



## Raising the Standards of Our IT Graduates

**Professor Joxan Jaffar**  
Dean,  
School of Computing

The School of Computing is evolving its undergraduate curriculum to boost the standards of its IT graduates. Currently, the School offers the following degree courses:

a) 4-year programmes:

- Bachelor of Computing in Communications and Media
- Bachelor of Computing in Computer Engineering
- Bachelor of Computing in Computer Science
- Bachelor of Computing in Electronic-Commerce
- Bachelor of Computing in Information Systems

b) 3-year programmes:

- Bachelor of Computing with Business Focus
- Bachelor of Computing with Technology Focus

The following Minor Programmes are also offered to students from other faculties:

- Minor in Management of Information Technology
- Minor in Computing

Major developments in the undergraduate curriculum in 2002 included the introduction of University Level

Requirements (ULR) and a new 4-year programme, namely, BComp in Communications and Media. In meeting the ULR, students in the 4-year and 3-year programmes are required to pass 28 Modular Credits (MC) and 20 MC respectively. This is approximately 17.5% of the respective programmes' total MC requirement for graduation.

BComp in Communications and Media was introduced with the aim to train students in the technological underpinnings of internet technologies as well as the required skills of media design and content creation tempered with a proper understanding of the social sciences (yet another reflection of the multidisciplinary nature of our degree programmes). Students opting for this programme have the opportunity to take up modules offered by the Faculty of Arts and Social Sciences. Likewise, students completing the BComp in Computer Engineering and BComp in Electronic-Commerce have been required to take substantial number of modules from the Faculty of Engineering and the School of Business, respectively.

The students from the School have also actively participated in special programmes such as the Student Exchange

*continued on page 16...*

## inside

PBL-in-Action: How to Implement Problem-based Learning in Business Marketing? **6**

Building upon the Socratic Method **7**

Teaching Evaluation and the Teaching Portfolio **7**

Faculty Rewards **5**

Uses and Limitations of IT **13**

Learning Objects **14**

Hi & Bye **8**

CDTL's Latest Book **8**

Developing Our Teaching Staff **9**

2002 Statistics at a Glance **9**

Teaching & Learning Highlights **10**

Problem-based Learning/  
The Socratic Method

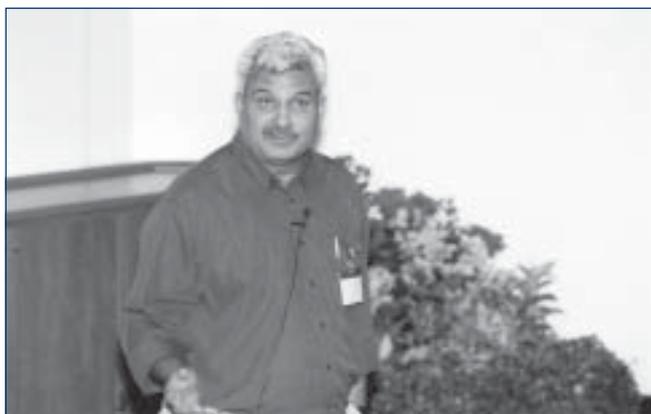
Teaching Portfolio/  
Technology & You

CDTL News /From the Faculties

# Teaching Evaluation and the Teaching Portfolio

Professor K. P. Mohanan, Deputy Director, CDTL

Dr Kevin S. Carlson, Educational Development Specialist, CDTL



K. P. Mohanan



Kevin S. Carlson

This brief article outlines issues related to teaching in the review for promotion and tenure within the NUS context. Beginning with an overview of teaching evaluation in the university, we shall provide some recommendations of how to construct a teaching portfolio. (Note: The term “teaching portfolio” is used broadly here to refer to the parts of the Promotion & Tenure dossier that a candidate presents in relation to his/her teaching).

## Teaching Evaluation at NUS

The university’s guidelines on teaching evaluation for Promotion & Tenure, Re-appointment, and Outstanding Educator Awards (HR 094/02), distinguish between:

1. Minimal threshold of *competence* in and *commitment* to teaching expected of all faculty members (such that falling below this level would be grounds against promotion and tenure). Basic teaching competence includes adequate knowledge, communicative ability, and the skills of conducting tutorials. Commitment to teaching manifests itself as the willingness to devote time and energy to teaching.

2. *Value-added* ingredients that contribute towards excellence in teaching (as the grounds for promotion and tenure based on teaching). The value-added ingredients that raise a teacher’s level above the threshold level towards excellence includes the following parameters:

- a) Accomplishment of higher order learning outcomes,
- b) Module development,
- c) Project/research supervision,
- d) Quality of teaching materials, and
- e) Educational reform activities

The Office of Human Resource’s (OHR) documents on teaching evaluation refer to exceptional qualities that make a teacher stand out from others. The following are some possible ways to identify exceptionality in teaching:

1. Given the available evidence presented in the teaching portfolio does the candidate stand out from the typical “very good” teachers in the discipline, particularly in terms of the learning outcomes facilitated by him/her?
2. What makes his/her teaching special?
3. How valuable are these special features (2) from the point of view of:
  - a) The given discipline or sub-discipline, and
  - b) University education in general?

If the answer to (3b) is “considerable”, the candidate is an outstanding educator; a similar answer to (3a) makes the candidate an exceptional teacher.

The types of learning outcomes that make a teacher exceptional *depend on the standard pedagogical practices in the discipline*. For instance, the valuable outcome of providing evidence for knowledge propositions is the standard practice in mathematics since theorems are accompanied by proofs in the subject’s conventional teaching, but not for the physical sciences. Hence, a teacher who closely attends to issues of justification stands out in the physical sciences, but not in mathematics. Likewise, a teacher who engages in argumentation and debates stands out in biology and psychology, but not in law and philosophy.

Exceptionality may also be a *function of the nature of the discipline*. Medicine is about solving the practical problems of health and illness that concerns everyone. Therefore,

we would expect a neuroscience module in medicine to centre on problems of medical illnesses. Conversely, for a neuroscience module in psychology, it would be desirable but not essential for students to be able to relate to practical problems and illnesses. Not all problems in astronomy have a strong practical component; the subject cannot be easily applied to solve practical problems that students care about, except perhaps in the hands of highly imaginative teachers. Hence, it may be necessary to view intellectual problems in astronomy as the counterparts of practical problems. Yet another example, the ability to help students understand abstract concepts that are not easily applicable to everyday experience may be a pedagogical challenge in particle physics and philosophy, but perhaps not in history and social work.

