As the proliferation of IT resources in the recent years have made significant impact on teaching and learning methodologies, we now present to you a two-part discussion on **IT in Education Today**. In this first part—**IT in Education Today I**, we discuss various issues in educational applications of IT and the actual usage of IT in one of the University's courses. In the next part—**IT in Education Today II** (Vol. 4 No. 4), we will feature discussion on the usage of IT in teaching and assessment.

e-Education
a 2001 Cyber-Space Odyssey?

J.A. Gilles Doiron
Principal Educational Technologist, CDTL

In a recent issue of *The Rapidly Changing Face of Computing* (Harrow, 2000), we are reminded of how far we have come on the technology evolutionary scale. In 1977, the popular Digital VAX11/780 minicomputer was five feet tall, cost around $150,000 (USD), weighed hundreds of pounds, contained less than one megabyte of memory, consumed six kilowatts of power, and often needed special air conditioning and a raised floor. It cranked out at one million instructions per second (1 MIPS). Twenty-three years later, we have the Compaq iPAQ H3600 handheld computer: five inches tall, weighing about six ounces (including its battery) and costing about $500 (USD). It has 32 megabytes of RAM, 16 megabytes of ROM, and delivers in the palm of your hand 142 times the compute power of the Digital VAX.

The leaps in technology are astounding, but is technology serving us or are we serving technology? During these last 23 years of escalating computer use in all faculties, its impact on university teaching is still largely a promise (Larose et al., 1999). Although widespread computer use has brought about the development of interesting applications of computer technologies, such as the Integrated Virtual Learning Environment (IVLE) at NUS and other e-learning environments, computer-assisted pedagogy is not commonplace. The integration of Information and Communication Technology (ICT) into the university environment has been largely based on the inherent attributes of the technology rather than its role in contributing towards meeting specific learning objectives (Doiron, 2000). Will technology continue to call the shots?

During this same period of time, major corporations and government agencies around the world have embraced computer-based training (CBT) as a cost effective and efficient tool to achieve particular staff training objectives. They also came to recognise the value of using the systematic approach to creating support materials for training: Instructional Systems Design (ISD). ISD proposes a set of instructional models that make use of various instructional strategy components to produce a course of instruction (Dick and Cary, 1990). Throughout the years, classical CBT and Computer-Based Learning (CBL) has been designed with reference to learning theories developed by David Ausubel, Albert Bandura and Robert Gagné. Much of today's pedagogy still adheres to Gagné's five

categories of learning (i.e. intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes); and the vast majority of CBT/CBL produced have been based on his behaviouristic approach.

Although, most CBT/CBL design will address some or all of Gagné's nine general instructional events (Gagné, 1965), Web-based Learning (WBL) is providing an added social communication aspect not previously available. Gagné's events of instruction include gaining attention, informing learners of the objective, stimulating recall of prior learning, presenting the new material (stimulus), providing learning guidance, eliciting performance, providing feedback, assessing performance, and enhancing retention and transfer. As you can deduce, some of these events are best handled through social interaction in a classroom setting rather than being preconceived and programmed to appear on screen when triggered by the user. In most CBT/CBL, programmed learning guidance and feedback is restrictive and impersonal, assessing performance is weak, and activities for enhancing the transfer of knowledge are non-effectual.

Recently, the work of social constructivists like Lev Vygotsky, a Russian psychologist and philosopher of the 1930s, is being touted as the missing evolutionary link in the education of *Homo Erectus*. Vygotsky emphasises the influences of cultural and social contexts in learning and supports a discovery model of learning (Luria, 1976). It is up to the student to construct his or her own understanding in his or her own mind, and the teacher acts as a facilitator during this process. Learning should also take place in a meaningful context, preferably the context in which the knowledge is to be applied.

Regardless of the convenience that ICT brings to teaching and learning, lecturers more than ever need to reflect on their role in the learning process. Teaching must be grounded to basic principles of good practice in tertiary education. These principles include encouraging contacts between students and faculty, developing reciprocity and co-operation among students, encouraging active learning, giving prompt feedback, emphasising time on task, communicating high expectations, and respecting diverse talents and ways of learning (Chickering and Gamson, 1987).

