

## Evolving Our Undergraduate Curriculum: The NUS Faculty of Engineering Experience

**Professor C.M. Wang**

Vice-Dean of Undergraduate Programs, Faculty of Engineering

The most significant development in engineering education in recent years is the birthing of the ABET\* EC2000 Criteria (<http://www.abet.org>). While the previous set of criteria was concerned with the counting of credits in certain categories of learning, the new one is outcome-based, radically affecting the engineering education community.

According to ABET's *Criterion 3 Program Outcomes and Assessment*, it is the responsibility of the institutions seeking accreditation of an engineering program to **demonstrate** clearly that their graduates have the following:

- a. an ability to apply knowledge in mathematics, science and engineering
- b. an ability to design and conduct experiments, as well as to analyse and interpret data
- c. an ability to design a system, component, or process to meet desired needs
- d. an ability to function within multi-disciplinary teams
- e. an ability to identify, formulate and solve engineering problems
- f. an understanding of professional and ethical responsibility
- g. an ability to communicate effectively
- h. the broad education necessary to understand the impact of engineering solutions in a global and societal context

\* ABET is the acronym for Accreditation Board for Engineering and Technology. Established originally in 1932 as the Engineering's Council for Professional Development (ECPD), ABET is recognised by the Council for Higher Education Accreditation as the only organisation responsible for the accreditation of engineering-related programs at colleges and universities in the United States.



- i. a recognition of the need for, and an ability to engage in, life-long learning
- j. a knowledge of contemporary issues
- k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice

It can be seen that the traditional engineering curriculum explicitly addresses only 5 out of the 11 program outcomes [i.e. (a), (b), (c), (e) and (k)]. The rest of the outcomes, which address *soft* skills such as teamwork, macro-thinking and effective communication, are usually not considered to be the primary objectives of an engineering curriculum. These secondary objectives are often relegated to the hidden curriculum. But due to demands from the engineering industry that such attributes are essential, ABET now requires these soft skills to be incorporated in the curriculum on a footing equal to that of technical knowledge and skills.

In addition, the ABET outcomes emphasise what engineers *do* rather than what they *know*. This means that the place of

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# Ethical Guidelines for Student Researchers

Assistant Professor Todd T. Ames  
Department of Sociology

There are a number of different approaches to sociological and anthropological research. When conducting research, sociologists and anthropologists at times face ethical and legal dilemmas and conflicts of interest, these dilemmas and conflicts apply to student researchers as well. Student researchers face the added risk of exposing their supervisors and schools to potential liability in some cases.

The following recommendations are intended to point out some common ethical concerns and to indicate areas in which potential problems may arise for student researchers. They are adapted for from the recommended guidelines of The British Sociological Association, the American Sociological Association and the Association of Social Anthropologists of the Commonwealth and the Social Research Association. (For a complete list of the guidelines, please see the BSA and ASA websites, <http://www.britisoc.org.uk/about/ethic.htm> and <http://www.asanet.org/members/ecostand.html>, respectively.)

## 1. Responsibilities of Researchers for Research Subjects

When Sociologists and Anthropologists carry out research, they enter into personal and moral relationships with their research subjects, whether they are individuals, households, social groups, organisations, businesses or governments.

While conducting research for scholarly and academic pursuits is a worthwhile endeavour, it does not provide any justification to abuse the rights of others. Researchers have the responsibility to ensure that their subjects come to no physical, social or psychological harm due to their involvement in the research.

Because research relationships are frequently characterised by disparities in power and status, researchers must ensure that they do not abuse their relationship with their research subjects in any manner, especially in areas of trust, promises and obligations.

Sociological and Anthropological research should be based on the concept of informed consent. This means that researchers are responsible to explain as fully and truthfully as possible, in a manner understandable to the research subjects, what the research is about, who is conducting the research, how the information will be utilised and who will have access to both the raw data and final data.

Research subjects should be informed of their right to refuse participation for any reason and at any time.