The examples above demonstrate that there are *different ways of achieving exceptionality*. For instance, a body of knowledge in a discipline can be made more meaningful by showing how it can be applied to solve practical or intellectual problems, how it has evolved from the history of the discipline, how it can be constructed, how its concepts and statements are justified, how it is connected to other disciplines and so on. One teacher's primary strength may lie in guiding students towards innovative applications, thereby facilitating creativity; while another's may reside in doggedly pursuing matters of evidence and justification, facilitating open-minded scepticism as a result; yet another's forte may be inherent in explaining recalcitrant abstractions, consequently facilitating deep understanding. Not every subject lends itself equally well to all the strengths. Likewise, not all teachers need to exhibit all the qualities to be called exceptional.

According to OHR's guidelines, statements about the quality of the faculty member's teaching are expected to be justified with concrete examples in the teaching portfolios. How do we accomplish this?

### The Teaching Portfolio

We would like to suggest that it is useful to treat the teaching portfolio as an extended "research paper" that demonstrates the quality of the candidate's teaching. The document presents specific evidence within the context of a coherent, integrated narrative. Mere displays of data (e.g. teaching materials such as PowerPoint slides, exams, syllabi) without an interpretative text to support the claim of high quality teaching are not particularly useful in convincing the committees about teaching excellence.

To help justify the claim of teaching excellence, we should:

1. Provide evidence and an explicit argument for the claim,
2. Present material so that:
  - a) Salient points are noticeably highlighted,
  - b) It is easy for a busy DEC/FRC/UPTC member to read the document, and
  - c) Clear tabs are used for quick reference.

3. Situate the claim within the value system outlined in the NUS guidelines on teaching evaluation; this necessitates analysis and interpretation of the presented material.

Teaching portfolios are evolving documents, not final products meant solely for submission at the time of review. They are both formative and evaluative. As teachers, it is useful to develop our portfolios almost as soon as we begin teaching. The portfolios are to be periodically revised, updated and supplemented with accumulating evidence. Revising reflections about our teaching is important as they form the basis of a coherent and integrated document.

### Some Recommendations

This section provides some hints for writing selected parts of the portfolio. Owing to space limits, only two parts, teaching philosophy and module folders, are highlighted as examples of the approach taken to develop the whole portfolio.

#### 1. Teaching Philosophy

While the scope of individual philosophies varies, we recommend elaborate discussion of at least three central, interrelated issues. First, it is useful to discuss the educational goals that we feel should be promoted in a university context. Common pitfalls in this section include:

- a) Overly brief discussion,
- b) Overuse of buzzwords without expanding upon their meaning in capturing educational processes, and
- c) Incongruence between philosophical statements and actual practices.

Next, it is useful for us to address how these educational goals are optimally promoted by certain teaching approaches. Writing about the issue helps us to reflect upon what we do in the classroom and explain how our teaching approaches have advanced the goals. (Incongruence between our philosophy and practices is a cause for concern).

The final issue is on how students interact with our approaches to develop the cognitive abilities reflected in the above educational goals. However, the issue is often intertwined with the previous one and frequently written concurrently with it rather than as a separate sub-section. The issue requires that we take the students' perspective, to explain exactly how they learn. It is also useful for us to describe the role of students in the learning process.

Overall, the teaching philosophy outlines our educational goals and builds a bridge between the abstract goals and the actual classroom activities undertaken to achieve those goals.

#### 2. Module Folders

Like the teaching philosophy, the scope of an individual's module folders varies. However, it is most useful to

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## Teaching Evaluation and the Teaching Portfolio

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present the module folder as more than mere reproduction of teaching materials (e.g. syllabi, lecture notes, exams). Explicit explanations and interpretations will help convince committees about the quality of one's teaching. The following issues that deserve such analysis on our part do not represent separate subsections, but rather are intertwined issues permeating the module folder:

- a) The *planning* of our modules flows directly from, and is coherent with our teaching philosophy. Choices concerning course content, teaching approach and assessment reflect the educational goals outlined previously in the philosophy. The focus here is the promotion of specific learning outcomes via the choices.
- b) *Execution* addresses how various aspects of planning are manifested in the classroom. It is desirable to give the reader a sense about what goes on in our classrooms by drawing a narrative picture. The narration is especially important if we use non-traditional approaches (i.e. other than unidirectional lecturing). We make the strongest case when we explicitly link particular activities with specific learning outcomes.
- c) Outcomes draw our attention to the definitive goal of teaching—actual learning outcomes—the ultimate criterion by which teaching is judged. Perhaps, the easiest way to demonstrate the outcomes is via our assessment tasks. Continuous assessments include both assignment handouts and sample papers completed by students. In the assignment handouts, it is useful to highlight briefly how the structure of the assignment has promoted specific learning outcomes. Sample papers can also display concrete manifestations of the outcomes. Reviewing them could be made easier by highlighting selected parts and providing a brief narrative explaining the specific cognitive skills illustrated by each part. In addition, our written feedback to students on the sample

papers could also bear evidence to the furthering of the desired learning outcomes. Finally, it would be desirable for us as teaching professionals to make the sample papers anonymous.

In terms of exams, it is best to include the complete exam. It is valuable to demonstrate that the exam questions are not repeats from previous terms' exams and tutorial questions (and the like) within that term. Dissecting some exemplary exam questions, highlighting the specific cognitive skills required by the questions, will help indicate the quality of the assessments.

Finally, when we use discussions or group work in our classrooms, it is extremely helpful to include brief transcripts of such as evidence of the learning outcomes promoted by such techniques. Again, the review of the data can be facilitated by highlighting parts of the transcript and providing a brief narrative outlining the specific learning outcomes illustrated by each highlighted part.

### Conclusion

It is most beneficial to present the teaching portfolio like a research paper such that the data are not only presented, but also analysed within a larger interpretative framework. Without such analysis and explicit arguments, the portfolio will be incomplete. An incomplete portfolio will underestimate the hard work put forth into teaching. Thus, a well-presented portfolio allows us to receive full and proper credit for the professional activity of teaching. ■

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Questions and comments about this article can be sent to the authors at: [cdtcks@nus.edu.sg](mailto:cdtcks@nus.edu.sg). For a full schedule of CDTL's seminars, workshops and the teaching portfolio seminar, visit: <http://www.cdtl.nus.edu.sg/cdtlhome/calendar.htm>. Look up the following pages on the CDTL website <http://www.cdtl.nus.edu.sg/Ideas/iot17.htm> and <http://www.cdtl.nus.edu.sg/handbook/evaluate/portfolio.htm> for more information on the teaching portfolio. Links to OHR's documents on teaching evaluation in NUS can be found at: <http://www.cdtl.nus.edu.sg/cdtlhome/policies.htm>. The FAQs on P&T on the FASS website: [https://ap1.fas.nus.edu.sg:8001/servlet1/admin\\_page](https://ap1.fas.nus.edu.sg:8001/servlet1/admin_page) contains helpful suggestions.