Present ICT can play a very active role in supporting some of these principles of good practice (Chickering and Ehrmann, 1996). For example, having a course web site with a student and teaching staff email roster makes faculty and students more accessible. Students can also benefit from customised computer-mediated communication (CMC) tools that facilitate study groups, collaborative learning, group problem solving, and discussion of assignments. Some IT developers responding to the educational market needs are producing sophisticated interactive learning programmes such as simulations, 3D visualisation and virtual reality environments that provide immediate meaningful feedback to the learner.

With the plethora of IT and electronic communication tools available, will the practice of teaching and the activities that produce learning undergo a radical change? Just as the adoption of other technologies like the electric light bulb, the automobile, the telephone and the television, to name only a few, has changed the way we live, ICT will engender changes to this and future generations. I believe that as we endeavour to make perspicacious use of ICT, it will support meaningful learning experiences, enable collaborative exchanges without time constraints, and empower students to take greater control over the curriculum sequence. With this independence, students will ultimately learn to value ICT for the key role that it will play in meeting the challenges of life long learning throughout their career. We are now in the year of Arthur C. Clarke's *2001: A Space Odyssey*, and thankfully "HAL 9000" the computer who says, "I can tell from the tone of your voice, Dave, that you're upset. Why don't you take a stress pill and get some rest." is not in command of our mission of 'Discovery'. Let's make sure that we integrate technology appropriately.

References

Chickering, A.W. and Gamson, Z.F. 'Seven Principles Of Good Practice In Undergraduate Education'. *American Association for Higher Education (AAHE) Bulletin*. March 1987.

Chickering, A.W. and Ehrmann, S.C. 'Implementing the Seven Principles: Technology as Lever'. *American Association for Higher Education (AAHE) Bulletin*. October 1996.

Clarke, A.C. *2001: A Space Odyssey*. New York, NY.: The New American Library, Inc., 1968.

Dick, W. and Cary, L. *The Systematic Design of Instruction* (3rd ed.). Glenview, IL.: Scott, Foresman, 1990.

Doiron, G. 'Anatomy On The Cutting Edge: Pre-Dissection Lecture-On-Demand At The National University Of Singapore'. *Proceedings of ICCE/ICCAI 2000*. Vol. 2, pp. 1399–1403. National Tsing Hua University, Taiwan.

Gagne, R.M. *The Conditions of Learning and Theory of Instruction* (4th ed.). New York: Holt, Rinehart and Winston, 1985.

Harrow, R.J. *The Rapidly Changing Face of Computing*. Dec. 11, 2000. http://www.compaq.com/rcfoc

Larose, François David, Robert Dirand, Jean-Marie Karsenti, Thierry Grenon, Vincent Lafrance, Sylvain and Cantin, Judith. 'Information and Communication Technologies in University Teaching and in Teacher Education: Journey in a Major Québec University's Reality'. *Electronic Journal of Sociology*: 4, 3, 1999. http://www.icaap.org/iuicode?100.4.3.3

Luria, A.R. *Cognitive Development: Its Cultural and Social Foundations*. Cambridge, MA: Harvard University Press, 1976. ∎

Any Time, Any Place Learning:
Redefining the Classroom for EG1104

C.M. Wang and K.K. Ang
Department of Civil Engineering

Some Features of EG1104

1. *Participatory workshop-lectures for active learning*
2. *Advanced web-based iTutorial system*
3. *NUS WebCast lectures*
4. *Inquiry-based tutorials*
5. *Assessment*

As the Faculty of Engineering moves towards the new learning paradigm, courses may have to be taught differently from past practices in order to emphasise student-centred learning rather than teacher-centred teaching. Here we share some modifications to the way we teach the course module EG1104 Statics. This course, taken by some 1200 engineering and cross-faculty students, now has the following features:

1. **Participatory workshop-lectures for active learning**, even with a large class size of 400 students per session. Peer instruction via buzz groups are encouraged in class by posing concept quizzes and thought-provoking puzzles at regular intervals during lectures. Printed lecture notes with critical information left out on purpose allow students to discover and learn during the workshop-lecture as they actively work through their notes. It is important to note that the contents of the lecture have to be pruned judiciously to allow for such participatory lectures.