Researchers need to carefully inform their subjects to what level and to what degree the subject's anonymity and confidentiality will be protected. Research subjects have the right to refuse the use of any data-gathering devices such as cameras, tape recorders, video cameras, or any other data-recording device. Researchers must not make unrealistic promises of confidentiality; but they also must not allow any



*Miss Ho Shu Ping & Mr Choy Kein Wai, among the first students in the Department of Sociology to use the new ethics guidelines in their honours research projects*

access to tape recordings, films or any other records other than those to people whom the research subjects have approved.

If there is the possibility that research records or materials may be shared with other researchers, the ways in which the data may be used must be explained to the research subjects.

When researchers collect data, make notes, make films, or make any type of recordings they need to make clear to their research subjects, what the data will be used for and who will have access to it.

In some research contexts, especially those involving long-term field research, the granting of consent must be considered not as a one-time event, but as an ongoing process.

Researchers need to be aware of any possible consequences of their work. They need to try and anticipate and prevent any outcome of their research that may be harmful to the research subjects. Even though research subjects may have granted consent, this does not absolve researchers from any responsibilities towards their subjects. This includes intruding into private and personal worlds of the research subjects in a way that they may find disturbing or unpleasant.

Researchers need to fulfil promises made to research subjects in regard to confidentiality, anonymity, and agreements to provide access to the final research report or thesis.

## 2. Covert Research

The use of covert research raises serious ethical concerns. In most instances, it directly violates the guidelines of informed consent. Students should only undertake covert research after a thorough consultation with their advisor or supervisor.

At times covert research may be deemed necessary as a means to avoid influencing the behaviour of the research subjects, or to gain information on social behaviour that is not normally open to the public. For whatever reason covert research is conducted, it is still vital to provide all the same protections of anonymity and confidentiality. If possible, informed consent of the research subjects should be obtained after the fact.

## 3. Anonymity, Confidentiality & Privacy

Researchers must strive to maintain the anonymity and privacy of their research subjects. Any personal information

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# Preventing Plagiarism

**Assistant Professor Philip Holden**  
Department of English Language & Literature

Plagiarism is a problem that is receiving increasing attention in the media. Recent publicity concerning the growth of online ‘paper mills’, websites offering past assignments on every conceivable topic to students for a small fee, gives the impression that a crisis is upon us. The solution often proposed is technological—detection software which looks for recurring patterns of words in a vast information bank of assignments.

Such an approach may be misguided. While some cases of plagiarism do involve a deliberate and systematic attempt to deceive, most arise from students’ confusion, carelessness, lack of confidence in their own voices and a lack of knowledge of academic conventions. Most cases of plagiarism can be guarded against by good module design, and a clear departmental policy that can be used as a safety net to deal with more severe cases. Fortunately, educational approaches that prevent plagiarism are also those that encourage active learning.

While most faculty members know what plagiarism is, we tend to struggle when asked to come up with a clear definition. Indeed, at a plagiarism workshop in CDTL last year, university faculty members from different disciplines had divergent, although not incompatible views, regarding what constituted plagiarism in their discipline. My own favoured definition is that plagiarism is the conscious or unconscious presentation of academic work done by another person as one’s own for formal assessment in a university module. Plagiarism can vary greatly in severity, from forgetting to enclose distinctive phrases from an acknowledged source in quotation marks to word-for-word copying of another student’s assignment or from the Internet.

When dealing with plagiarism, it is important to first have a clear departmental policy which can be brought to the attention of all students, and which can guide faculty members if they come across cases of plagiarism. The University Scholars Programme, for instance, publishes an Honour Code and Penalties for Plagiarism on its web site. Beyond this, however, module design is clearly important. Plagiarism needs to be discussed in modules which students take early in their academic career, especially those which aim to introduce students to disciplinary norms. A brief mention of plagiarism and a handout is often, in my experience, not enough—such strategies will not reach students who are already unaware of academic norms. At the same time, giving a long lecture on plagiarism can be off-putting to students, since they may well feel that an assumption has been made that they are all planning to plagiarise. Prolonged discussion of plagiarism

also may take up time that should be devoted to content in an already packed introductory module.