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# PBL-in-Action: How to Implement Problem-based Learning in Business Marketing?

**Dr Wee Keng Neo, Lynda**

Former Deputy Director, Temasek Centre for Problem-Based Learning,  
Temasek Polytechnic  
Consultant (Special Projects), Principal's Office, Republic Polytechnic



Temasek Polytechnic (TP) adopts Problem-based Learning (PBL) as the central pedagogy for all disciplines. This paper illustrates the planning and implementation of PBL at the Diploma in Marketing (DM).

## PBL Curriculum Design

The DM adopts an outcome-based education approach. The exit outcomes for the graduates influence what and how to learn. The students should be able to demonstrate the following:

- Acquire new, relevant and integrated knowledge on marketing.
- Reason and problem solve.
- Communicate clearly in both oral and written forms.
- Work effectively and efficiently in teams to accomplish agreed goals.
- Determine what they need to know to solve the problem and seek the new knowledge.
- Reflect on their experiences and propose areas for improvement.

The subject-based curriculum was de-constructed and re-constructed to address these outcomes. Considering the students' eventual work demands, tutors determined the core knowledge needed. Overlapping topics were eliminated. Similar topics were clustered and given a new name (e.g. 'Marketing Environment' refers to Environmental Scanning and Marketing Research). Two consultants reviewed the new curriculum to ensure relevance and academic rigour from the marketing and PBL perspectives.

All teaching materials are available online. For simple topics, students are expected to learn via online learning. They complete the online test to determine their level of understanding. They consult their tutors for learning difficulties. Face-to-face sessions are conducted using problems. Problems are crafted based on the remaining complex topics. Process skills such as reasoning and problem solving, self-directed learning and teamwork form part of the curriculum. Students progress from simple problems with short duration of completion to more complex and longer problems to build their confidence.

Problems act as stimulus for acquiring and synthesising new knowledge. The quality of the problem affects student learning in PBL. A good problem is one where the cues for learning objectives are embedded. In clarifying and identifying the problem, students should be able to identify these cues and learn the new knowledge. All problems are subjected to a review by a panel of senior tutors.

## PBL Process

The PBL process is conducted in small groups of 5–6 members per group. Learning starts with a problem. Students assume responsibility and plan their own learning. They engage in collaborative learning. They use problem solving and reasoning skills to clarify and identify the problem, generate ideas, and seek new and related knowledge to solve the problem. On completion, they reflect on their work and receive feedback from peers to improve themselves.

There are at least 2 meetings per problem. *Figure 1* shows the tasks in each meeting. For complex problems, students meet more often as they conduct reiterative learning. *Figure 2* shows the template that students use to record their discussion so that other members can build on the idea.

*Figure 1. PBL Process*

Scheduled Class	Activities
Meeting 1	<p><b>Group Setting:</b> When a new group is formed, members take turn to introduce themselves. They establish ground rules to enhance group dynamics and effectiveness. The roles of tutor and students are discussed and agreed upon.</p> <p><b>Problem Identification/Ideas Generation/Learning Issues:</b> The tutor presents the problem to the group. Students perceive the problem from their personal angles. They clarify and identify the facts. They brainstorm and generate ideas using the PBL Worksheet (<i>Figure 2</i>). Based on the ideas generated, they formulate learning issues that they need to learn in order to solve the problem. They plan the information resource that they intend to consult.</p>
Break	<p><b>Self-directing Learning:</b> Students seek relevant knowledge on their own.</p>
Meeting 2	<p><b>Review Information Resource:</b> Students review their selected information sources for credibility and validity.</p> <p><b>Synthesis and Application of New Knowledge to Solve the Problem:</b> Students conduct peer sharing of new knowledge that they apply to try and solve the problem. Often, they engage in reiterative learning until they are satisfied with their solutions. They discuss, develop and justify their solution.</p> <p><b>Reflection and Feedback:</b> Students conduct self- and group feedback on their learning outcomes, i.e. knowledge learnt, problem solving process, self-directed learning and teamwork.</p>

*Continued on page 12...*

# Building upon the Socratic Method

**Assistant Professor Kenneth Paul Tan**

University Scholars Programme & Department of Political Science



As far as possible, I would like my students to start the learning process with prior knowledge and intuitions, and then work through a rigorous process of responding to an indeterminate series of questions that seeks to clarify and critique every stage of their response.

This Socratic process is meant to mimic critical thinking performed at the individual level, thereby inculcating a powerful habit and method of critical reflection. It is an active student-centred learning method that works by treating the students' responses with interest, fairness and respect, helping them realise that they, their thoughts and personal experiences can be an immediate source of learning for their peers and teachers. Consequently, students can become more confident to re-examine the familiar in the light of the new and less familiar, and make risky, but often profitable, connections among theoretical, historical, and empirical sources of knowledge, textual encounters, personal experiences and intuitions. This can mean that whatever is learnt Socratically will be owned by students themselves, becoming the stuff of long-term memory. The critical processes enacted in this method can instil a way of thinking, communicating, and acting that goes beyond passivity in life.

I have used the basic Socratic method in different ways to serve different purposes in my teaching. Many of these examples will be discussed in a book about pedagogy and citizenship that I am currently writing. In this article, I shall highlight one example from a University Scholars Programme module called "Democratic Possibilities in Singapore"—please see <http://www.scholars.nus.edu.sg/sep/use2302/schedule.html>—a module that aimed to encourage 34 students from diverse disciplinary backgrounds to become active and critical citizens.

I organised new students coming to class for the first time into four groups of unequal numbers, different genders and disciplinary profiles. Each group was given a set of building materials comprising postcards, playing cards, and paper plates. The task, which was explained only to the few who had arrived punctually for class, was to compete against the other teams to build the tallest structure in 15 minutes using at least one item from each kind of building material. They were responsible for explaining the objective and rules of the competition to other members who arrived later. At the end of the session, the winning team was presented with only four lollipops, which they had to decide how to distribute amongst the group (each group had more than four members). The activity was designed to serve

as an icebreaker, to be fun, and for an immediate experience of the various key concepts, processes, and issues that would be explored with greater levels of complexity in subsequent weeks.

