will be responsible for learning the necessary skills to operate

the system. The initial thought is for this team to exist until the system is set up. However in view of the vendor's high after-service charges, it may be more cost-effective to keep the team to provide after-service support.

The second concern is about the number of users and system capacity. Ten years ago students were allowed to register online for the first time. Since the number of students who owned personal computers at that time was still manageable, the system was able to keep up with the number of online registrations. However, the popularity of the service exceeded the university's expectation and on one occasion the system collapsed when the university underestimated its capacity. The university then devised a roster to allow the students to register at different times. Similarly, when the Hong Kong Examinations and Assessment Authority results are announced, the JUPAS Office offers JUPAS applicants who wish to make changes to their programme choices, different time slots. This is a common practice among all Hong Kong higher education institutions. The rapid development of technology and access to ICT will not decrease in the future. This means that the new system must be robust enough to handle the continuing and increasing demands.

The third concern is about the future development of the SIS. The charges for post-installation service will be by headcount. For the time being, alumni service is not included because the vendor will charge per one alumni login. The university therefore, needs to define the future scope of the SIS services.

Recent development of the SIS and HCM projects

The SIS and HCM systems were introduced in phases to be operational in 2010. The formal project website was launched in June 2010 (Figure 4).

Figure 4: SIS and HCM project website

The SIS project development consists of two phases. The objective of phase 1 (March 2009-October 2010) was to replace the existing home-grown systems with PeopleSoft Campus Solutions to provide the required ICT structure for the new 3-year curriculum to be introduced in 2010-2011. The scope of phase 1 includes the implementation of the following functions: academic structure, campus community, admissions, curriculum management, student records and enrolment, gradebook, transcript, student financials, self service, and class and examination scheduling. The scope and detailed requirements for phase 2 (2010–2012) will be focused on enhancing the new SIS following its initial launch in 2010, and on the development of new functions required for the new 4-year curriculum to be introduced in 2012 to 2013. The HCM system was also implemented in two phases. Phase 1 go-live for the new software was planned for late 2010. Phase 2, scheduled to be launched in early 2011, will add online recruitment, staff development, decentralization of financial clearance for prescribed types of staff and additional management reports.

Discussion

HKU is undergoing a major ICT-supported administration and management system upgrade in the midst of a major education reform in Hong Kong. The most significant aspect of this reform is the extended length of undergraduate studies from three to four years, which implies an increased number of students, courses and teaching and administrative staff. In response to such changes, a new ERP system was chosen and is being implemented, which brings about organizational changes to the university.

Change process

The data collected in this study indicate that not only technological tools and corresponding skills will experience changes but so will the assumptions and modus operandi of the university administration and management with consequences in the organizational culture and learning. According to Argyris and Schön (1978), the changes to be counted as organizational learning involve challenges of staff assumptions and values that underpin the organizational practices ('double-loop learning') and not just change in surface level practices ('single-loop learning'). Single-loop learning does not question underlying assumptions. It refers to organizational adaptation or making a short-term response to an emergent problem. Double-loop learning tackles basic assumptions and beliefs, and it involves developing a deeper appreciation and alternative perspectives on the problem. There is no doubt that all Student Connect end-users at HKU have been through a double-loop learning. However, these organizational learning processes were not integrated since they were clustered by system modules and administrative offices unlike the new ERP system that will demand more 'abrupt' organizational learning. Attached side effects could be bigger but they are rather unpredictable at the current stage. Students would possibly be the least affected group compared to the teaching and administrative staff. Administrative staff will continue to carry the heaviest burden during the change given their critical role in providing services and supporting the university community.

Change management

HKU's migration from an in-house system to an ERP system can also be seen as a higher education institution's struggle for survival in the context of globalization which includes cultural, economic, political and technological dimensions and where technology itself is one of the determining elements of time and space of globalization (Hopkins, 2002). Hong Kong has been centrally involved in globalization given its geographical, cultural and historical loci that link the West with East; and fulfilling a dominant role within a regionally developing globalized Asia. However, Hong Kong and HKU cannot rest on their laurels. A commonly expressed belief in the strategic management literature is that 'organizations do learn and adapt and that this enhances the organization's ability to survive' (Fiol and Lyles, 1985, p. 808). HKU has been constantly adjusting and evolving in an era of fast changes and globalization.

The last decade has seen rapid expansion in the HKU student population, from 14,848 (academic year 1997/1998) to 20,834 in 2010, a 40 percent increase in absolute numbers. Internationalization of the student population mirrors globalization with an increase in non-local students growing from 11 percent to 21 percent in the same period. The increasing student population, internationalization across campus and especially HKU's research-oriented mission and vision can be regarded as the chief reasons for choosing an ERP system. Proof of this is that all instruction-oriented Hong Kong universities are using Banner, whereas all research-oriented universities will be using PeopleSoft which offers comprehensive communication among modules on the local network.

Innovation adoption

Laudon and Laudon (1998) summarize four types of organizational change enabled by ICT in the business sector, namely, automation, rationalization, re-engineering and paradigm shift. They are also applicable in the case of the new ERP system for HKU. Paradigm shifts, especially those related to organizational culture and ways of operating administration and management will be substantially modified.

Regarding the type of technologies adopted by institutions, Christensen (1997) calls sustaining technologies those that improve the performance of established products along the dimensions of performance that mainstream customers have historically valued. Christensen also describes his concept of disruptive technologies which occur when an institution driven solely by satisfying customers' current needs, fails to adapt or adopt new technologies that will meet customers' unstated or future needs. Obviously, predicting the future and guessing the tacit needs of end-users is not an easy thing to do. However, one of the most interesting findings of this case study is a blending of top-down decision making with bottom-up implementation processes. Politely urged by the University Grants Council, which also granted funding for the external consultancy, the HKU senior management collegial body performed a rational decision-making process on two issues: (1) opting for a commercial system instead of continuing with an in-house-built system despite the fact that the latter had a high standard of functionality; and (2) choosing a specific ERP system over all other existing systems.

Change and sustainability

Seen from the end-users' perspective, such decision-making could be perceived as a top-down model without any public consultation. However, transparency and rationality were always in place from decision-making process to contract management and implementation. Collegial and collaborative work of an ad hoc team composed of HKU staff and experts from the vendor's company, has been monitored by an external consulting company during pre-tendering and implementation dispelling all negative notions usually linked to any top-down decision-making process. Furthermore, the ongoing implementation phase is increasingly a bottom-up approach in terms of gathering end-users' experience backed by a testing period in which all the faculties will have a hands-on say.

As for possible contingencies and their solutions, most of the management staff interviewed for this study feel that the high expectations of end-users is the most imposing and crucial challenge for sustainability. They felt that HKU end-users are too used to the advantages of the in-house-built ICT system, and may not welcome any change that could bring a disruption to their routines. Leskes (2003) argues that fundamental and sustainable change is possible given the right combination of vision, compromise and commitment. Similarly, an integration of three drivers is clearly demonstrated in all the cases. They are: (1) vision and mission, (2) commitment and enthusiasm, and (3) external resource and support. All of these are being handled and moving forward in the case of the new ERP system at HKU. It is always easier to find a remedy or palliative to a predicted liability than to solve an unexpected problem nobody can be certain about at this stage.

Recommendations

The implementation of the ERP software project can be daunting for higher education institutions. Based on the HKU's case study, here are some recommendations:

- ERP system implementation projects are complex and expensive, thus resource commitment and availability of budget, time, and expertise are crucial.
- The institution should retain ownership of the implementation process if the development of the ERP project is outsourced. Responsibility for ERP project implementation should be shared by the internal information technology unit and functional administrative units where the system is being implemented, and an ad hoc project management team as well as a full-time project manager should be ensured.
- An ERP project needs to be planned up front to reduce the risk of sizable unplanned efforts and costs. Professional external consultants can help to minimize such contingencies.
- Identify where your institution is, where it wants to go and how it is going to get there. This includes understanding your institution's strengths, weaknesses and core competencies, as well as the areas you want to improve. When a new institution is just starting out and firm processes do not yet exist, it would be more appropriate to begin with an ERP system as a way to structure operational processes. However, it would be a challenge for a comparatively well-established institution to adopt an ERP system.
- Identify a clear rationale for adopting an ERP solution and when it should be implemented. For

example, research-focused and teaching-focused universities would consider a different ERP solution and their approach to centralizing and decentralizing aspects of the ERP system maintenance and application services can vary substantially.