In my own discipline, Literature and Cultural Studies, I solve the problem by having students practise skills that are crucial to their discipline, and smuggling in a discussion of plagiarism. The ability to identify key passages in literary texts, to read them closely, and to communicate such a reading to an audience through quotation, summary, and paraphrase, are central to my discipline. Having students carry out such exercises early on in the semester through a process of drafting and revision of a first assignment enables problems, such as plagiarism, to be identified and addressed in discussion with the whole class. Students thus see not just that plagiarism involves a breach of an academic code of conduct, but also the reason why such a code exists. Asking and answering basic questions about what research is in one’s discipline—questions that may be obvious to us, but not to our students—is a good strategy for preventing plagiarism.

In my own classes, I follow up introductory discussions by giving students considerable freedom to choose their final research projects, but requiring them to go through a process of submitting a proposal and drafts to me so that it is very difficult to plagiarise. In larger classes, it may well not be possible to give such detailed attention to the process of student writing. However, there are ways to work around this. Each student could post a proposal to the Integrated Virtual Learning Environment for discussion, for example, and could be asked to comment on one proposal by another student. The lecturer could then briefly review the discussions and make a single posting drawing together points raised. The initial proposal for each would then be part of a public record.

Despite all the precautions above, a small minority of students will still plagiarise. Plagiarised essays, in my experience, frequently have some of the following characteristics (although it is also worth noting that non-plagiarised essays may also feature them):

- sudden and inexplicable changes in vocabulary, tone and sophistication of argument;
- consistent use of American English in either the whole essay or in some paragraphs;
- unusual and consistent referencing system (e.g. if you’ve asked for MLA style, and received APA style).

If these features are present, you may well find you already have a hunch where the material comes from. If not, check first texts in the essay bibliography, and in the module reading lists—it is surprising how much material is plagiarised from these sources. Afterwards, move to the Web. Try entering distinctive phrases which do not appear to be by the student into a search engine such as <http://www.google.com> using inverted commas in this manner, so that the whole phrase is searched for by “...”. Finally, anti-plagiarism software

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## Preventing Plagiarism

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available, either commercially or non-commercially, may be of use, although I have never used it myself.

Above all, we should remember that widespread plagiarism itself is a symptom of deeper pedagogical problems, and that

a strategy that maximises prevention through proper module design and a good relationship with one's students will substantially reduce the number of cases. ■

### Useful Resources

#### Advice Pages

University of Minnesota Plagiarism Advice Pages—<http://cisw.cla.umn.edu/plagiarism/>.

Faculty Resources, West Michigan University—<http://www.wmich.edu/library/users/faculty/plagiarism-faculty.html>.

Robert Harris's Advice on Combatting Plagiarism—<http://www.virtualsalt.com/antiplag.htm>.

#### Anti-Plagiarism Software

Plagiarism Resources Center, University of Virginia—<http://plagiarism.phys.virginia.edu>.

[Note that the free software developed here can compare a large number of papers submitted electronically to see if they are copied from each other or from a common source. It cannot search the Internet for other possible sources.]

Pagarism.org—<http://www.plagiarism.org/>.

[Offers a free trial of their commercial software through <http://www.turnitin.com>, a related website.]

#### University Scholars Programme Sites

Academic Honour Code—<http://www.scholars.nus.edu.sg/uspinfo/students/academiccode.html>.

Penalties for Plagiarism—<http://www.scholars.nus.edu.sg/uspinfo/students/plagiarism.html>.

# Some Thoughts on Problem-Based Learning

Associate Professor W.A.M. Alwis

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The approach to education in terms of a mosaic of highly structured subject-based knowledge domains is familiar to all. It is hard to think of education in any other way. Delivery of instructions, demonstration of solutions and testing of knowledge using predictably patterned examinations define the norm. A teacher would not feel comfortable in a class if he/she does not have a high degree of pre-planned control over the sequence of events in the class or cannot answer all questions asked by students. Most are quite happy to conduct rigidly teacher-centred classes even when they agree that student-centred education would be the better option. It is not surprising that the majority of class textbooks had been written to fit into such a system with chunks of highly organised information interspersed with end-of-chapter problems.

What is easily overlooked is that the process of rigidly structuring knowledge and instruction unwittingly limits applicability of knowledge. For example, in engineering mechanics, a ladder leaning against a wall may have been fondly analysed step by step in the class, yet a spoon in a soup bowl that leans against the edge and then slowly spins into the soup, would be a 'killer' in the examination paper—unless of course, the spoon problem also had been similarly discussed and possibly 'the' solution had been posted on the notice board or made available through the Intranet.

