e-Learning: Changes in Teaching and Learning Styles

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ABSTRACT

Availability of vast amount of information on the web has provided access to all types of learning material. The teacher's lecture notes is no longer the primary focus of a learning process, and the teacher's role and the student's learning process are changing.

In the modern global learning environment e-learning has become a facilitator in organisational development through knowledge sharing, especially in the area of web based training and project management. It has also become a potential business for many organisations.

The changes that should be happening in teaching and learning are discussed here with the aid of two case studies. The key technologies and practices of e-learning at University of Western Sydney (UWS) are highlighted here and are compared with the existing activities of the external degrees program at University of Colombo School of Computing (UCSC).

The importance of identifying learning objects, assessment methods and training to apply the learning outcomes are some of the changes in the teaching process. These changes should be considered as a strategy to implement e-learning systems. The learning process is activity based and focuses on group and individual work with presentations and discussions. E-learning environment together with tutorial and practical classes facilitates the learning process.

1.0 INTRODUCTION

Traditionally format for the transmission of knowledge is in the form of lecturing in the classroom. In this approach the teacher or lecturer is responsible in providing the knowledge to its listeners. This approach has its own characteristics and inherent benefits as highlighted next [12].

Lectures can convey large amounts of factual material to many listeners at the same time. Lectures can present material in a faster and simpler way according to the needs of the audience. The speaker can convey the knowledge in a way that no book or other media can. Lectures can communicate the intrinsic interest of the subject manner and also convey material otherwise unavailable in published form. The lecturer can control the delivery process by deciding on what to cover and whether to answer questions.

The lecturing approach emphasises learning by listening and assists those who are poor readers and who are unable to organise printed material.

However this approach has its own weaknesses. Lecturing encourages one-way communication and puts students in a passive role that can hinder their learning. It assumes all students are learning at the same pace and at the same level of understanding, which is hardly true. Also lectures do not sustain student attention and tend to be forgotten quickly.

Lecturing alone is not suited for learning applications, analysis and synthesis as well as for complex, detailed or abstract material. Other form of learning methods such as practical sessions, group work, tutorial classes, take home activities has to be used in these situations.

Teacher dictating notes or students copying notes from the board has become part of most lecture sessions. In some cases printed handouts have replaced this and have given the lecturer additional time to practice different teaching methods. Notes had become an important part of a lecture due to the need to sit for exams and as a source of future reference.

Limited access to published material and the high cost of textbooks have been a bottleneck. Hence the teachers are unable to expect the student to gather own knowledge and as a result the student learning process has been centred on lecture notes. This means the knowledge testing mechanisms or exams are also based on the teacher's lecture notes. Due to this the exam papers have focused on testing student's knowledge on theories, proofs and concepts that are already available in their lecture notes.

Over a long period of time the classroom teaching approach has gradually prevented the student in stimulating ideas and actively participating in the learning process. Also the students have been lacking the problem solving skills, i.e. to apply the knowledge gained into real world situations. As indicated above these skills cannot be acquired though lecturing alone.

With the introduction of cheap Indian textbooks along with easy and cheaper duplicating facilities the access to printed material is not a barrier as in the past. The World Wide Web and the Internet have provided every body the opportunity to publish as well as to access any material of their choice. Hence we can find a wide variety of study material on the web. Thus it is no longer necessary to limit student's knowledge to

lecture notes. More importantly the students have many sources to acquire knowledge and using e-learning sites they are able to learn at their own pace.

The need to change the teacher's role from lecturing to activity based and student learning from passive to active has already being realised. The recent educational reforms that took placed were a result of this. Application of theories and acquiring problem solving skills are becoming part of modern learning process.

In the field of IT the technology is changing fast and the employees have been forced to retrain their staff on regular basis. New recruitments are also trained to enable them to adapt to the organisation's needs. Students produced through the traditional classroom approach would take a longer period to adjust to a working environment than those trained under the modern learning process. The trained graduates are more suited to fit into employment and are able to secure higher remuneration than the untrained graduates. Hence most companies have faced the problem of loosing their trained staff unless they are well looked after. The introduction of modern teaching methods should help to address this problem and eliminate the need to train graduates prior to employment.