- As an ERP system is meant to facilitate the work of leadership and foster appropriate governance, ERP projects should be endorsed by the senior management of the institution, which should remain actively involved throughout the project implementation.
- The institution should enforce an adequate policy on customization and have a comprehensive and effective staff development programme. Employees of different departments should receive training on how to work as a team on the project implementation. Ensuring change management and fostering a culture of change is crucial to any ERP system implementation project.
- The institution should establish key performance indicators to carry out post-implementation measurements to ensure sustainability of the ERP system implementation

Conclusions

In business, making changes is typically done through techniques of business process re-engineering, which often involve radical redesign and improvement (Pearlson and Saunders, 2004). ERP systems are large information systems that provide the core functions needed to run a business and, not surprisingly, they are widely used by large corporations around the world. These systems have been a familiar part of ICT-mediated administration and management environments for years, yet institutions still spend a lot of resources on them.

Universities have also turned to ERP as a means of replacing existing management and administrative computer systems (Pollock and Cornford, 2004). "While higher education uptake of these ERP add-ons has been modest, rising student expectations and increasing recruiting competition may drive more institutions to invest in getting strategic value out of ERP data that are now usually oriented toward purely transactional use" (Allison et al., 2008, p. 20). However, the ERP implementation at HKU clearly goes beyond mere "transactional use" and aims to meet the challenges of education reforms, innovation adaptation and sustainability. As reiterated in the message from the Deputy Vice-Chancellor on the SIS and HCM project website: "Although our existing systems have served us well for many years, they cannot readily and economically take us into the future and support the kind of university reforms we foresee. We therefore decided that it was in the best interest of the university to acquire and implement new generation information systems."

This study shows that the selection and evaluation of a new ERP system is critical and complex. The task of defining the needs and making the final decision are collective processes in which both the institution's senior management and stakeholders have to play their part.

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The adoption and use of ICT in management and technical education in Indian Institute of Management, Calcutta, India

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Higher education in India

Higher education institutions (HEIs) create, store and disseminate knowledge. They differ from primary, secondary and higher-secondary bodies in one principal way. The quality and efficiency of pre-tertiary institutions dictate the average level of education in a country by imparting general education among the populace as widely as possible. HEIs, on the other hand, focus on specialized learning by nature. They create, consume and share information at the cutting edge. This asymmetry in focus is a key to understanding the respective roles of pre-tertiary and tertiary education in a nation's growth and development. Pre-tertiary education systems are designed to create a level playing field for citizens so that they can participate in every aspect of a modern society. HEIs go beyond that by charting the roadmap of societal development. They act as incubators of industrial strength, socio-economic strategies, and artistic growth.

While the principal aims of these levels of education are broadly different, they should not be considered to be mutually exclusive. On the contrary, a good tertiary education system is built only by using the levels preceding it as foundations and building blocks. There must also be a feedback loop from tertiary to pre-tertiary levels through the development and diffusion of newer content and teaching tools to create a dynamic whole. The entire system not only creates the mass of human capital which determines how well a country measures up on a global developmental scale, but also the direction of its movement on that scale in the future.

To understand India's education system, especially its higher education, one must view it through the lens of its colonial history. Before consolidation under British Rule, India's education system was highly fragmented. There was no uniformity of language, content and standards. Indeed, there is no record that the concept of "curriculum", as we commonly understand it, existed. Basic education was localized and focused overwhelmingly on what may be deemed theology and the classics. This was a simple continuation of the individualized teacher/student learning tradition which can be traced back for millennia. In essence, there was no education "system" per se.

35 Indian Institute of Management, Calcutta. The author thanks Rajeev Kumar, Manju Jaiswall, Jacob Vayyakil, Manish Thakur, Runa Sarkar, Somprakash Bandyopadhyay and Raghavendra Chattopadhyay and Venkata Kishore Ayyadevara at IIMC; P. Vigneswara Ilavarasan, Manoranjan Mishra and Aaditeshwar Seth at IITD; Swati Bhattacharyya and Mr. Bibhooti Sahoo, in charge of the library systems respectively at IIMC and IITD for their contribution and assistance.

After India came under the British Crown, administration of a vast country proved to be a challenge for the rulers from overseas. The need was great for the creation of a corps of secondary administrators under the direct supervision of British nationals, and this was the reason behind the origin and subsequent growth of the peculiarly lopsided Indian education structure. British Indian education was not geared towards the social welfare ends of the recipients of that education; rather it was to facilitate the smooth administration of the country. The emphasis was thus on a small and selective higher education, rather than a broad-based and organic education system.

There was no radical overhaul of this structure after India gained independence from British rule, and similarly no redirection of focus at a grand level. The structure largely remained as of old, with one noteworthy feature which remains peculiar to India and South Asia. This is the structure in which geographically separated undergraduate "colleges" enrol students under a single regional university in a structure of "affiliation." Thus, colleges cannot grant degrees on their own, but instead grant them on behalf of the university to which they are affiliated.[36] In addition to full-fledged universities, there are some HEIs which are recognized as "deemed universities" by the Government of India. These are entities which have been granted this status in recognition of growth in enrolment and quality.

Only HEIs recognized by the University Grants Commission (UGC) are authorized to award degrees to graduating students. An idiosyncratic feature of the higher education system is that some HEIs are entitled to award diplomas which are nevertheless recognized to be, in most cases, equivalent to degrees. The most famous of these are those granted by the Indian Institutes of Management (IIMs). The peculiarity lies in the graduating students not being awarded the distinctions of higher education that are universally bestowed in less constrained systems. For instance, the graduates of the doctoral programme at IIMs cannot use the moniker "Ph.D." but are instead known as "Fellows".[37]

Another interesting entity in the Indian higher education space which can be regarded as a natural precursor of many of the ongoing and envisioned information and communication technology (ICT)-based initiatives is the Indira Gandhi National Open University (IGNOU). It was set up in 1985 by an act of the Indian Parliament. The social mandate was explicit from its very inception, as is reflected in its high enrolment of nearly 1.8 million students.[38] More interesting was the explicit consideration of any and all means of communications for the diffusion of higher education in a vast country. Section 4 of the Act, *Objects of the University, states*: "The objects of the University shall be to advance and disseminate learning and knowledge by a diversity of means, including the use of any communication technology, to provide opportunities for higher education to a larger segment of the population…" (IGNOU, 1985). This makes IGNOU the first university in the country to emphasize the use of communication tools to enhance student learning.

ICT and higher education institutions

India displays a sharp dichotomy in the adoption and use of ICT. On the one hand it has not kept up with the developmental expectations, with continuing high levels of poverty and illiteracy. It ranked 134th among 182 countries according to UNDP's Human Development Index (HDI) in 2009, rising to 121st out of 169 countries in 2010 (UNDP, 2009 and 2010). Its population is largely rural, a factor that has limited the manufacturing human resource base. Yet its prowess in ICT, more specifically in software services, is the

36 For a detailed discussion, see Agarwal (2007), Chapter 7.

37 Interestingly, this leads to the situation in which any university under the UGC system can refuse to recognize the IIM Fellows during faculty recruitment, although these latter people easily outrank the Ph.Ds. of the latter in academic prestige.

38 IGNOU: A brief profile. *http://www.ignou.ac.in/aboutus/ignoubrief.htm*, accessed in January 2010.

envy of the world. The country faces the challenge of leveraging these strengths to bolster other economic and social sectors.

India's higher education system reflects this paradox. As a whole, it suffers from poor funding and allocation of resources, coupled by an inadequately trained and unmotivated teaching staff. The emphasis of rote-learning at pre-tertiary levels largely carries over to HEI environments as well. In spite of this, the scientific, technical and managerial graduates of Indian HEIs are much sought after internationally. It is difficult to explain such extreme divergence in input and output for a single country.

The mission of HEIs is the creation, storage and dissemination of knowledge. ICT is in many ways the perfect supporting vehicle for that end. Being a stable or emerging high-end technology, it meshes well with the position of HEIs as apex points of learning. Since ICT is a means of storing, processing and channelling data or information, it is ideally placed to act as central nervous systems for HEIs. Colleges and universities in the richer nations have made the transition to use ICT in a smooth and incremental manner. This has been possible because of the excellent linkages that HEIs in these countries maintain with industrial and global technological developments, in addition to the greater purchasing power that they have. Those in the poorer countries have had to, and are still climbing, a much steeper learning curve. However, since ICT is a networking technology which displays significant positive externalities, it has the potential to generate disproportionately higher gains in poorer nations.