If the purpose of education is to prepare students for the future, then why is it not recognised that students need to be



enabled to tackle things that are not necessarily addressed in textbooks, lectures or other well-structured knowledge delivery systems? Don't we know that the real world out there is very complex and changes constantly? Academic institutions from time to time find that they have too many staff highly specialised in a 'presently less important' domain—shouldn't this make us worry about

the highly organised yet limited preparation we attempt to provide the future generation with?

It is not easy to find solutions to the problems we see in education. Problem-based learning (PBL), however, seems to be a far better option than the lecture-tutorial based instruction scheme widely practised today. PBL duly acknowledges that each student already knows some aspects about a subject and this may vary widely from student to student in a given class. PBL allows each individual to view a subject in a personal way and construct knowledge in a manner that fits one's own pre-existing knowledge. PBL necessarily trains students to gather knowledge on a need basis to solve problems—the best way to handle a future where the needed knowledge cannot be predicted. In comparison, just like a driver who picks up a group of passengers from a certain point and transports them to another point by taking full control of the vehicle, an instructor in the lecture-tutorial scheme attempts to take a whole class along a pre-planned route in a well-guided manner—for what purpose is the question here.

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# “Tiring, because we have to think so much”: Experimenting with PBL in a Class in the Social Sciences

Assistant Professor Hendrik Meyer-Ohle  
Department of Japanese Studies

## Why Try Problem-based Learning (PBL)?

**M**y initial reason for experimenting with PBL in my fourth year module on the Political Economy of Japan was to increase student participation. In the first run of the module, students had been preoccupied with writing their theses and had thereby come to class insufficiently prepared and motivated. Not wanting to create a heavily pressurised atmosphere in a class that for most participants was their very last at NUS, PBL promised to offer an alternative that required students to assume greater responsibility in the learning process. As the above quotation by one of the participants in the module shows, my expectations were more than fulfilled.

## Redesigning the Syllabus

The introduction of PBL required the redesign of the syllabus. Under the new syllabus, the first part consisted of two sessions and introduced the study of political economy and PBL. For the second part of the module, six separate problems were developed, each taking up a certain element of Japanese political economy. The PBL process for each problem was concentrated over one day. A moderated one-hour problem exploration session in the early morning was followed by a five-hour period of individual and group study and finally a two-hour session for presentation and discussion of solutions in the afternoon. The third part of the module focused on theoretical models. Since the PBL approach gives students the freedom to choose their own research questions, and students displayed a tendency to avoid larger theoretical issues, I decided to run this part of the class in the conventional reading-based way.

## Problem Design

I generated the problems from newspaper articles. To spark off a discussion among students and to stimulate their urge to find out more, relatively short articles were selected that touched upon a certain topic, contained controversial or highly opinionated statements, or provided only incomplete information. The use of older articles introduced an added dimension since these inspired students to hypothesise about and investigate the circumstances at the time when the article was written and also how issues developed afterwards.

## Some Learning Results

PBL completely fulfilled my expectations of increased student participation and motivation. Students warmed up quickly to the new approach and took over complete responsibility for problem definition, selection of research sources and presentation of solutions. I could limit my own role to that of a true facilitator by creating a suitable learning environment, encouraging participation of all group members and ensuring



*Asst Prof Meyer-Ohle with his students*

that participants stayed within the prescribed PBL process.

Besides increasing participation, PBL proved to be advantageous in many other ways. The group of students enrolled in the module was highly heterogeneous in regard to previously acquired knowledge in the topic area. While under the conventional approach it had been very

difficult to pitch the course to a level that catered to the needs of all participants, PBL allowed students to distribute tasks according to interests, learning needs and capabilities. It was often the weaker and initially less interested students who came up with unconventional questions that led to interesting research problems. Overall, participants were surprised how many research questions they were eventually able to derive from a relatively short newspaper article and over the course further developed their skills in this regard.