Following the activity, the students were engaged in a Socratic dialogue that encouraged them to articulate, develop, frame, and defend their intuitive ideas about these concepts, processes, and issues to which they would later attach specific critical vocabularies encountered in their course readings. I used a whiteboard to map out the flow of discussion, which included the following argument clusters raised mostly by students themselves:

- Links between aspirations, group dynamics, talent, stereotypes, and exclusions
- Leadership, decision-making, and different bases of authority
- Competition as threat, motivation, discipline, and control
- The status and role of late-comers
- The dynamics of reward and blame
- And by analogy, Singapore's nation-building project, citizenship roles, hierarchy of talent, technocratic government, ideology, new-generation Singaporeans, economic competitiveness, and income distribution

I drew the discussion to a sufficiently open-ended conclusion by directing students to focus on the relationship between democracy and nation building in Singapore.

The 'jargon-free' discussion gave students the confidence to participate fully even if they had never given politics and current affairs any serious thought. It became apparent that their intuitions and prior knowledge mattered deeply. I continued to build upon their awareness and understanding in the subsequent weeks, discussing specific theories and issues that could help them to develop new, interesting and personally meaningful ways of thinking about democracy in Singapore.

It was noteworthy that students themselves took turns to lead small-group discussions using the Socratic facilitative style in the weeks that followed. In fact, they even ran the final sessions effectively by themselves as a significant part of their overall assessment. They had to design the two-hour sessions, during which they would perform a philosophical dialogue written on given topics such as

*Continued on page 16...*

## Hi & Bye

CDTL would like to welcome as Associate Directors the following:

- **A/Prof Anjam Kursheed** (Department of Electrical & Computer Engineering, Faculty of Engineering); and
- **A/Prof Eleanor Wong** (Faculty of Law); their terms of office will run from February 2003 to December 2004.
- **Ms Teo Siok Tuan**, Publications Officer who joined in December 2002;
- **Ms Christine Tan**, Technical Support Officer who joined in January 2003; and
- **Ms Koh Hwee Bee**, Administrative Officer who joined in February 2003.

We are also pleased that the following Associate Directors will continue to serve with the CDTL till December 2004:

- **A/Prof Alice Christudason** (Department of Real Estate, School of Design & Environment);

- **Prof Matthew Gwee** (Department of Pharmacology, Faculty of Medicine) and
- **Prof Y.K. Ip** (Department of Biological Sciences, Faculty of Science).

At the same time, the following Associate Directors completed their terms of office in December 2002. CDTL would also like to thank them for their invaluable input and wish them well in their future endeavours:

- **A/Prof Chee Yam San** (School of Computing);
- **A/Prof Lim Lum Peng** (Department of Preventive Dentistry, Faculty of Dentistry);
- **A/Prof Seah Kar Heng** (Department of Mechanical & Production Engineering, Faculty of Engineering); and
- **A/Prof Ter Kah Leng Nee Khew** (NUS School of Business). ■

## CDTL's Latest Book

*Ideas on Teaching*, published by CDTL in February 2003 is a compilation of papers written by practising teachers based on their own experiences in university teaching. Launched originally in 2000 as a 1-page series, CDTL has recently collated the articles from 2000 & 2001 with new ones to form the booklet. It contains discussions on specific topics in teaching and learning to generate further thought and discussion as well as tips and perspectives on teaching to encourage improvement in teaching. All NUS teaching staff members are entitled to a free copy of the booklet. If you have yet to receive yours, please contact your faculty's Dean Office immediately.

CDTL hopes to turn *Ideas on Teaching* into a regular annual publication. For further enquiries or if you (teachers) would like to submit short articles (about 500 words long) for the next volume targeted to appear in early 2004, please contact Ms Verena Tay at 6874 8047 or email: [cddtayv@nus.edu.sg](mailto:cddtayv@nus.edu.sg). ■



Calling All Writers...

CDTL invites articles on any teaching and learning topic for the following two newsletters:

**CDTLink** (700 words maximum per article; photos & illustrations in hard/digital copy are welcomed)

**CDTL Brief** (text-only newsletter; 1000 words maximum per article)

To submit articles for consideration or to obtain more information,

please contact: **Ms Teo Siok Tuan**

Email: [sioktuan@nus.edu.sg](mailto:sioktuan@nus.edu.sg)

Tel: (65)-6874 4692 • Fax: (65)-6777 0342 ■

# Professional Development Programme (Teaching)

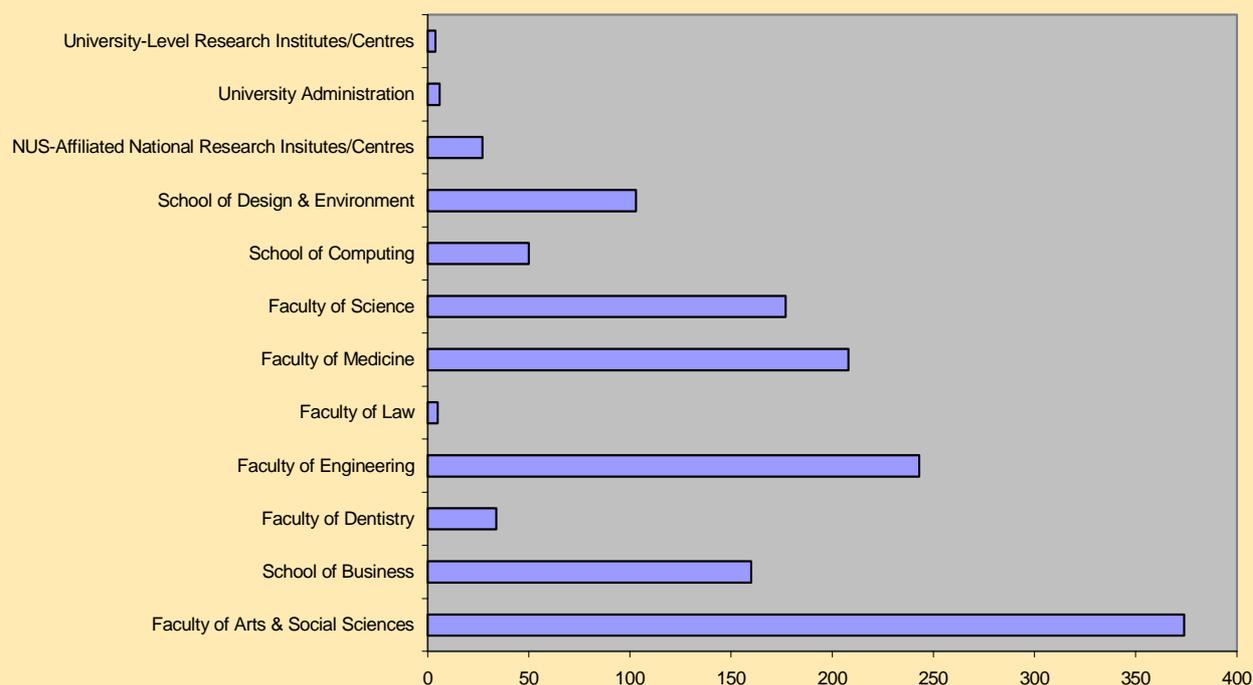
25-27 February 2003

## Developing Our Teaching Staff

To help the NUS academic staff with less than 3 years of full-time teaching experience in higher education get a head start in their teaching careers, CDTL conducted the intensive Professional Development Programme (Teaching) during 25–27 February 2003. ■