The Ministry of Human Resources Development (MHRD), which oversees all plans and policies in education in India, is publicly placing considerable emphasis on ICT for remedying the historical deficiencies in the nation's education system. It has published a lengthy mission document which underlines the need for the application of ICT in the education sector and discusses the options available for the country to become a knowledge super power (MHRD, 2009). Among the inherent weaknesses it identifies in the current educational realities are "opportunities lost because of difficult access to information and guidance," "questionable quality of teaching at various places," "a lack of access to institutions," "time mismatch between school hours and employment hours for those learners who have to simultaneously earn the livelihood for their families" and "the lack of a strong contingent of motivated teachers."[39]

Although the report does not mention these weaknesses as being endemic only in higher education, it can be argued that their magnitude would probably be higher at the tertiary levels. For example, educators of a high calibre are a scarce resource for universities, and each faculty member can possibly only teach a relatively small number of students in a traditional classroom setting. This would mean that even if the demand for higher education in the country was high, it could not be met through brick-and-mortar campuses. Similarly, one major problem with adult education is the trade-off between earning and learning, since working adults cannot find the time to attend classes because these invariably overlap with normal business hours.

In this context, ICT has the potential to mitigate and overcome many of the traditional problems and barriers to make higher education more universal and equitable. One of the first documents which highlighted this came out of a 1996 workshop by the National Science Foundation in the USA (NSF, 1998). Although the report focuses on undergraduate scientific and technical education, some of its conclusions are equally applicable to other subjects and to general tertiary education. Among these are better and more interactive learning relationships between students and faculty, rapid creation and sharing of material, and better collaboration across disciplines, locations and cultures.[40]

39 MHRD (2009, pp. 6-7), the full list of weaknesses and strengths is included in Appendix A.

40 NSF (1998, p.1).

Background information on Indian Institutes of Technology and Institutes of Management

A crucial reason behind India's technical and managerial prowess is undoubtedly the two networks which are readily known by their acronyms. The Indian Institutes of Technology (IITs) and the Indian Institutes of Management (IIMs) were originally set up to provide the backbone human resources needed for the country's development. They are highly competitive, attracting and accepting the best and brightest of the nation's students.

The IIT system was envisioned after India attained independence in 1947 as the incubator of national scientific and technological development, in line with the socialistic path chalked out by the young country's planners. The first one was set up in 1951 at Kharagpur. At present, the IIT system consists of 15 autonomous institutions loosely coordinated by an IIT Council.[41]

Like the IITs, the IIMs were also set up by the Indian government. Their aim is to create high quality managerial human capital in line with the overall business and social development of the nation. Unlike the IITs, they fall under the "equivalent to universities" category, and their graduating certifications are called diplomas instead of degrees. The seven institutes comprising the IIM system are physically located at Calcutta, Ahmedabad, Bangalore, Lucknow, Kozhikode, Indore and Shillong. Typically they offer all or a subset of programmes in postgraduate management education (including doctoral programmes), executive programmes, consulting operations for the private and public sectors, distance education modules, as well as training which can be both generic or structured individually to clients' requirements.

At present, the IITs and IIMs face two major conflicting challenges. First, because of the insulated nature of India's developmental path since independence as well as excessive reliance on the government in financial and administrative matters, their infrastructure and intellectual capital have fallen behind world-class institutions in other countries. Secondly, they have not been able to balance their twin mandates of elitism and contributing to mass development. Overall, whatever the human capital they have generated has tended to remain concentrated among a small minority of people. In effect, they do indeed act as intellectual leaders for the rest of the country's HEIs, but there is a vast distance between the leaders and the led. It is hoped that ICT can remedy both deficiencies.

ICT infrastructure and knowledge management at IIMC

For a HEI located in one of the biggest cities in India, the Indian Institute of Management, Calcutta (IIMC) has a fairly large campus of approximately 130 acres. Spread across the campus are several student hostels, academic and administrative buildings, power generation facilities and faculty quarters. The setting demands a dedicated team of professionals to provide and maintain good ICT resources.

The ICT environment on campus has multiple layers. At the simplest level are the computers and related hardware in faculty offices, labs and student hostels. At the second layer is the information exchange mechanism through the telephone system and the Internet. Classroom infrastructure is a third component. The trading lab under the jurisdiction of the Finance and Control Group is a standalone entity. The library

41 The 15 institutions are at Kharagpur, Mumbai (Bombay), Chennai (Madras), Kanpur, Delhi, Guwahati, Roorkee, Bhubaneshwar, Hyderabad, Patna, Punjab, Rajasthan, Indore and Mandi. *http://www.iitkgp.ac.in/rti/council1.html.*

system is largely independent, but has to contend with the Computer Centre for various connectivity and other issues. Functionally, there are two broad service areas – acquisition and maintenance

The acquisition of computer and related hardware is completely outsourced to a private company. The current vendor, Dynamic Optima Services Private Ltd. (DOSPL), received the contract through competitive bidding. DOSPL is not an original equipment manufacturer like Dell, HP or Lenovo. Instead, it markets what in India is popularly known as "assembled machines." The contractual system in theory keeps costs down for IIMC.

All faculty offices are supplied by DOSPL with identical set-ups. Each computer runs on an Asus motherboard with an Intel Core 2 Duo E7400 CPU at a clock speed of 2.80GHz, with 2GB of memory and 500GB hard drive. The monitor is a 20" Samsung SyncMaster 2043. MS Windows XP and MS Office 2007 Enterprise Edition come standard. Each computer also has a webcam and a pair of headphones/ microphone combination for online voice and video chats. The other piece of hardware which completes the package is a HP multifunction printer.

The interesting thing is that DOSPL is responsible for only the maintenance of the hardware. All software problems in theory fall under the jurisdiction of IIMC's own Computer Centre. It is here that the rather short-sightedness of the institutional apparatus becomes apparent. The Computer Centre staff have no professional qualification in ICT management. Being responsible for maintaining the software and the Internet local area network (LAN) on campus have led to recurring problems regarding connectivity and computer operations for faculty and students.

This shortcoming is especially apparent regarding access to the Internet on campus. Initially, the Computer Centre had restricted open access to the Internet, and required that all inbound and outbound traffic to be routed through three gateway servers for security purposes. All client machines were assigned IP addresses dynamically. Not having fixed IP addresses also made it impossible for faculty members to connect to their office machines by setting up virtual private networks (VPNs). This system of using proxies has since been discarded in favour of open access to the Internet.

In addition, IIMC does not have a single wireless network which covers the entire campus in one single mesh. Instead, the Computer Centre has set up and maintains several ad-hoc networks with wireless routers of varying strengths. This arrangement set up across the routers has made accessing the Internet wirelessly a rather immobile affair. Since multiple users connecting to a single wi-fi router is not really feasible, browsing the Internet in the classrooms can be interrupted anytime. The other interesting feature – possibly with serious repercussions – is that wireless access is entirely open, i.e. it does not need a login name and password. IIMC has recently also implemented Cisco Clean Access as a way of authenticating Internet usage. However, this technology is not platform-neutral, meaning that it does not treat MS Windows, Mac OS and GNU/Linux client machines the same way for authentication.

The telephone system is Electronic Private Branch Exchange and leases lines from the government-owned telecom provider Bharat Sanchar Nigam Ltd. It is not automated and the technology is rather outdated. Every telephone on campus has an extension number ascribed internally, and it is not possible for someone calling from outside to reach an IIMC employee except through human operators.

Similarly, IICM's knowledge management system also needs to be improved. The problem is not a matter of monetary resources since funds were available for certain software and services. For instance, in 2008-2009, 5,424,728.00 Indian rupees were spent on Finance and Accounts Administration Software. What is missing is coordinated planning, particularly for fundamental items such as login IDs for staff and students, and a unified web space or portal that will provide access to all aspects of life in IIMC such as financial transactions, email messages and library borrowing records.

Library system

Located in the heart of the campus, the B.C. Roy Memorial Library is also the nerve centre of all scholastic and research activities in IIMC. According to the library's website, it has a base holding of 160,000 books and 40,000 online full text journals. The library has 22 staff members who have varying degrees of technological skills which they have picked up on the job. The library's electronic information management system is of a high level of sophistication, and could well be studied by other institutions in India. What emerged is the importance of vision and leadership for systematic transformation in the technological and work-cultural sense, as well as the importance of institutional support.