Rest of the paper is organised as follows. Section 2 presents the characteristics of e-learning systems. Section 3 describes how some of those systems have evolved. Some of the e-learning related activities at UCSC are presented to illustrate this process. Section 4 highlights the approach adopted at UWS and the things we need to do in order to achieve our goals. The conclusion summarises the changes that had taken placed in teaching and learning styles due to e-learning.

2.0 E-LEARNING

Hosting of a website to provide easy access to course related information over the Internet can be seen as the origin of the current e-learning systems. It evolved through content that was provided on the web in the form of lecture notes and other learning material such as lab exercises. This reduced the need for long classroom sessions to deliver knowledge and also offered the students the flexibility to learn at their own pace. Now we could see several learning methods being used as part of online teaching over the Internet [6, 10].

In e-learning systems students are able to communicate with their teachers through email and discussion groups. In this situation students do not get immediate response from their teachers and some times may also not get what they want within the required time. However some systems offer online discussions among students, teachers and other participants via chats, videoconferencing and groupware. Here students are able to get immediate response to their questions despite not being physically present.

Online assessment is a key component of an e-learning system and it is used to evaluate student's learning progress. Quizzes in the form of multiple-choice questions are part of this and it has the capability not only to give feed back for the student responses but also to monitor student's learning progress and achievement levels.

Various information in the form of course overview, contents, objectives, notes, slides, exercises, workbooks, references, worked examples, model and past papers with solutions, links to external resources, student prepared material and their solutions are provided to the learners through these websites. Special interactive sessions with multimedia are also part of these systems.

2.1 E-learning Solutions

There are many e-learning integrated solutions such as WebCT [14], Lotus Learning Space [7] and Blackboard [2]. These systems provide templates to organise the layouts of the dynamic content that would be provided by the teachers. Using these tools teachers themselves can easily publish their content in their website.

WebCT is one such tool used by most e-learning providers including UWS. WebCT allows posting of course material, hosting bulletin boards, conducting online quizzes etc. However to explore the full functionality of an e-learning system other supporting mechanisms must be used in addition to tools such as WebCT.

For instance the current e-learning systems lacks the dynamic nature of learning, the different preferences of learners, customised learning content and establishment of non-sequential learning scenarios [9]. As a result poor learning satisfaction, unclear learning methodologies and indisposition of learners to use e-learning are among the undesirable results of e-learning implementations.

Lytras et al [8, 9] have distinguished six value components for e-learning products, namely: needs (which refers to the process of examining the needs of the learners), knowledge (which refers to the discovery and construction of the required knowledge), motivation elements (which refers to the enhancement of motivation elements on an e-learning environment), problem solving (which refers to the ability of learning scenarios to solve specific problems that learners face), team synergy (which refers to establishment of team synergy and collaboration mechanisms) and packing (which refers to putting together the right mixes of the relevant components for the support of any specific learning situation). All of them in cooperation

formulate the concept of a learning product that has to be constructed and delivered using Information and Communication Technology in an advanced way.

2.2 Bloom's Taxonomy

The learning process itself has been well defined through the Bloom's Taxonomy of educational goals [3, 4]. It is some thing that all teachers should be aware of as well as practice. Bloom has defined six question categories, namely: knowledge, comprehension, application, analysis, synthesis and evaluation.

Researchers in the recent past have come up with variations to Bloom's Taxonomy to accommodate the dynamic e-learning scene present in e-learning systems [9]. Lytras et al have defined ten different learning processes to support different learning models. Analysis, synthesis, reasoning, judging, problem solving, collaboration, simulation, evaluation, presentation and relation are these learning processes. The objective is to provide flexibility to dynamically construct the learning scene for every learner.

E-learning itself is widely being used. Research and surveys have indicated that it is gradually overtaking the traditional classroom-based instructions at least in the form of investments to provide such facilities [5].

3.0 E-LEARING AT UCSC

As identified in section 2, hosting of a website to provide easy access to course related information originated the e-learning process. At University of Colombo although a website [11] had been there for sometime it did not provide course information beyond overviews, subjects offered with brief syllabi and some project guidelines. However with the introduction of the Bachelor of Information Technology (BIT) external degree in 2000 the University of Colombo School of Computing (UCSC) then known as the Institute of Computer Technology (ICT) launched a web site [1] to provide learning support.