2. **Advanced web-based iTutorial system** for learning anywhere, anytime. The web-based tutorials have advanced diagnostic capabilities to assist students to learn independently and at their own pace. By programming the lecturers' experiences into the tutorial system, common mistakes can be intelligently pointed out by the system with further clues provided to entice students to think further on how to solve the iTutorial problem. To discourage copying, the numbers used in the tutorial questions are randomised and are unique for each student. Students are, however, encouraged to collaborate and solve the problems together if they prefer to do so. The web-based tutorial system also allows the lecturers to monitor the students' performance in the tutorials at a glance so that students who are lagging behind may be identified at an early stage despite the huge class size. Based on a survey held at the end of the course, students have found the system friendly and easy-to-use. Some comments on web-based

An Example of Inquiry-Based Tutorial Questions

The Leaning Tower of Pisa, Italy, built in 1350, is 58.2 *m* tall and has a circular base of diameter 19.6 *m*. For the past several centuries, its longitudinal axis has been inclined by 5.6° toward the south from the vertical (see Fig. 1a). The weight of the tower is 144 *MN*. The diameter of its cross-section changes slightly from bottom to top, and accordingly its centre of gravity is approximately 27.1 *m* above the base. The pressure that the sandy, claylike soil exerts on the rigid, circular base slab of the tower may reasonably be approximated with the relation

$$p = C_1 + C_2 r^{0.6} \cos\theta \quad N/m^2$$

where r and θ are polar coordinates (with measured due south as in Fig. 1b). Determine (a) the constants C_1, C_2 and (b) the maximum and the minimum pressures exerted on the tower's base by the soil and give their locations.
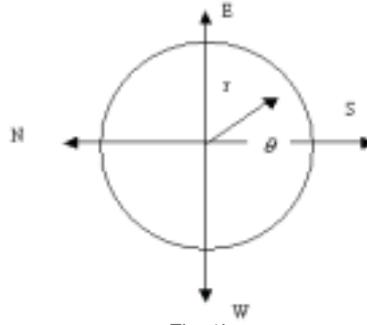
Fig. 1b

Fig. 1a

Check out the online edition of this issue at *http:/www.cdtl.nus.edu.sg/brief* for more examples and illustration.

iTutorials obtained from a student survey include:

"*...the idea of iTutorial is very good. It makes students keep pace with what is being taught and should be adopted in other modules...*";

"*...iTutorials are good for foundation building...*"; and

"*...it is a very good scheme. I really enjoyed learning Statics. If not for the iTutorials, I may not have learnt Statics well...*".

3. **NUS WebCast lectures** combined with the use of an innovative IT product that allows one to literally write over an LCD monitor touch screen with a digitising pen, enabling students to see the lecturer writing virtually over PowerPoint slides. In a survey, it was found that students gave an overwhelming preference to the use of such an editable PowerPoint system over conventional transparencies/non-editable PowerPoint slides. By webcasting lectures, students are accorded the convenience of being able to 'attend' lectures anywhere within the campus. Such lectures are also archived and deposited into the University's multimedia-on-demand server so that students can review portions of the lectures if necessary to reinforce their understanding of topics that were perhaps found difficult to grasp during the actual lecture.

4. **Inquiry-based tutorials** that provide opportunities for students to develop their inquiry skill that is so essential for life-long learning. Questions in these tutorials are designed to provoke questioning from the students due to their vagueness, open-ended nature, life-like and novel problems. In these tutorials, the students are encouraged to spar with their tutors and among themselves. Based on a survey, about 60% of the student population strongly agree that the inquiry-based tutorial questions do stimulate innovative and creative thinking.

5. **Assessment** consisting of three open-book quizzes (25%), one exploratory laboratory experiment (5%), web-based tutorials (10%) and an open book examination (65%).

Acknowledgements

IT & English Literature

Dr Terence Dawson
Department of English Language & Literature

There is far too much chatter these days about the use of IT in teaching. I am quite prepared to concede that in some disciplines IT may have revolutionised teaching. But in relation to English Literature, although it provides an excellent *learning* aid, it is only of marginal use for *teaching* purposes.

University students of engineering or medicine usually know what they want to do when they graduate. In contrast, very few students who embark on a three- or four-year course in English Literature know what they intend to do. Most can only rationalise their choice of subject to a certain point, and no further. If asked, they tell you that no other subject exercises a stronger appeal and they enjoy reading. At least, they *say* they do—but very few make a point of reading each set text *before* the respective lectures, and far too many even come to tutorials unprepared.