Computerization of the library

The "informatization" of IIMC began in 1994, again broadly reflecting the increasing importance of ICT in the economy and society of the country as a whole (see Box 1). The first generation of library and information systems at educational institutions in India, including at IIMC, concentrated mainly on programme development and creating roadmaps. Several collaborative initiatives were started among various HEIs, but mostly in an ad hoc manner. Around this time, the Calcutta Library Network (CALIBNET) was set up with funding from the government, with the aim of linking HEIs in the Calcutta metropolitan area. IIMC's library was also a member, but information about CALIBNET and IIMC's involvement is unavailable from public sources.

A major hurdle which faced Indian libraries in this era of transition was the absence of reliable Library Management Systems (LiMS) software. Such products existed in the more developed nations, but there were two principal hurdles in making an open international purchase. First was an institutionalized reluctance to spend funds on software which were not perceived to have any immediate positive returns. Second was the poor after-sales support in India, even from international players. For instance, one of the competing vendors, GEAC Library Solutions,[42] although offering a very developed product, simply had no representation in the country. This automatically eliminated it from contention because after-sales support was a crucial factor for the troubleshooting and implementation in the post-deployment period. However, it should be emphasized that sourcing even from domestic vendors did not ensure support. For example, TECHLIB, an LiMS from the National Informatics Centre also failed on this count.

In 1996, a decision was made to purchase LibSys as the primary vehicle for the LiMS at IIMC, developed and marketed by Info-Tek Consultants Pvt. Ltd.[43] As of 2010, LibSys has become the most widely adopted suite of

42 *www.library.geac.com.*

43 *http://www.libsys.co.in/home.html*

LiMS software in India, used by all the leading national institutes. There were some primary reasons behind IIMC's library's decision to purchase this over others. First, in 1996, although not technologically comparable to more sophisticated products from developed countries, LibSys had an edge in essentially being the first in a field of one in India in the LiMS domain. Second, Info-Tek was willing to work with the library on debugging during and after implementation. Last, there was the very compelling argument of being able to partner with and learn from peer institutions across the country using identical set-ups.

At that time, the entire library was staffed by 40 people without any technical background or familiarity with LiMS. All processes, from acquisition of new reading material, to filing, indexing and circulation were entirely manual. The best picture of the state of ICT in the library at that time is that of a single-use workstation for consulting a bibliographic database subscribed in CD-ROM format, with paperwork initiated for setting up a networking system. The single-user workstation was located inside the office of the Librarian, off limits to the other users, and that there was no local area network (LAN) connection within the library or between the library and the Computer Centre to support the CD-networking system.

The appointment of a tech-savvy librarian signalled an internal administrative mandate for the implementation of a computerized system. However, there was ambiguity and confusion about what computerization meant in reality. The library had purchased a few computers, including a server to support Maitryee (an LiMS which was supposed to be developed in the public sector, but did not come to

Box 1: Automation of Indian libraries

In order to understand the adoption and course of development of ICT at the B.C. Roy Memorial Library, it is important to view them in the perspective of the overall ICT strategic push from the Government of India in the country as a whole. From the mid-1980s, there were plans for connecting the country's HEIs, and especially their libraries, through backbone channels for easier sharing of information, holdings and other resources. Among the first documents to spell these out were the Seventh Five Year Plan (1985-1990) and the National Policy and Library and Information System (Jebaraj and Devadoss, 2004).

Although the matter was not clearly laid out in any single document, the problem facing the policy makers could be broken down into the following:

- Connecting institutions spread across geographical heterogeneity.
- Specifically connecting libraries located in and serving these institutions.
- Having a reliable system of communication.
- Having a standard, shared suite of protocols for easy replication and economies of scale.
- Optimal use of scarce resources for meeting an immense base of end-use requirements.

Given the federal administrative structure of the country, HEIs and libraries typically are quite autonomous, a situation compounded by financial, linguistic and cultural differences on a scale not encountered in many other countries. Not surprisingly, multiple networks, standards, and administrative routines came into existence at the national, regional and state levels. Among the noteworthy are the Educational and Research Network (http://www.eis.ernet.in/) which still forms the primary backbone of flagship institutions like IIM Ahmedabad and IIM Bangalore, Information and Library Network (*http://www.inflibnet.ac.in/*) and Developing Library Network (*http://delnet.nic.in/*).

One noteworthy feature is the attempt at some centralization. All central and state government websites, for instance, have been designed and built by the National Informatics Centre (*www.nic.in*). Research and development support is provided by the Centre for Development of Advanced Computing (*http://www.cdac.in/*). A primary force behind many of the national initiatives is the National Science & Technology Management Information System (*http://www.nstmis-dst.org/*). A possible problem with this approach is the lack of clear delineation of jurisdiction as well as separation of responsibilities.

fruition). All the computers were put in a single room instead of being used to set up a library-wide LAN. Clearly, directions for infrastructure and how best to transform manual processes to ICT-based automated workflows were lacking.

From computerization to information management

The problems IIMC's library staff found most difficult after the purchase of LibSys were not technological, but rather human capacities to make the transition from a completely manual system to an automated one. The elementary task of cataloguing took on daunting dimensions given the existing collection of 72,000 volumes and a library staff with no computerized cataloguing experience, or for that matter any knowledge of computers.

This period, between 1997 and 1999, highlighted the importance and necessity for building up the human capital to run a modern and complex library system. Many of the procedures had to be improvised, and the technological and human requirements met through a steep internal learning curve. As an example, in the absence of trained data-entry operators, a typist on the library payroll had to be trained for simple tasks on a computerized system. The shortage of human resources also made it imperative that only back-volumes were processed. Even so, the assignment took nearly two years to be completed.

Between 1996 and 1997 – which coincided with the installation of a fibre optic backbone at the institute – a large part of the back data were converted to machine readable format and the first online public access catalogue was released. Simultaneously, current books were also brought under the purview of computerized record creation with the help of the trained typist. Also between 1997 and 1999, journal procurement was brought under this computerized system.

The second wave of automation at the library was initiated in 1999. This consisted of several tasks proceeding in parallel. First, the book acquisition procedure which had been entirely paper-based was computerized. The automation was then extended to the billing system as well. In terms of the library holdings, the library took the next logical step of barcoding each of the volumes for smoother checking in/out and tracking. The last and critical exercise was to undertake the manual checking of the entire database created in the first wave (1997-1999). This was again a lesson in creating a system from scratch, since there simply did not exist an automated system or software algorithm for comparing the "true" information with the data entered previously. Thus, the only way to achieve this was to again retrain and retool existing employees. The entire operation required a further couple of years. At the end of the exercise, which ended in 2001, the library had completed barcoding its entire stock, set up an ICT-supported physical verification, and corrected the bibliographic data of a substantial number of records.