## 2002 Statistics: Who attended CDTL's Staff Workshops and Seminars?



# TEACHING & LEARNING

## highlights



Screenshot of the Blackboard website

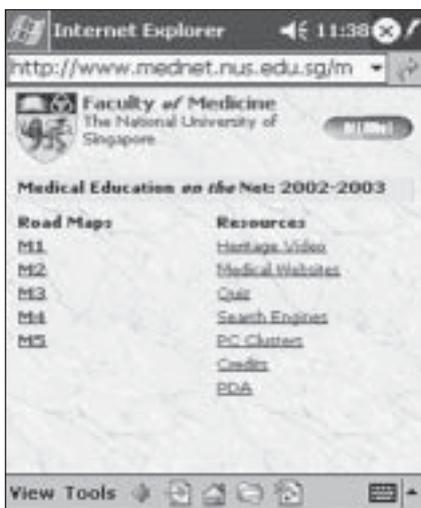
### *Faculty of Arts & Social Sciences*

#### **'Borderless Classroom': A NUS Collaboration with University of Hawaii, Manoa**

In semester 1 (AY2001/02), the Department of Geography collaborated with the University of Hawaii, Manoa (UHM) in a five-week 'borderless classroom' exercise. A total of 180 students (130 from a level-2000 tourism geography module in NUS, and 50 undergraduates enrolled in geography/anthropology courses in UHM) were involved. The objective was to provide students with a 'no-walls classroom' experience in which exchange of ideas could take place virtually between students in the two campuses. The main

assignment involved exchanging information on Hawaiian/Singaporean culture and tourism developments through a shared Internet site—the Blackboard (UHM's equivalent of the Integrated Virtual Learning Environment) that served as a 'virtual classroom'. Through the site, students could post questions and photos, answer queries, watch videos, access websites, chat 'live' with other students and faculty members as well as submit assignments.

To encourage peer learning and review, students were also encouraged to read and comment on the works submitted by other students on the Blackboard. They also voted for the best group assignment, and the results of the poll tabulated. Many students feedback that they benefited from the information exchange with their American counterparts. What better way to learn more about geography and tourism in Hawaii by interacting with the UHM students? The Blackboard had certainly provided a convenient and user-friendly environment that facilitated trans-border collaborations and cross-cultural dialogues. We look forward to more of such interactions in the future. ■



Screenshot of mobile version of MEDNet

### *Faculty of Medicine*

#### **Medical Education with Wireless Handheld Personal Digital Assistants (PDAs)**

An on-going trial in the Faculty of Medicine is aimed at evaluating the use of wireless PDAs in medical education, using the NUSNET 802.11b wireless network. The compact size of PDAs is especially convenient for clinical students who move from place to place to see patients.

Wireless PPCs (Pocket PCs) have been successfully implemented for curriculum delivery and online assessment of medical students by the Department of Neonatology since November 2001. In July 2002, ITU (Information Technology Unit) Medicine launched a mobile version of MEDNet, the medical curriculum intranet, for wireless PDA access (<http://www.mednet.nus.edu.sg/mobile/>). The installation of NUSNET 802.11b wireless network points in the National University Hospital is expected to enhance the scope of wireless PDA applications for clinical students in the future. ■

### *University Scholars Programme*

#### **Teaching in the Socratic Method: Teaching by Asking Instead of Telling**

The Socratic method is one of the many student-centred teaching methods used by teachers in the University Scholars Programme. The teacher puts forth an initial viewpoint for a particular topic, and thereafter asks questions that challenge the students to move from one solution to another until they arrive at a reasonable answer. The process by which teacher and student collaborate on arriving at an answer is considered to be more important than the answer itself.

While the Socratic method may be less successfully applied to content-based modules, it can be used in a greater variety of modules than most would imagine, including disciplines such as mathematics ([http://www.garlikov.com/Soc\\_Meth.html](http://www.garlikov.com/Soc_Meth.html)). Most faculty members in the Scholars Programme use it to some degree. Examples are Dr Kenneth Tan, in his module “Democratic Possibilities in Singapore” (see article on page 7), and A/Prof Anh Tuan Nuyen, in his module “The Quest for Moral Excellence”. ■

## *NUS Business School*

### **The Asia-Pacific Executive MBA for the Senior Executive**

The Asia-Pacific Executive MBA (APEX-MBA) Programme, offered by the NUS Business School since January 1997, has just opened applications for its 12<sup>th</sup> intake. The latest ranking of Executive MBAs (EMBA) in Asia by the Chief Executive China Magazine confirms its success. APEX-MBA was ranked 3<sup>rd</sup> after the HKUST-Kellogg and Chicago (Singapore) Programmes and top of the ‘all Asian’ EMBA programmes.



*Graduating APEX-MBA students*

From the Faculty’s perspective, teaching these mature and experienced executives is a growth, networking and research opportunity all at the same time. Participants come from the best-practice blue chip companies, more often than not have global work-experience, and are experts in their own fields. Some even have a Ph.D.! The instruction philosophy is focused on drawing from the vast experience of the participants, while at the same time introducing the latest concepts and ideas from the field. Visit [www.apexmba.com](http://www.apexmba.com) for further information on the programme. ■

## *Faculty of Science*

### **Teaching & Learning Seminar 2002**

For the third consecutive year, the Department of Mathematics organised the Teaching & Learning Seminar on 6 November 2002. The annual event provides an open, informal and conducive environment for staff to share with one another their teaching philosophies, experiences and methodologies. Staff found the seminar interesting, beneficial and informative. In particular, two speakers from the Faculty of Engineering who shared their views on the teaching of engineering mathematics provided the staff with new perspectives on teaching. The following staff presented talks at the seminar:



*A/Prof Helmer Aslaksen addressing staff at the seminar*

“**Teaching Mathematics and Training Mathematicians**” by *Prof Lee Seng Luan, Department of Mathematics*;  
 “**Experiences in Teaching Engineering Mathematics**” by *A/Prof Jacob Coetzee, Department of Electrical & Computer Engineering*;