Sometimes, when up against students who have only skimmed through the introduction to their text before giving a presentation that is all 'smoke' and no substance, my patience snaps and I ask them: How would you feel if, just before the anaesthetic took hold, the surgeon about to slice you open leant over and whispered, "*Confiteor*. I couldn't be bothered to learn anything about the appendix—but I'm going to *pretend* I know where it is"?

We more or less know what skills are expected of a medical student, a law student, or an economics student. But what skills does a teacher seek to foster in a literature student?

Literature is a problematic discipline: no two teachers of literature will ever entirely agree on what ought to be learned on a literature course, or why. Since this is so, how can one usefully discuss the use of IT in teaching the subject? In teaching *what*?

The study of literature is often thought to have two aspects: (1) 'knowledge' (i.e. a solid grasp of the major works and tendencies that make up a literary tradition); and (2) the 'skill' specific to the discipline (i.e. an understanding of how to analyse literary language and to what end). The first assumes that students have an appetite for extensive reading; the second assumes they are keen to develop skills in intensive reading.

Sadly, although many of our students readily devour books that catch their imagination (whether fantasy or contemporary poetry), all too often they have little or no appetite for any classic text apart from those that they are 'required' to read for their various courses. Although on a good day many of our students can identify 'irony' in any given passage, they have considerable difficulty in commenting on the significance of its use.

Understandably, IT is a great help to such students. If they suddenly realise that they haven't left themselves the time necessary to read a set text, they can access the Web and quickly learn enough to bluff their way through a tutorial. Film students no longer need to go to the university campus just in order to watch a film at an appointed time. They can follow it on their own computer, at home and at any time that suits them. They can pause the film whenever they feel like a break, and can replay key scenes as they see fit.

I have no difficulty understanding how useful IT is for such purposes. IT empowers students to learn where and when they choose. It gives them immediate access to enormous amounts of information from their home. But the benefits come with some worrying drawbacks. There is a very real danger that the over-abundance of readily available IT resources will *impede* the real learning process for undisciplined

students. There already exist numerous sites where students can go to download essays written by other students.

But even such abuse pales when compared to the benefits, for students and teachers alike. In the coming years, the Web is going to become an ever more important medium for serious research. A bewildering range of material is daily becoming more readily available. The websites of libraries, newspapers, museums, galleries, university research groups and even private individuals are becoming increasingly sophisticated. It will not be long before intelligent coordination further expands the usefulness of such resources.

However, I cannot see that IT necessarily improves the nature of the teaching process. The truth is that it makes little difference whether a teacher writes with chalk on a blackboard, with a felt-tip pen on a whiteboard, uses so-called transparencies and an OHP or takes advantage of a multimedia computer and its associated programmes. Indeed, as with all multi-purpose products, the drawbacks of the latter almost outweigh the benefits. Unless one's 'jpeg' files are very large indeed, they do not project well onto a large screen and the sound quality from the CD-player is less than impressive.

In teaching literature, the aims are not to explain facts, but to encourage students to question interpretations; not to indoctrinate, but to persuade students to challenge the latest ideological fad; not to appeal to authority (whether that of a critical theorist or that of a literary critic), but to urge students to think for themselves. To encourage them to step outside the tramlines laid down by previous scholars, to make their own connections, and to envisage previously unexplored implications. To persuade them to formulate, substantiate, and defend their own thoughts about the relation between a text and a tradition, or of the significance of a text in the on-going dialogue between the individual and society.

Such an objective supposes that students should have lively and challenging minds. They must be willing to read widely, to read well, and to elaborate possible arguments and think them through to an interesting conclusion. Not the teacher's conclusion, not even the conclusion of the leading authorities in the field, but their own.

Although good students may indeed make intelligent use of all the IT resources available to them, it is very unlikely that the use of IT in the classroom will ever produce a significant increase in the number of such students. As it always has, good teaching will always boil down to the ability of the teacher to get his or her students to think for themselves. ■

CDTL Brief Online

Check out the above articles in our interactive edition of *CDTL Brief* Online. In addition to the articles published in the printed version, *CDTL Brief* Online has the following features: discussion forums, instant feedback forms, and links to web pages and illustrations related to the topics discussed. The interactive *CDTL Brief* Online is located at *http://www.cdtl.nus.edu.sg/brief*.