Initially the course content was expanded and detailed syllabi were provided along with guidelines for teaching. This included number of hours to be spent for each topic, the need for practical for each topic with software and hardware requirements and the recommended reference list. Model papers and answers were also provided. All of them were part of this website. An extract of the brief and detailed syllabus of the IT2301 Database Systems module is given in Figures 1a and 1b.

As teaching to students is not part of a university's external degree programme the private educational institutes had to takeover the teaching role for this course. In order to identify the depth of course content the teachers of these institutes wanted to know the learning objectives of each module and hence this was also provided. Later on other student support activities such as weekly television programs and correspondence through e-mail or phone was also provided. Using telephones students are able to have online discussions on academic and non-academic matters. Also through emails some forms of discussions have taken placed. At the moment although the content and quizzes are provided for the students of the first two semesters they are yet to be organised in a manner that will allow the student to interactively participate in the learning process.

3.1 Content Based Learning Objectives

When looking back at the Bloom's Taxonomy one important item when developing content is the identification of learning objectives. It should be measurable and not vague. The content should be identified to achieve the learning objectives. However due to the use of above mention sequence to introduce our learning objectives they were based on the content supplied. As a result the teaching process and the testing mechanism has deviated from the process that should have been used to achieve some of the goals of this course.

Figure 2a illustrates an example of a set of learning objectives developed to support the content provided as in Figures 1a-1b. Here each objective tries to explain why we should learn the content identified. We can also see that most objectives are not measurable due to the use of words such as "understanding".

Now we shall look at the abilities of a person after achieving the objectives of a module. In the selected example the main objectives (figure 1c) have focused on theoretical knowledge and application skills. However if we look at the topic objectives (figure 1c) and the brief syllabus (figure 1a) we see that more emphasis has been given for acquiring theoretical knowledge.

3.2 Content Based on Learning Objectives

Next we would identify the learning objectives before content. When we adopt this process we are in a position to highlight the importance of application skills. Figure 2b illustrates the learning objectives for the same module with the content identified to support the learning process. Here we have one main objective accompanied by about 6-7 detailed learning objectives. Also each objective is measurable and is of the type "to be able to design and develop" and not of the type "understanding" etc. Bloom's Taxonomy is an ideal source to learn how to prepare the learning objectives [3, 4].

When comparing the content of figure 2b with figure 1a we see that they are different. The importance here is the identification of essential topics to achieve the

main objective and ignoring the nice to know content. Certainly the awareness of the nice to know content should be there but it can be in the form of being able to refer to them as and when needed.

The application skills acquired through this process will allow the student in performing database design and development activities on real world problems. Such a student is in a position to fit into an organisation without further training. However a person who learned the content under the first approach would need to be further trained, as the focus had been more on theory.

Besides developing the correct learning objectives few other activities should also be practised. These are discussed in section 4.

The need to change the teaching and learning process has already being identified and necessary changes have been happening. Some of them can also be seen in our internal degree programs.

At UCSC we still have not gone to the level of using an e-learning platform although such systems were built for internal use. UCSC is in the process of developing content for e-learning systems and we expect these to be available for students in the immediate future.

4.0 E-LEARING AT UWS

University of Western Sydney (UWS) is one of the pioneers in adopting e-learning into their education system. They initiated it by developing their own product called the PlatformWeb with facilities such as upload material and construct online quizzes that are now part of products such as WebCT. Due to the added functionality of WebCT, UWS now uses WebCT for student learning and PlatformWeb for administrative purposes.

Due to the early introduction of e-learning at UWS, the UWS has been able to identify the needs to change the traditional teaching and learning processes. In fact they are practising most of these changes and the impact of them can be seen from the performance of the students after graduation. As indicated in section 3.2 students no longer need to be further trained to commence employment.

UWS has focus on student's being able to solve problems using current technology and related issues. Identification of module content based on learning objectives has helped to achieve this task. In addition to this we need to do few more things before/after developing the learning objectives (outcomes) for course modules.

4.1 Aims of the Course

In the case of undergraduates, we must first identify the aims of producing the graduates. This will be done with the consultation with the industry, academics and professional bodies. Also, in addition to the subject knowledge the graduate should have the skills on communication, group work and content.