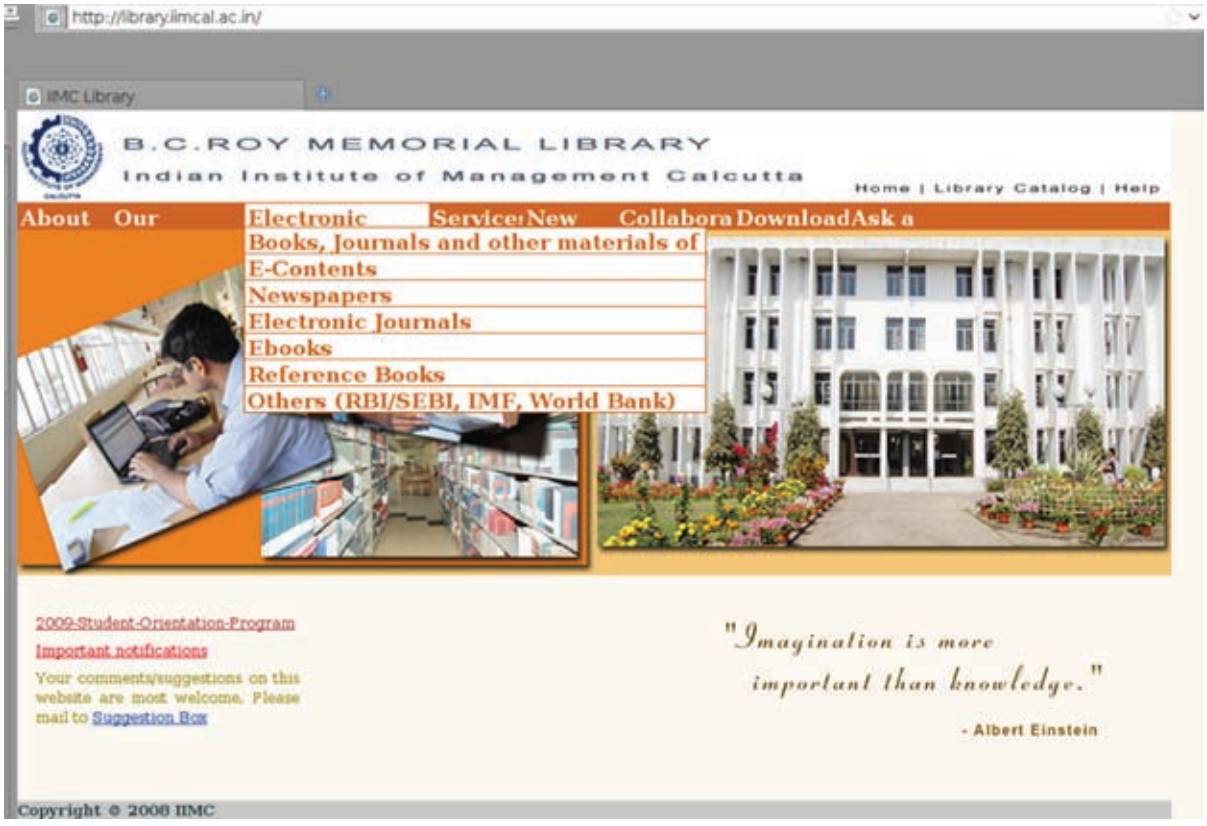
The third wave overlapped somewhat with the second one. Starting in 1998, it marked the real and substantial entry of the B.C. Roy Memorial Library into the domain of ICT-enabled operational procedures. The roots of this initiative went back to 1994 when the library had subscribed to a full text database from the University of Michigan. For various reasons, the subscription had not been sustained. In 1996, the library implemented CD-Net, a system in which CD databases could be hosted on an internal server and then shared over the IIMC LAN. The problem with this was that as a technology, it was already obsolete. It was neither scalable, nor was it supported long-term because of licensing and technical issues.

In 2000, the B.C. Roy Memorial Library became a founding member of the IIM Library Consortium in which all the IIMs decided to share their electronic resources through a wide area network. This was directly influenced by the model common in the US, in which economies of scale and scope are achieved among libraries through sharing digital collections and cost burdens. This was key to bringing IIMC's library to the forefront of libraries in India, and making common information searching by faculty and students heavily ICT-centric.

Operational problems

The emphasis which the library places on ICT-based service delivery is apparent from its website (Figure 1). It is a point of interest that design and maintenance of the website are completely separate from that of the institute. The library's website was revamped after consultation with stakeholders and with dry-runs in a sandbox in 2009. It is a sophisticated gateway through which the library services can be accessed in ways which are at par with those found in most leading institutions globally. The main portal of IIMC, on the other hand, was designed a decade ago and does not incorporate modern developments in web design – a common complaint of the students. In many ways, this reflects the peculiar modularity of the ICT environment of IIMC, which creates systematic drag and inefficiency.

Figure 1: B.C. Roy Memorial Library web portal



One common refrain in all the discussions and interviews was the fragmentation and improvisation of the administration of IIMC's ICT infrastructure. The library finds it difficult, if not impossible, to implement many ICT-enabled services because they need the cooperation of the Computer Centre, which may not be easily forthcoming. This is particularly problematic for cases which require unrestricted access to the Internet without gateway servers, through open ports, or fixed IP addresses for database-hosting computers.[44] It is difficult for someone not directly involved with internal administrative processes to assess such situations.

ICT in the classroom

ICT in the classroom should be viewed as a complex, integrated system instead of being evaluated for their availability or quality. It should be emphasized that although technologies have an inherent attraction in popular imagination as cures-all, their utility is maximized only from optimum usage. It is not enough that a particular technology is available as a solution for a certain problem-situation. Even if it is the appropriate and best technical solution, its utility would be nil if there is not enough systematic capacity for it to be implemented in practice.

The other key consideration is the appropriateness of the technologies in terms of financial capabilities. This is especially true for developing countries since policy tools must heavily factor in financial tradeoffs against alternative strategies. For instance, even assuming that credible research backed the gains in the student learning experience from the use of computers in the classroom, it might still be argued that the funds could be better used for more pressing concerns such as providing toilets and running water, rather than purchasing computers.

IIMC, unlike most HEIs in India, is very well positioned financially, so the financial constraint is much less binding. Being an autonomous institution with excellent revenue sources, purchase decisions at the institute are not, in general, hostage to fiscal compulsions. IIMC is among the pioneers in India in the adoption and use of ICT on campus, and its technological footprint is probably among the best in India.

"ICT in the classroom" should not be taken in a literal sense. Rather, the phrase is used holistically, covering the major ways in which interactive technologies can facilitate improvements in teaching methods for educators, and enhance and optimize learning for students. This report has identified the following key areas in which ICT enter the classroom:

- Classroom ICT infrastructure
- Software environment
- ICT in learning

There is, of course, considerable natural overlap between these aspects. For example, learning is obviously a function of hardware and software capabilities. However, availability does not necessarily translate to optimal usage.

44 On a network with access to the Internet, each machine is uniquely identified by a number called an Internet Protocol (IP) address. Within a LAN, it is common for a gateway server to assign client machines temporary, periodically changing IP address through a dynamic host configuration protocol. This creates a problem where it is critical, such as for database-hosting machines, that clients have fixed IP addresses.

Classroom ICT infrastructure

The hardware capabilities of IIMC's classrooms are quite good. All lecture halls are equipped with multimedia equipment. Every classroom has a digital projector, a roll-down projection screen on the wall facing the students, and a computer connected to the Internet on a podium for the lecturer. The computers all run on MS Windows XP and are loaded with the MS Office suite of software. The larger lecture galleries also have speakers embedded in the walls connected wirelessly to lecturers' clip-on microphones.

There are two enhanced media classrooms on campus, which fall directly under the jurisdiction of the Visionary Leadership in Manufacturing (VLM) programme. The programme itself is highly specialized, catering to experienced professionals in the manufacturing industries, and is a joint effort by IIMC, IIT Kanpur and IIT Madras. The design of the curriculum, with extensive collaboration between the three cities and with centres in Japan, is such that high-speed audio-visual connectivity is a basic necessity. The rooms have advanced networking capabilities, and high-speed online connections are used to link the centres with each other. The facilities are loaned outside of VLM on a needs-basis, for example in case of doctoral defences when a member of the dissertation panel is not on campus.

In addition to the regular classrooms, IIMC has an expansive building which houses the Management Centre for Human Values. Entirely circular in structure, the building was not originally designed for teaching, but for corporate training and cultural lectures. Around a central indented platform, benches go up in galleries on all sides. The circular wall and high domed ceiling give the centre very poor acoustics. It is impossible to be heard across the room using a normal conversational voice. Due to a shortage of teaching space, the building had to be retrofitted as a lecture hall to accommodate a hundred people. The shape, in which it is impossible for the lecturer to face the entire student body at the same time, has necessitated the positioning of two projection screens angled to each other. In addition to the lecturer's microphone, the classroom is also equipped with wireless microphones which are circulated amongst the students who wish to raise questions during the lectures. Needless to say, the sessions can be a daunting experience for teachers and students alike.

The auditorium of the institution is often used as a classroom when the occasion demands. This building is a showpiece on the campus, originally designed to host large audiences for formal events. It is also used regularly for seminars and corporate training programmes when the number of participants is more than can be accommodated in the biggest gallery rooms. It houses sophisticated audiovisual, projection and networking systems, with Internet access provided wirelessly. Due to huge class sizes, direct interaction between lecturers and members of the audience are possible only through the use of wireless microphones.

The institute provides Masters degree students with a computer lab for practicing classroom exercises and assignments. Doctoral students have their own lab. In addition, the Finance and Control Group at IIMC, one of the most respected departments in management education in the country, set up a separate Financial Trading and Research Lab in 2009. It has 40 terminals and is used for training students for financial careers as well as for accessing streaming financial data for research purposes.