“**Equilibrium and Optimum: How to Kill Two Birds with One Stone**” by *A/Prof Ajay Kumar Ray, Department of Chemical & Environmental Engineering*;

“**Motivating and Engaging Student Interest in a Mathematics Lecture**” by *A/Prof Tay Yong Chiang, Department of Mathematics*; and

“**The Joy of GEM**” by *A/Prof Helmer Aslaksen, Department of Mathematics*. ■



*Breakout sessions: Novel in-class tutorials for GEM1530K*

### **Breakout!**

One of the great challenges of General Education Modules is that they call for a multidisciplinary integration of wide-ranging topics in an up-to-date fashion. However, it is difficult to find suitable tutors with sufficient domain-knowledge to conduct constructive discussion-based tutorials. Hence, a novel approach was tested out for GEM1530K—Life as a Complex System—where available extra lecture slots were used for hybrid large/small-group in-class tutorials. Modelled upon the breakout sessions adopted by business consultants, students were divided into teams to discuss a certain topic and then asked to give presentations afterwards. The sessions were very lively and the students were able to engage comprehensively with the subject. Encouraged by the students’ learning and enthusiasm, this method will be refined further for future use. ■

## School of Design & Engineering

### Scripting Spaces: Film, Architecture, Time & Spaces

Film and architecture are closely related visual art forms by virtue of their similar emphases on time and the use of various spatial devices to create perceptions that stimulate both the sensorial and the intellectual. Throughout the history of modern architecture, architects have always been inspired by the rich reservoir of spatial imageries used in film masterpieces to choreograph their architectural spaces. In a design project in the first-year architecture course, students were asked to explore such intriguing and inspiring connections between film and architecture. They were to design a small urban dwelling for different film directors, drawing inspirations from the directors' works. The students were given a list of films (chosen for their evocative representations of spaces and places in different cities) such as Wim Wenders' *Wings of Desire* and Wong Kar Wai's *Chungking Express*. In the design processes, related modes of representations such as video-captures, montages and narratives were used, culminating in a refreshingly rich variety of spatial experiences expressed in the final design. ■



Composite image of students' projects

## PBL-in-Action: How to Implement Problem-based Learning in Business Marketing?

...continued from page 6

Figure 2. PBL Worksheet

Facts	Ideas	Learning Issues	Action Plan
List facts from the given case to support your ideas.	List as many possible ideas that you can generate.	Assess what you do not know and what you need to learn in order to solve the problem.	Show how and where you intend to address your learning issues.

### PBL Assessment

PBL equips students with content and process skills. Tutors observe and intervene to ensure that the group achieves the learning outcomes. This constitutes formative assessment. The assessment tools are designed to reflect the stages of PBL so that students will internalise each stage. Figure 3 illustrates the assessment plan. External assessors form part of the assessing team to provide inputs on the student performance.

Figure 3. Assessment Plan

Tools	How	Weightage
Report & PBL Worksheet	Group	40%
Oral Presentation	Group	10%
Integrated Test	Individual	15%
Concept Map	Individual	15%
Self & Peer Assessment	Individual	10%
Tutor Assessment	Individual	10%

### PBL Programme Evaluation

Figure 4 shows the tools that tutors use to track their performance for areas of improvement.

Figure 4. Tools for Evaluating PBL

Tool	Purpose
Tutor Feedback Survey	To assess a tutor's performance in facilitating the PBL process.
PBL Survey	To gather the students' perspective about their learning experience in a PBL environment.
Problem-Fit Survey	To assess the relevance and effectiveness of the problem in stimulating student learning and addressing the planned learning outcomes.
Graduate	To gather graduate's opinions of the entire learning experience at the institution at their point of exit.
Employer	To obtain employers' feedback on performance of graduates in the work place.

### Conclusion

PBL integrates all aspects of learning such as facilitation, questioning, creative and critical thinking, problem solving, cooperative learning, team building, active learning and discovery-based learning to provide for holistic learning experience. This prepares the students to be ready for work and change. It is difficult to refute the relevance of PBL in this information age where students need to embrace change and ambiguity well.

To realise the benefits of PBL, it must be implemented correctly. Giving students a problem, forming them into groups for learning with little intervention do not constitute PBL. Piling PBL on top of the current teaching environment of content coverage and instruction merely suggests PBL as a teaching tool that adds on to the already busy curriculum.

Strategic planning to determine what to learn and how to learn is critical. Tutors need to articulate what and how to learn and show evidence of accomplishment. Evaluation serves as input for a learning organisation to correct itself and improve. PBL is a journey with many opportunities of reflection and just-in-time improvements. ■



# Uses and Limitations of IT

**Associate Professor Seah Kar Heng**  
Department of Mechanical Engineering

We are living in an age when technology pervades virtually every facet of our lives. In recent years, there has been an enthusiastic push to make use of Intelligent Technology (IT) for the enhancement of teaching and learning because of the advantages derived. There is, however, the danger that in their eagerness to cash in on IT usage, teachers may be tempted to employ IT under circumstances in which it would be totally unnecessary for, or perhaps even detrimental to, teaching and learning. What is desired is a balanced view of IT and its applications.

## Uses of IT

The numerous advantages of IT are pretty obvious. For example, by simply accessing a website, information can be obtained at the click of a mouse, saving the student much precious time walking to the library to reserve or refer to a book. IT nowadays also provides easy access to materials through, say, e-books and e-journals. Online discussion forums between lecturers and students are also possible.

IT is able to perform many functions that the lecturer is unable to fulfill. For example, it can be used to demonstrate animated examples of certain machinery (in the case of engineering), without which the lecturer would need to arrange for the students to visit a mechanical plant. In the absence of the lecturer after office hours, students can still communicate with him or her, as well as with each other through IT facilities. This enables education to free itself from the confines of the classroom.

Nowadays, there are online courses made available to interested parties from all walks of life, eliminating the need for students to travel to a specific location for lectures. They can even be in other countries. For instance, in Europe such courses attract students from many other European countries. In the US, MIT is trying to put all their courses online so that students from all over the world can subscribe to them under a distance-learning scheme. The students however may need to go to MIT once in a while when it is really essential or the lecturers may need to go overseas to teach their foreign students occasionally. Such online courses are also ideal for very large classes that are too huge to fit into a lecture theatre. Students can access online lectures at their own convenience and learn at their own pace. Moreover, it allows for the inclusion of additional material and animated demos, and may end up more

interesting for the students. Even remote-controlled practical laboratory sessions are possible with IT and these have been conducted in some advanced countries.