For example Mathematics and Information Technology course at UWS aims at producing graduates with

- a good grounding in the mathematical and statistical techniques useful in modelling and simulation tasks and computer software development
- a sound knowledge and skills in computer programming, computer systems analysis and software engineering, information systems, database and data mining and visualisation techniques
- the knowledge and skills needed to analyse and improve industrial and management processes
- communication and inter-personal skills required of a modern professional

4.2 Modules of a Course

The next step is to allocate the knowledge and skills identified to the respective program structures. This will help to determine the modules/subjects for each program.

For example the following are some of the modules that should be taught to achieve the above goals. Some of these modules (e.g. Systems Analysis and Design) will actually have several components such as systems design principals, systems engineering principals etc.

- Statistics and Maths for Computing
- Programming Principles
- Systems Analysis and Design
- Information Resource Management
- Application Development

4.3 Grouping of Courses and Research

We should look at the learning outcomes only after determine the modules as indicated in section 4.2. Before developing the learning outcomes the UWS has done another important activity. They identified sub-discipline groups and members to develop the learning outcomes. These groups can be informal but ideally linked to the research groups. Some academics may be in multiple groups.

Linking sub-discipline groups to research groups means that the members can teach subjects related to their research interest. This has given the academics the opportunity to apply or perform their research as part of teaching.

As the modules/subjects are allocated to the sub-discipline groups the learning outcomes are first prepared for each sub-discipline group and then only for the modules. This process will identify the need to have each of the modules identified for respective programs. Through this process core and optional modules can also be identified.

For example the need to teach advanced topics such as artificial intelligence, image process etc can be identified through this process. This will also assist in distinguishing the modules offered for various courses, like Information Technology and Computer Science.

4.3 Module Handbook

After developing the learning outcomes we need to determine the method of measurement, presentation and assessment method. At UWS a handbook is prepared for each module by the module coordinator. It describes the above items (actually there are 14 altogether). You will find many handbooks from the UWS web site [13].

At UWS there is a policy that all modules must have a minimum 40% for continuos assessment. So the final year exam is at most 60%. There are modules without a final exam. The lecturer decides the structure of the exam papers. There is no rigid rubric as in many other cases. This gives the flexibility to include long and short questions with different mark allocations. This is needed for case studies and various application testing. The importance here is application skills are acquired through practical, tutorial, group/individual work, presentations and discussions. They are tested and evaluated through continuos assessments. Unfortunately external degree program of UCSC do not have this component due to the practical difficulties in running both types of systems (i.e. internal and external).

Annually, before the semesters commence handbooks are prepared giving the lecturer the flexibility to achieve the module learning objectives using his own style. At UWS for a given module a lecturer teach up to 200 students and when there are 800 students there will be four staff members doing the same course at different times and locations. Usually all of them share the same handbook and assessments (prepared jointly before the commencement of the course). UWS keeps two week to do this approval process (before the semester begins). There are sub-discipline group meetings to approve them. The sub-discipline groups helps to identify any overlapping content as well as to review course content.

5.0 CONCLUSIONS

Teaching and learning have changed with the use of technology. E-learning environment together with tutorial and practical classes facilitates the learning process. The teachers have been able to focus on activity-based learning due to the presence of learning material over the Internet. Here we have highlighted the importance of identifying learning objects, assessment methods and training to apply the learning outcomes. The changes have provided opportunities for cooperative learning. Teachers now spend less time in front of the class and more time working with small groups of individuals. The learning process is activity based and focuses on group and individual work with presentations and discussions. These changes should be considered as a strategy to implement e-learning systems.

The changes in teaching and learning styles have transformed course evaluations from testing of knowledge to application of knowledge. This in turn has eliminated the need to further train the raw graduates. Finally this will serve the industry need of being able to directly employ people who can do things and the degree certificate will become just an entry qualification for the job interview.