Software environment

In most cases, basic academic hardware is fairly standardized across the world. The typical computer box now runs on chips designed by Intel or AMD, has a hard-drive to the order of several hundred gigabytes, and a memory of between 1 and 2 gigabytes. Almost certainly the operating system will be some variant of MS Windows – more commonly XP for developing countries, and increasingly, Windows 7 in the richer nations. Some edition of MS Office will be installed as the standard productivity suite.

Software applications, on the other hand, tend to exhibit a great deal of heterogeneity across individuals, functional areas and schools. It is easy to see, for example, that a history major would not need software considered essential by someone majoring in industrial design. Software selection is hence largely dependent on curricular focus.

As a business school, the software requirements of IIMC are not very sophisticated. The teaching focuses mainly on what students would encounter at entry-to-mid-level positions in the corporate world. Hence popular courses are geared towards areas like mathematical programming, business intelligence, marketing and financial modelling. The software of choice in these cases depends individually and entirely on the professors in charge of the respective courses. Commonly used software are IBM ILOG CPLEX, Stata, Amos, MATLAB and R-project.

On the other hand, certain software which are collectively known as Learning Management Systems (LMS) are increasingly turning into de facto backbones of academia worldwide. Among the leaders in the class are Blackboard, Moodle and Sakai. These software – or more correctly, software suites – allow users to run several applications or functions on a single platform or portal. Applications include one-to-one or one-to-many collaboration, calendar, file hosting, secure grading, and so on. The most well known among LMSs is Blackboard, which is a proprietary, closed-source package. Moodle and Sakai are, on the other hand, open-source and thus freely customizable. IIMC runs Moodle on an internal server, and this is a key tool for the Post Graduate Diploma in Computer aided Management. Participation is open to all, and faculty in any functional area are free to use it in teaching their courses.

ICT in learning

This report stresses the importance of ICT in learning, but takes the position that availability does not automatically translate to proper or optimum usage. Essential is the knowledge – human capital – to use the technology. Perhaps even more fundamental is the willingness to try out newer ways of doing things. Interest and willingness to adapt and change are the key prerequisites, in the absence of which financial and technological investments do not yield expected returns.

IIMC seems to be lagging behind global institutions in its use of technology learning tools. A common refrain from students was that the faculty were behind the curve in newer technological approaches (see section on Voices of the students). For instance, Moodle, although being freely available to all faculty, is not used by the majority of professors. Their reluctance could stem from institutional barriers, such as having only limited control of the course site, and a 2 Mb size restriction on file uploads.

ICT for revenue generation and for social outreach

As mentioned earlier, two of the problems which elite HEIs in India are increasingly grappling with are cutting their financial reliance on the government and reaching out to the masses. There is usually a direct trade-off between finances and expansion for social inclusivity, since higher education is typically enormously expensive in terms of human, operational and capital expenditures. This is a special problem for institutions of national importance which have historically been heavily subsidized through public funds but can be accused of being breeding grounds of exclusion. IIMC has found ICT to be very effective in dismantling this trade-off and turning it into a positive relationship. The embodiment of this newer format of curriculum delivery and revenue generation are the Long Duration Programmes (LDPs).

LDPs are long-distance programmes in which the IIMC faculty members teach management theories to students dispersed throughout the country. Students are linked to each other and the professor in a virtual classroom. The ICT backbone and infrastructure is provided by third party vendors. The duration of the LDPs is approximately one year. Unlike the regular postgraduate programmes conducted on campus, these are designated as certificate courses, i.e. they do not grant diplomas as in the main residential programmes, and thus have lower market value. Nevertheless, the LDPs are very popular among working professionals to whose needs they are tailored.

First, the classroom sessions are held after business hours keeping in mind the time constraints of working adults. Second, the costs of the courses are much less than those on-campus which tend to be prohibitively expensive by Indian standards. For students, LDPs are a good value proposition since they access curricula at par with the best management education in India at a vastly discounted price, even after factoring in the characteristic constraints of long distance education. The brand name of IIMC, even though acquired in an off-campus format, carries considerable weight in Indian industry.

The LDP model was a pioneering effort by IIMC, and its structural and operational aspects make it an interesting study. The institute itself does not have the technological wherewithal to run the programmes independently, so two vendors provide the ICT infrastructure on a revenue sharing basis. The revenue shares of the vendors, NIIT Imperia (*http://www.niitimperia.com/*) and HughesNet Global Education (http://*www.hnge.in/*), are the single biggest cost of the programmes. There is an additional critical aspect of the programmes which is handled by these service providers. IIMC does not oversee the marketing of the LDPs at all, which is completely the responsibility of NIIT and Hughes. This arrangement takes into consideration the additional human resources that IIMC would have required otherwise. The other reason is that these organizations run similar programmes in collaboration with other HEIs, and hence have a well rounded system already in place which can be easily scaled up.

Virtual classroom

This section describes one off-campus classroom session for an LDP as an example. As is the norm, a LDP session is held in the evening for 3 hours with a 15-minute break in the middle. In addition to the faculty in charge, the vendors' personnel are on location to provide technical support and operate the system.

The classroom is usually a basic studio with a desk, keyboard and mouse controls for a computer. In front of the desk and against the facing wall is a projection screen. A camcorder on a tripod next to the screen and facing the instructor beams the video feed of the lecture over the Internet and into the individual computer monitors of the students spread across the country.

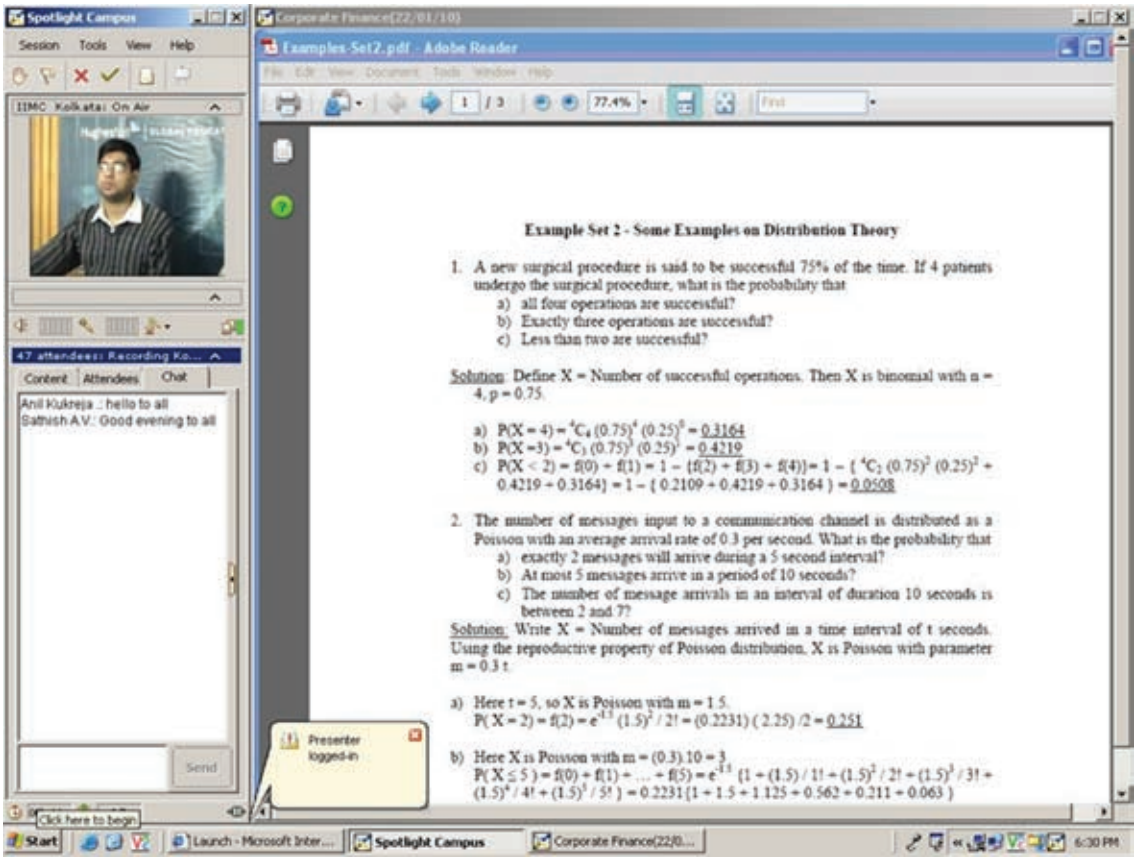
A main characteristic difference between a regular classroom setting and the LDPs lies in the fact that LDPs students cannot have direct audio-visual many-to-many interactivity of the regular classroom. Nonetheless, interactivity can be of a high order because of the way in which the system is designed. The blackboard equivalent in the virtual classroom is MS PowerPoint. The entire lecture/presentation is loaded beforehand onto a computer manned by the technician in a room which is partitioned off from the studio by a glass wall. The technician flips through the slides at signals from the instructor and monitors the audio-video feeds from the camcorder. The system allows the lecturer to switch to MS Paint in case there is a need for something to be written out, such as illustrating a mathematical point with an extempore example using scribbles drawn with the mouse.