With IT, lectures can be repeated in exactness, and teachers and students can easily review and evaluate such and such a lecture at will. PowerPoint presentations are permanent records that are convenient to edit and send via the Internet. Video conferencing saves money and time in travelling and globetrotting on the part of the participants. There are so many other uses of IT—the list is almost endless. So, does this imply that the lecturer is redundant?

## Limitations of IT

Despite the fact that PowerPoint presentations are extremely popular and attractive, many top universities in the US discourage their use for teaching and learning. One of the reasons is that the lecturer's train of thought could be restrained by the prepared presentation, hindering flexibility and on-the-spot reaction to changes in circumstances. Students have often complained that such presentations are too fast for them to follow and assimilate. A certain amount of personal touch and sense of 'live performance' is also lost. Lecturers themselves admit that by flashing facts and figures using PowerPoint presentations actually squeezes too much of the syllabus into a short space of time. Using transparencies on an overhead projector has a more human touch and students can follow the lecturer as he changes transparencies. Moreover, PowerPoint presentations take ages to install and are practically useless during an equipment or power failure, requiring a backup on transparencies in any case.

Although websites are generally powerful tools for gathering information, not all websites are well designed or user-friendly. Those that are complicated end up wasting the surfer's precious time. Students sometimes complain that such and such a website is more confusing than educational. As for web casting of lectures, the impression that students get when using these is that they feel that they are communicating with a machine rather than with a person. It has been found that distance-learning students from other countries or other universities accessing online courses tend to drop out more frequently than those within the same university for the simple reason that they just do not feel part of the learning community.

## Conclusion

All IT programs are limited in scope, and therefore are inflexible beyond their capacity. Judicious use of IT has its advantages. Still, it is up to man, who created IT, to know how far it can be harnessed for the purpose of teaching and learning. ■

# Learning Objects

**Mr Eugene Hiew**

Manager, e-Learning & Courseware Development  
Centre for Instructional Technology (CIT)

Some educators are starting to create small, stand-alone chunks of learning activities and instructional materials, which can be assembled and potentially sequenced to meet different learners' needs. These chunks of contents are commonly known as learning objects; they constitute a departure from the traditional practice of building online instructional materials as an entire course website.

Since 1997, organisations like the IMS Global Learning Consortium<sup>1</sup> have been hard at work, formulating specifications needed to address the different activities related to learning objects. In July 2002, a standardised scheme for labelling learning objects, commonly referred to as the Learning Object Metadata (LOM), has been accepted as an approved international standard, opening up new opportunities for learning systems that adhere to this standardised labelling scheme. These standards-based systems will be able to search, retrieve and exchange learning objects. Emerging specifications that address packaging, sequencing and distributed repositories are also being formulated.

The term 'learning object' was first coined by the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronic Engineers<sup>2</sup> (IEEE). The definition of a learning object as spelled out by the LTSC, however, has been found to be too broad, encompassing "any entity, digital or non-digital, that may be used for learning, education or training"<sup>3</sup>. There is a practical need to be able to distinguish between any digital raw media assets and learning objects. The former are any digital media comprising of text, images and sound; however unlike learning objects, they may not be independent, defined pieces of instruction. Therefore, the learning object is

typically a collection of digital media that is put together with specific instructional or learning objectives in mind. At the same time, in order to facilitate re-usability, it must be designed as the smallest logical unit of instruction. There are various learning object frameworks that have been proposed by content developers. One such framework, that CIT has adopted, is an adaptation of the CISCO Systems<sup>4</sup> re-usable learning object framework.

By focusing on a single core concept, each learning object is conceived in the following manner:

## 1. Overview

- State learning objectives
- State prerequisite knowledge

## 2. Content Presentation

- Provide multimedia materials and active engagement of the learner

## 3. Practice/Assessment

- Enable students to verify for themselves their progress

## 4. Summary

- Reinforce learning objectives

This framework shares similarities to the nine events of instruction proposed by Gagne<sup>5</sup>:

- Gain attention
- Describe goal
- Recall prior knowledge
- Present lesson content
- Provide lesson guidance
- Elicit performance

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1. IMS originally stood for the Instructional Management Systems (IMS) project that existed as a project within the National Learning Infrastructure Initiative of Educause. Since then, the acronym stuck on, even though the organisation has expanded beyond its original project scope to include standards for learning servers, learning content and the enterprise integration of these capabilities.

2. The IEEE is a non-profit, technical professional association of more than 377,000 individual members in 150 countries. Through its members, the IEEE is a leading authority in technical areas ranging from computer engineering, biomedical technology and telecommunications, to electric power, aerospace and consumer electronics, among others.

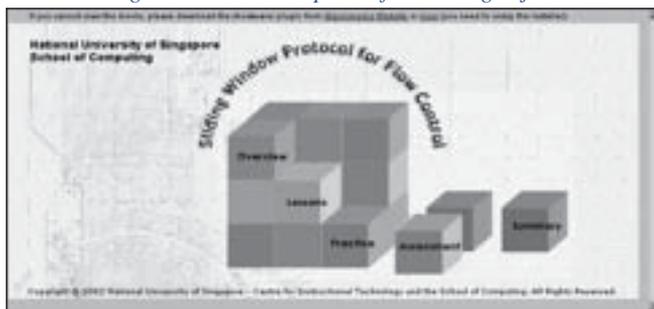
3. Learning Technology Standards Committee, Institute of Electrical and Electronics Engineers, Inc. (15 July 2002). Draft Standard for Learning Object Metadata, p. 6. [http://ltsc.ieee.org/doc/wg12/LOM\\_1484\\_12\\_1\\_v1\\_Final\\_Draft.pdf](http://ltsc.ieee.org/doc/wg12/LOM_1484_12_1_v1_Final_Draft.pdf). (Last Accessed: 21 January 2003).

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4. Cisco Systems, Inc. is a worldwide leader in networking for the Internet. The Cisco Internet Learning Solutions Group (ILSG) proposed and adopted the reusable learning object strategy, as it recognises a need to move from creating and delivering large inflexible training courses, to database driven objects that can be searched and modified.