6.0 ACKNOWLEDGEMENTS

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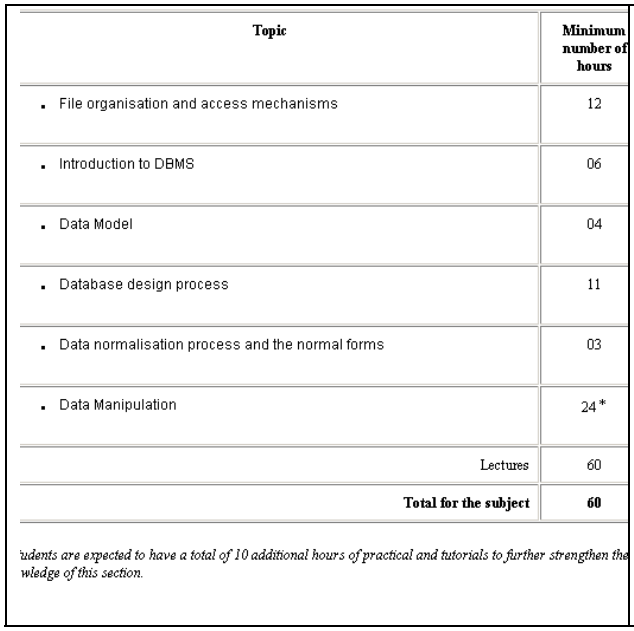
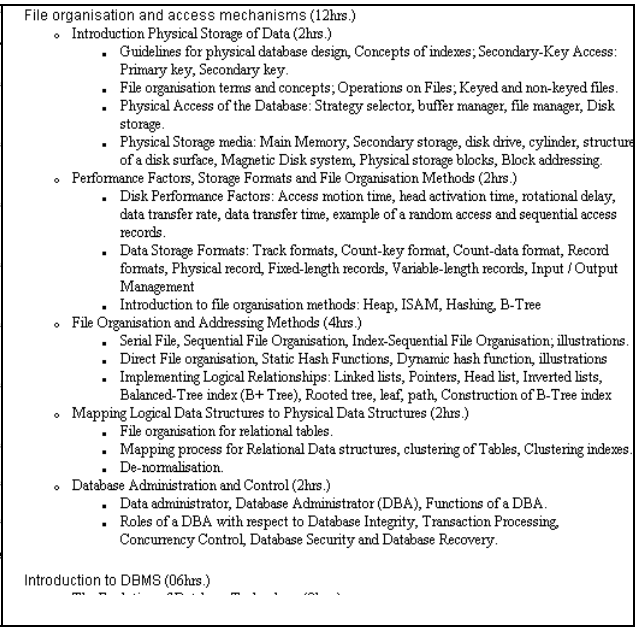


Topic	Minimum number of hours
▪ File organisation and access mechanisms	12
▪ Introduction to DBMS	06
▪ Data Model	04
▪ Database design process	11
▪ Data normalisation process and the normal forms	03
▪ Data Manipulation	24*
Lectures	60
Total for the subject	**60**

udents are expected to have a total of 10 additional hours of practical and tutorials to further strengthen the wledge of this section.

Figure 1a: Brief syllabus Course Module IT2301

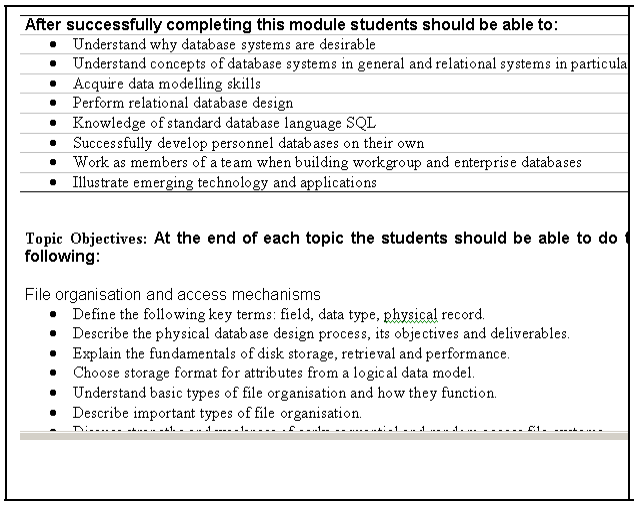


File organisation and access mechanisms (12hrs.)