Another aspect where PBL proved its worth was the handling of academic texts by students. Readings used by students in the course of their research were often similar to those that would have been assigned as readings in a conventional class. Nonetheless, students tackled these readings with the purpose to answer a research question they had developed on their own and this made a significant difference. PBL offered participants the opportunity to construct their own understanding of issues instead of being provided with given solutions from the beginning or applying a given theoretical concept to a problem. Because they had to cope with a number of sources under time constraints, students also had to develop more effective methods of reading and digesting the available information.

Many of the points raised above might seem trivial and the objectives and results of PBL not much different to those of term projects assigned to students. However, while actual work on projects often remains a black box to the instructor, the introduction of PBL brought greater transparency in regard to the way students discussed in groups, tackled problems and came up with solutions. Having to work on a succession of problems (six in my case) combined with systematic peer and self-evaluations also allowed students to progressively develop their skills.

## Afterthought

In introducing PBL, I was privileged in being able to experiment with a small group of experienced students. Consequently, the class was not typical for most of the classes taught in the Faculty of Arts and Social Sciences. I still feel that PBL could be introduced into larger classes, especially if students were exposed to the approach more frequently and could thereby

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# Re-writing Problem-based Learning for Literary Studies

Dr Bill Hutchings & Ms Karen O'Rourke

Department of English & American Studies, University of Manchester, England

As a self-directed method that prioritises group-management of tasks, Problem-based Learning (PBL) seems ideally suited to a discipline such as literary studies that works so much through discussion and debate, with a relative lack of clear target responses to questions. It might even be argued that the current dominance of tutor-directed models within literary studies actually runs counter to the true nature of the subject. A literary text seldom, if ever, has a single issue or problem as its concern, even when a critic or even the author claims that it does. There will always be a diversity of potential response generated among diverse readers. It is arguably in the apprehension of this diversity that the real creativity of the subject lies. A PBL method, in which it is the group itself that defines the learning objectives, tasks and methods of inquiry, is particularly appropriate.

In order to investigate how PBL could be aligned to our own context and environment, Karen O'Rourke, a graduate of this Department, was appointed Research Assistant (PBL) in October 2000. Since then her work has focused on:

- identification and evaluation of models of good practice (building on the existing bibliography and archive produced by a previous institutionally-funded research project), and assessment and transferability of PBL methods
- testing of models for their validity for literary studies teaching
- assessing the appropriateness of PBL at particular levels of study and for different student groups
- observation of PBL sessions and gathering of feedback from students and tutors/facilitators
- examination of the changing role of the tutor/facilitator
- problem design
- assessment of human and material resource implications (e.g. library provision, staff/student training and development, finding space for multiple small-group meetings)
- development of specific materials to support the delivery of PBL in literary studies
- investigation of appropriate monitoring and assessment techniques in line with departmental requirements and PBL objectives
- networking, training and dissemination activities

The first semester of 2001–2002 saw us working with seminar groups taking a second-year course in eighteenth-century literature. Each week, we held four two-hour seminars, each of 15 students, supplemented by a weekly one-hour plenary



lecture. Each seminar group was organised into three sub-groups of five students for the PBL work. Some students were already familiar with forms of group work, and most had experience of oral presentations. New to all, however, was the idea that they should take increasing responsibility for their learning objectives, research methods and presentation procedures—and that they should do so while being

filmed and observed by the Research Assistant. The videotaping of seminars proved to be no hindrance at all. We reassured students that the filming would have no effect on their assessment and would not be kept for any purposes other than those of the project. The students quite simply 'forgot' about the camera (and Karen!) in the corner of the room.

Our initial strategy for encouraging students' defining of their learning objectives and methods of inquiry was to move gradually from small, contained tasks close to 'problem-solving' in method, to more open problems with less defined outcomes. Thus, an early session presented students with Samuel Johnson's elegy, 'On the Death of Dr. Robert Levett', and asked them to discuss specific questions, such as 'Does the poem imply any belief system?' and 'What level(s) of language does the poem employ?' These questions were 'problem-solving' in the sense that the accompanying lectures had provided some information about religious belief and attitudes to language in the eighteenth century. To an extent, then, students were being asked to apply existing knowledge to a new text. But the investigative nature of their group discussions soon opened up new areas of exploration, such as the nature of poetic diction and the appropriate register for such a solemn topic, which transcended the limits of lecture material and transformed the nature of the learning process. In only a few weeks, students were confidently undertaking tasks of a broad and open-ended nature, addressing issues of genre and reader-response by defining their own research needs and proposing their own methods of inquiry.