5. Gagne, R. (1985). *The Conditions of Learning* (4th ed.). New York: Holt, Rinehart & Winston.

Figure 1: A screen capture of a learning object



- Provide feedback (reinforcement) to learner about performance
- Assess performance
- Enhance retention and transfer

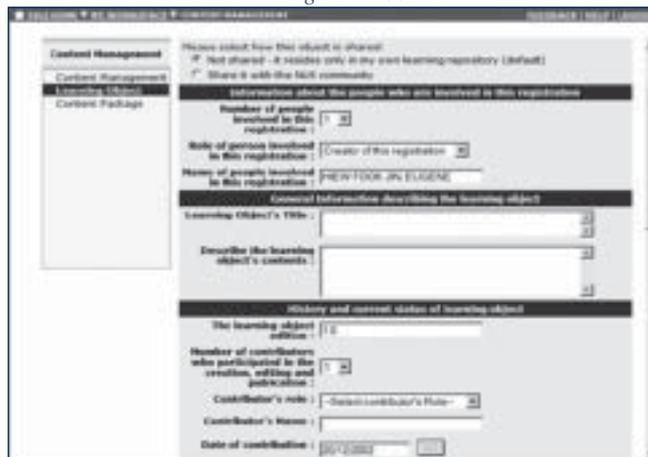
Apart from creating contents with the proposed learning object framework, other types of instructional materials also encapsulate specific instructional objectives that may serve as useful references in learning. For example, web-cast lectures can serve as an invaluable instructional reference for students, and may therefore form a different category of learning objects.

As learning objects are delivered through the Web, they can be created with existing web-content creation tools that are readily available and vary in sophistication and complexity. For instance, common HTML editors like Microsoft FrontPage can be used to create a learning object. So too can other commercial software like Macromedia Director, Flash and Authorware that provide richer environments for developing engaging instructional web-delivered multimedia content.

Lecturers have traditionally built courseware websites (i.e. customised websites that are specific to a particular module and not designed for re-use). Such module websites are typically expensive, time-consuming, one-off efforts to create online instructional materials. However if these instructional materials could be re-used, aggregated, disaggregated or re-sequenced when needed, it would allow for greater choice and efficiency. More importantly, it would also reduce the need for lecturers to create all the instructional materials they need from scratch, thereby reducing the need to 're-invent the wheel' for every new course offered.

In order for learning objects to be discovered and deployed by different users, they have to be registered with a learning object repository. The Integrated Virtual Learning Environment (IVLE) content management tool is one such repository. To register a learning object with a repository, one fills up a web form to describe the learning object, much like creating a label to describe the contents within a can of food. Based on the LOM standard, the set of fields,

Figure 2: Registering a learning object with the IVLE Content Management tool



which 'labels' the learning object, ensures that the registration of a learning object need only be done once in its 'lifetime'.

If required, the learning object with its registration information can be imported into or exported out of the IVLE content management tool. In addition, learning objects can be aggregated or disaggregated from the IVLE Lesson Plan; or they can be packaged and sequenced together into a content package, which can then be referenced from the Lesson Plan tool.

Figure 3: Learning objects can be packaged and sequenced



The various pieces of technology and instructional theories related to learning objects are just beginning to fall into place. Standards bodies have started to address the issues of managing and sequencing learning objects. There is still pedagogical research, standardisation and technological refinement needed before a complete strategy for learning objects becomes clear.

However, just like the use of the Internet in education, packaging contents in a learning object framework provides another instructional option for lecturers. Technologies that support the registration and delivery of learning objects are not perfect; but like the rest of the Web, they are functional. The fundamental mechanisms for the exchange and re-use of learning objects are already in place. Lecturers can already register the learning objects they create, aggregate learning objects in different sequence and re-use them in multiple modules through the IVLE platform today. ■

## Building upon the Socratic Method

...continued from page 7

“meritocracy and democracy in Singapore” in teams. The task was to facilitate discussions surrounding the themes and issues raised in their dialogues in the Socratic manner. Through the processes involved in the exchange of ideas, students learnt a most practical democratic skill—how to facilitate a discussion with focus and clarity, and stimulate active, inclusive, spontaneous and intellectually responsible debate. ■



Students meeting for the first time, learning about democracy and nation building through an activity based on teamwork and competition.



A student facilitating discussion amongst his peers, learning the Socratic method as a form of democratic citizenship training.

## Raising the Standards of Our IT Graduates

...continued from page 1

Programme, Undergraduate Research Opportunity Programme and NUS Overseas Colleges. The number of students participating in programmes offered by NUS Overseas Colleges has been increasing steadily in the past 3 semesters such that the participants now constitute approximately 50% of the latest cohort going to Silicon Valley and Bio-Valley.

Another important change in the curriculum is the inclusion of a more rigorous requirement of science-related modules for both the 4- and 3-year programmes. Students are now required to take up to 5 modules (or 20 MC) of Physics, Calculus, Linear Algebra, Statistics and Life Sciences to meet their degree requirements.

The School has also introduced a new module—(CS 2220) *Introduction to Computational Biology*—in semester 1 (AY 2002/03) with an aim to provide a broad overview of computational techniques commonly used in bioinformatics. Students taking this module would develop an appreciation of the role of bioinformaticians as a bridge between computer science and



The Centre for Development of Teaching and Learning (CDTL) provides a wide range of services and facilities to promote the teaching, learning and research programmes of the National University of Singapore. These include teaching and learning support, research on educational development issues, as well as instructional design and development.

## editorial information

**Guest Writers** Joxan Jaffar; K.P. Mohanan; Kevin S. Carlson; Wee Keng Neo, Lynda; Kenneth Paul Tan; Seah Kar Heng; Eugene Hiew.

**Contributors** to 'From the Faculties: Teaching & Learning Highlights': Chang Tou Chuang, Lee Szu Hee, Kenneth Paul Tan, Wirtz Jochen, Lynette Wong, Frederick H. Willeboordse, Chang Jiat Hwee.

**Advisor** Daphne Pan

**Editor** Verena Tay & Teo Siok Tuan

**Graphic Design** Ma Lin Lin

**Photography** Frederick Chew  
(unless provided by authors)

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Contributions on teaching and learning topics, as well as feedback on this issue, are welcome and should be addressed to:

**The Editor, CDTLink**  
Centre for Development of Teaching and Learning  
National University of Singapore  
Central Library Annexe, Level 6  
10 Kent Ridge Crescent, Singapore 119260  
Tel: (65) 6874-3052 Fax: (65) 6777-0342  
Email: [cdtpost@nus.edu.sg](mailto:cdtpost@nus.edu.sg)  
<http://www.cdtl.nus.edu.sg>

biology. The School plans to offer more advanced bioinformatics-related module in the coming academic year.

The curriculum guidelines provided by both the Association for Computing Machinery (ACM) and Institute for Electronics and Electrical Engineering (IEEE) recommended a 4-year degree programme structure for computing. In view of this and the School's belief that having more students undergoing the 4-year programmes will boost the standard of its graduates in the IT market as well as better equip them for higher degrees, the School has lowered the minimum CAP (Cumulative Average Point) requirement for eligibility for the 4-year programmes from 3.8 to 3.5 with effect from AY 2002/03. Consequently, close to 40% of each cohort are expected to be eligible for the 4-year programmes, up from 25% previously. ■