- Introduction Physical Storage of Data (2hrs.)
  - Guidelines for physical database design, Concepts of indexes; Secondary-Key Access: Primary key, Secondary key.
  - File organisation terms and concepts; Operations on Files; Keyed and non-keyed files.
  - Physical Access of the Database: Strategy selector, buffer manager, file manager, Disk storage.
  - Physical Storage media: Main Memory, Secondary storage, disk drive, cylinder, structure of a disk surface, Magnetic Disk system, Physical storage blocks, Block addressing.
- Performance Factors, Storage Formats and File Organisation Methods (2hrs.)
  - Disk Performance Factors: Access motion time, head activation time, rotational delay, data transfer rate, data transfer time, example of a random access and sequential access records.
  - Data Storage Formats: Track formats, Count-key format, Count-data format, Record formats, Physical record, Fixed-length records, Variable-length records, Input / Output Management
  - Introduction to file organisation methods: Heap, ISAM, Hashing, B-Tree
- File Organisation and Addressing Methods (4hrs.)
  - Serial File, Sequential File Organisation, Index-Sequential File Organisation; illustrations.
  - Direct File organisation, Static Hash Functions, Dynamic hash function, illustrations
  - Implementing Logical Relationships: Linked lists, Pointers, Head list, Inverted lists, Balanced-Tree index (B+ Tree), Rooted tree, leaf, path, Construction of B-Tree index
- Mapping Logical Data Structures to Physical Data Structures (2hrs.)
  - File organisation for relational tables.
  - Mapping process for Relational Data structures, clustering of Tables, Clustering indexes.
  - De-normalisation.
- Database Administration and Control (2hrs.)
  - Data administrator, Database Administrator (DBA), Functions of a DBA.
  - Roles of a DBA with respect to Database Integrity, Transaction Processing, Concurrency Control, Database Security and Database Recovery.

Introduction to DBMS (06hrs.)

Figure 1b: Part of Detailed Syllabus of Module IT2301



After successfully completing this module students should be able to:

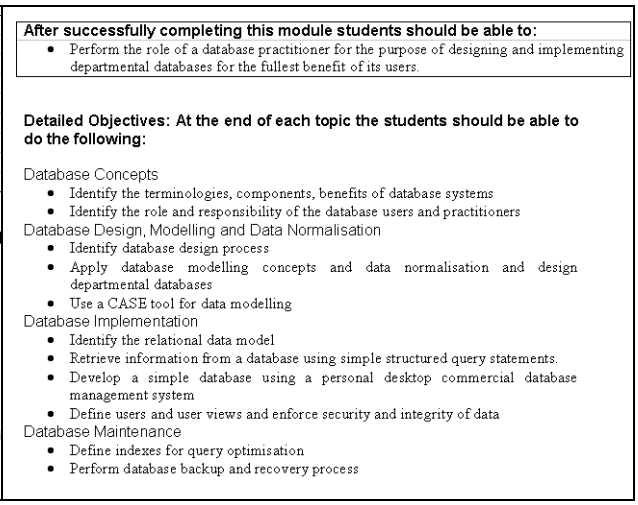
- Understand why database systems are desirable
- Understand concepts of database systems in general and relational systems in particula
- Acquire data modelling skills
- Perform relational database design
- Knowledge of standard database language SQL
- Successfully develop personnel databases on their own
- Work as members of a team when building workgroup and enterprise databases
- Illustrate emerging technology and applications

Topic Objectives: At the end of each topic the students should be able to do t following:

File organisation and access mechanisms

- Define the following key terms: field, data type, physical record.
- Describe the physical database design process, its objectives and deliverables.
- Explain the fundamentals of disk storage, retrieval and performance.
- Choose storage format for attributes from a logical data model.
- Understand basic types of file organisation and how they function.
- Describe important types of file organisation.

Figure 2a: Part of Original Objectives of Module IT2301



After successfully completing this module students should be able to:

- Perform the role of a database practitioner for the purpose of designing and implementing departmental databases for the fullest benefit of its users.

Detailed Objectives: At the end of each topic the students should be able to do the following:

Database Concepts

- Identify the terminologies, components, benefits of database systems
- Identify the role and responsibility of the database users and practitioners

Database Design, Modelling and Data Normalisation

- Identify database design process
- Apply database modelling concepts and data normalisation and design departmental databases
- Use a CASE tool for data modelling

Database Implementation

- Identify the relational data model
- Retrieve information from a database using simple structured query statements.
- Develop a simple database using a personal desktop commercial database management system
- Define users and user views and enforce security and integrity of data

Database Maintenance

- Define indexes for query optimisation
- Perform database backup and recovery process

Figure 2b: Part of Revised Objectives of Module IT2301