Of course, there are more sophisticated technologies including interactive whiteboards which is vastly superior to drawing letters or mathematical symbols in MS Paint with a mouse. Web-based knowledge management platform such as Blackboard, Moodle or Sakai can also be utilized. Similarly a portal can be developed to integrate tools such as wikis, secure grading or feedback on assignments. Course material when distributed via email is difficult to keep track of over time; a better solution is to host them on a secure web space supported by a backbone of high bandwidth to ensure smooth transmission.

Pedagogy

Interaction in the LDP classroom occurs among the participants and the faculty at two levels. The image beamed onto the monitors of the students is divided into two vertical panels. The bigger panel displays the presentation material or MS Paint doodles under discussion. The thinner vertical panel on the left is again divided into an upper and a lower zone. The former displays the live video feed of the faculty captured through the camcorder. The lower section is a chat box in which the students type out questions and responses in real time. It is to be noted that every student has exactly the same screen on his or her monitor (Figure 2), and a ceiling-mounted projector displays the same video feed on to the projection screen facing the instructor. That all the participants effectively see identical images is what generates the interactivity in the virtual classroom.

Figure 2: Screenshot of LDP virtual classroom environment



The communication in this virtual classroom setting is, however, different from that of a brick-and-mortar classroom in a substantial way. Audio-visual communication works only downstream, in broadcasting mode from the teacher to the students, while upstream communication is purely text-based. Students, in other words, cannot be heard or seen by the lecturer. When, for example, students want to ask the professor a question, they type it out on their computers and the message is displayed for all to see on the public chatbox.[45] Student discussions play out in the same chatbox.

Overall assessment

It is difficult to make an objective assessment of online education delivery as exemplified by the LDPs. Even within the academic community, opinion is divided as to the desirability of adopting and expanding upon such programmes. It should be noted that IIMC's foray into this market was not originally due to philanthropic or social welfare concerns, but for revenue generation. This could, on the other hand, be interpreted as generating net positive social gains, since financial self-sufficiency for an HEI translates to less drain on the common public exchequer.

Whatever the subjective judgment on the matter of financial incentives, that an elite HEI can reach out to the masses in ways simply not possible otherwise should be construed as unambiguously positive.

45 The teacher can override the default mode to put a call through to students individually. This has to be used with discretion and obviously cannot generate continuous vocal interactivity as in a normal classroom.

The regular, on-campus programmes at IIMC are extraordinarily expensive by Indian standards. They are conducted on a full time, residential basis, which automatically excludes working adults. By taking into consideration the needs of those constrained financially or in terms of time, the LDPs are indeed opening avenues which would otherwise remain closed to a large section of the 'eager but unable.'

Such offerings would not have been possible a decade ago. The LDPs run on the back of developments in computational and communication technologies. The relative backwardness of the technical apparatus should not be taken as an indictment of the effectiveness of the set-up. The backbone medium, the Internet, has a minuscule footprint in most developing countries. Even so, its potential is enormous. The biggest gain is in distance and in scale. The first is obvious, but the second is easily overlooked. In a standard classroom environment, a lecturer can impart knowledge to perhaps 100 students. In the virtual classroom, this number could easily be doubled before system drag sets in. In countries with gross mismatches in educational needs and capacities, this aspect cannot be overemphasized.

Voices of the students

All teaching tools, including technological ones, must ultimately benefit their end-users. In an academic setting, the most important stakeholders are undoubtedly the students. Even if enormous amounts of resources are poured into ICT, the initiatives would be deemed failures if the students do not derive any positive utility out of them. In well run academic institutions around the world, technological systems are set up only after extensive research, consultation, testing, and with exacting specifications created beforehand. This professional structure of ICT administration ultimately ensures user satisfaction. Easy and institutionalized means of stakeholder participation plays an equally important role.

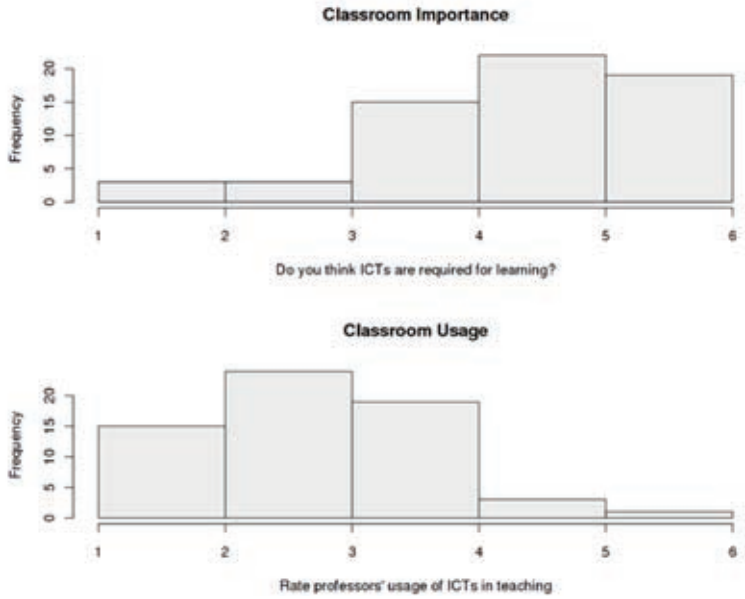
As noted, the management of the ICT machinery at IIMC has several shortcomings. There is, in theory, an Internet service group which is managed by students and which is entirely responsible for the maintenance of the institute's website. However, the existence of this group does not mean that the institute can neglect its duties and obligations. Unfortunately, student involvement and feedback are neither solicited nor encouraged in matters of ICT policies.

Feedback from the end users is useful for ICT policy-making. For this report, an online survey was designed and administered to students.[46] Some of the survey results are shown in Figures 3-8.

The questions were mostly ranking exercises, ranging from 1 (worst) to 6 (best). A glaring message is the contrast between student expectations and actual delivery of services. For instance, Figure 3, which compares students' thoughts on the utility of ICT tools in classroom learning against professors' actual use of them, reveal them to be almost mirror images. Responses to questions like their opinion on the transparency of the IT acquisition process (Figure 7) are rather harsh. In fact, for this particular question, there was not one single respondent who assigned a score of 5 or 6. What gives the exercise a certain poignancy is that there is obviously a great perceived need for exposure to cutting edge ICT training. When asked if they would be interested in attending training sessions on online services such as personal website creation, file transfer protocol and security measures, almost half of the students confirmed affirmatively (Figure 8). Student frustration was most apparent in their comments – a reflection of the fact that perhaps as stakeholders, they have no voice and had used this opportunity to speak up.

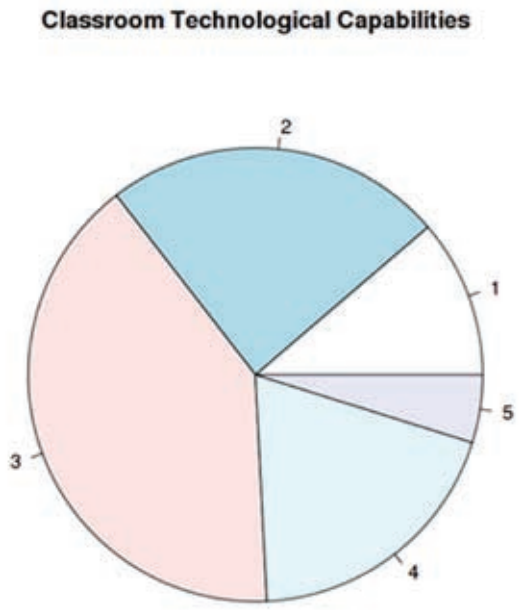
46 N=62. The questionnaire is available at: *http://spreadsheets.google.com/viewform?formkey=dGxpWkI5RUYxcVdyNjlWaFkzQUNITHc6MA*

Figure 3: IIMC student survey results: classroom importance



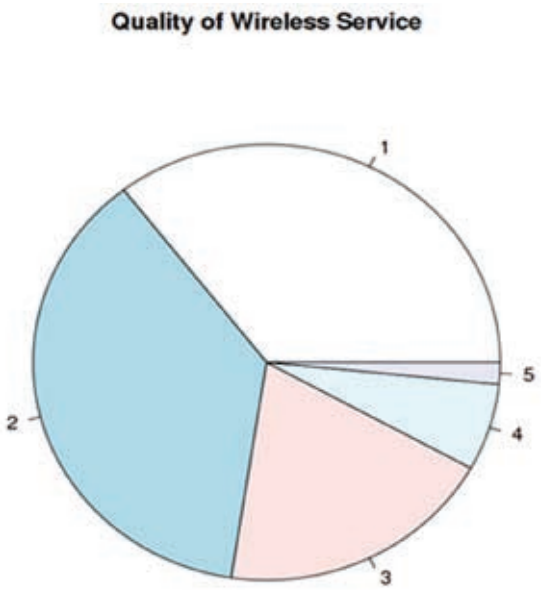
Note: ranking: 1 (worst) to 6 (best)

Figure 4: IIMC student survey results: classroom technological capabilities



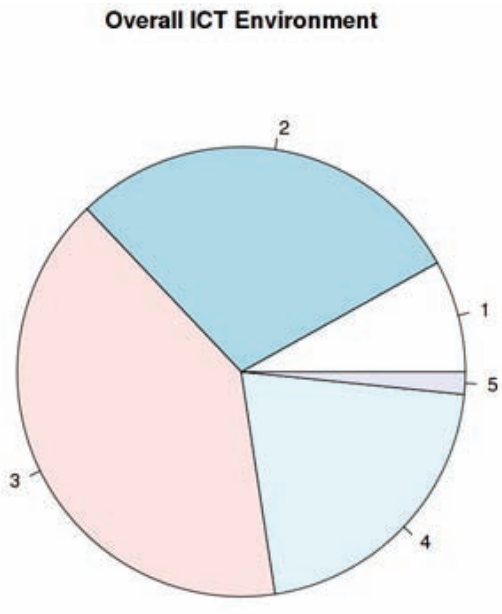
Note: ranking: 1 (worst) to 6 (best)

Figure 5: IIMC student survey results: quality of wireless service



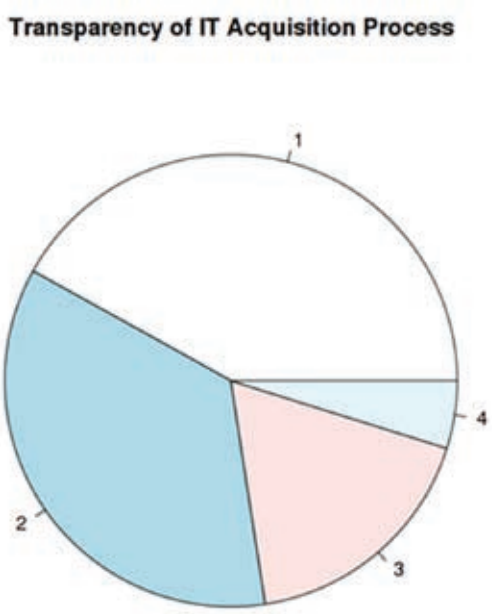
Note: ranking: 1 (worst) to 6 (best)

Figure 6: IIMC student survey results: overall ICT environment



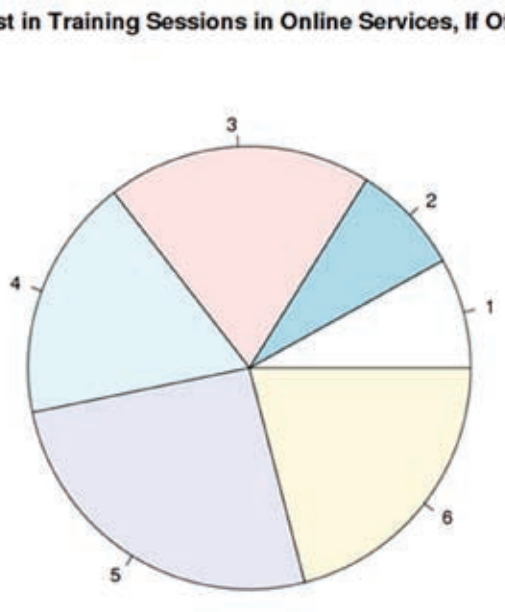
Note: ranking: 1 (worst) to 6 (best)

Figure 7: IIMC student survey results: transparency of ICT acquisition process



Note: ranking: 1 (worst) to 6 (best)

Figure 8: IIMC student survey results: interest in training sessions in online services, if offered



Note: ranking: 1 (worst) to 6 (best)

Conclusions

This report discusses the state and use of ICT in Indian higher education, focusing primarily on the IIMC, one of the leading centres of tertiary education in India, as a case study. There is extreme qualitative heterogeneity in Indian education in general, more so in higher education. Thus, a possible and very reasonable objection to doing a case study on IIMs and IITs is that they have very little in common with other HEIs in terms of regulatory and financial autonomy. Thus, whether or not the IIMs and IITs purchase certain kinds of hardware or software would be of little relevance for most Indian universities, simply because the latter do not have the capacity to emulate the institutes. By this logic, any case study on these elite institutions would be highly unrepresentative.

On the other hand, the IITs and IIMs were set up to be thought-leaders in their domains for the rest of the country. So their ICT strategies should help other HEIs in charting out their own technological roadmaps. It is hoped that this report has provided some insight for that process.

The general and background information included here came from a variety of secondary sources such as existing research and websites of government organizations in the education sector. The bulk of the information was from in-situ observation, structured interviews, and conversations with faculty, staff members and students. A very valuable component was a survey administered to students and faculty about their opinions on the availability and quality of ICT on the campuses.

The following points emerged in the course of the study:

- Research in this domain is plagued by a lack of information. Official data are either not collected, or not made available to researchers. The general opaqueness regarding the collection and dissemination of data has implications for the integrity of published information.
- The management of ICT needs urgent attention. On-campus support is a persistent problem and decisions appear to be made on an ad hoc basis.
- Technology decisions suffer from being under multiple jurisdictions without a clear line of authority. Acquisition and implementation processes have a perception of being opaque.
- Classroom technologies are of an older generation in comparison with those in more economically advanced nations.
- Students feel the need for the introduction of newer technologies in classrooms, and also feel that faculty members are behind the curve in adoption and proficiency.
- Some HEIs, including IIMC, are making some impact on providing affordable distance education by partnering with private technology vendors.

Much of the information presented here, being gathered through interviews and personal observation, is necessarily subjective. Like all case studies, care should be taking in extrapolating and drawing generalizations.

APPENDIX A

Weaknesses and strengths identified in india's education system

Weakness:

- Abundance of unnurtured talent.
- Lack of timely and easy availability of knowledge resources to all.
- Opportunities lost because of difficult access to information and guidance.
- Mismatch between demand and supply of knowledge and skills.
- Lack of collaborative learning.
- Questionable quality of teaching at various places.
- Non-standardized testing.
- The lack of a legal framework that links the qualification and certification framework to the prescribed requirements for the job and a regular performance appraisal of those who prepare the content and of those who deliver and teach it.
- The growing digital divide.
- A lack of personalized monitoring and long term tracking of growth and enhancement in learning, skill and performance.
- A very low percentage of digital literacy.
- Lack of encouragement to excel.
- Substantial duplication of effort at various levels.
- Mismatch between school hours and employment hours for those learners who have to simultaneously earn a livelihood for their families.
- A lack of access to institutions.
- A lack of access devices to digitally bypass shortcomings of institutions and teachers.
- A lack of multi-layered networks for knowledge absorption and knowledge propagation.
- The lack of a strong contingent of motivated teachers.
- Inefficient functioning of the knowledge delivery mechanism.

Strengths:

- A large human resource of high intellectual calibre.
- A large number of expert faculty in almost every field.
- A growing middle class with a high priority for education.
- A number of world class institutions of learning and research.
- Technological and communication backbone to take their advantage in the field of knowledge empowerment of the mass of learners

Source: *MHRD. 2009. National mission on education through information and communication. Ministry of Human Resource Development.* ***http://www.education.nic.in/dl/MissionDocument.pdf****, accessed January 2010.*

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