Student evaluations of the process were extremely positive and have encouraged us in our next stage, the implementation of a full PBL pattern, involving problems extending over three-week spans, in third-year courses during the second semester of 2001–2002. Student comments included:

*"It's good that we are encouraged to learn for ourselves because that's what life is like. Makes a change from being spoonfed information..."*

*"I particularly enjoyed the way that we were learning for ourselves rather than a passive process."*

*"I have found these seminars a lot more beneficial than other tutorials where no-one interacts and the tutor just speaks."*

*"I felt we had a real sense of direction and purpose—individually and as a group."*

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# How Best to Conduct Team Teaching: My Opinion

Associate Professor Benito C. Tan  
Department of Biological Sciences



Ideally, team teaching utilises the coordinated expertise of several faculty members to achieve a common course goal. This pedagogical method is widely practised in many universities, local and overseas, especially in the science discipline, where one modular subject matter often covers a wide array of specialised topics. As a university student before and now a faculty member at NUS, I have witnessed both success and failure in team teaching.

At its best, team teaching provides the students with a wide range of challenging and eye-opening viewpoints on a broad subject matter expounded by different faculty members who themselves are the experts and authorities in their area of specialisation. At its worst, it becomes a disorganised and confusing presentation of unrelated and contradicting information. In addition, it can become an excuse for the teacher to evade his teaching responsibilities.

Here are some fundamental rules to follow to achieve a successful team teaching endeavour:

1. To be effective, the teaching team must have a dedicated coordinator who has a clear curricular vision of the module.
2. The choice and sequence of delivery of topics should be agreed upon beforehand among the participating faculty with the coordinator in the leadership role.
3. The coordinator should make the course goal and lecture timetable clear to the students on the first day of the class.
4. The topical discussion at each class meeting should reflect and relate to the main theme of the modular subject matter.
5. There is some truth to the adage that too many cooks spoil the broth. Ideally, a teaching team should not consist of more than three lecturers.
6. The coordinator should attend, at least during the first time of the course implementation, all of the lectures.
7. It is mandatory that the coordinator should always maintain a proper overview of the modular offer to assure topical correlation and synthesis of the knowledge with help from the students.
8. The full attendance of the coordinator also assures that the final exam questions can be comprehensively constructed to evaluate fairly and objectively the learning outcomes expected from the students.
9. All participating faculty members should be repeatedly made aware that the success of the team-taught module depends on the combined effectiveness of the team performance.
10. In planning the tutorials, it is best to involve and divide the responsibility among members of the teaching team,

instead of passing the assignment to other department staff.

11. It is necessary and important for the coordinator to do internal control and adjustment should a disruption arise during the semester owing to the failure of a team member to deliver the anticipated performance.
12. Most importantly, because of the limited number of lecture hours assigned to each of the team members, the course coordinator becomes the only person who has the opportunity during the semester to build good rapport between the teaching group and the students that is essential and a pre-requisite to an effective learning environment.

Team teaching is like running a relay marathon. The members of the team should be well selected to complement each other not only in the area of knowledge and expertise, but also in terms of compatibility of personality and willingness to work as a team.

The best team teaching effort is therefore like the making of an Oscar-winning movie with the coordinator as the producer and director. Once the teaching roles are scripted, the teaching cast should do its best to give an impressive performance. The participating lecturers should be made to realise the importance of playing the supporting role and to stay focus on the topic assignment(s) in order to make the entire production unified and outstanding. If possible, the team members should also audit each other's lectures at least once during the semester in order to establish an organic connection between individual lessons. In my opinion, only this kind of well-coordinated teamwork will bring a rich and colourful educational experience that will benefit both learners and teachers. ■

## "Tiring, because..."

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take over larger responsibilities in moderating discussions and evaluating their contributions.

Finally, in deciding whether and how to introduce PBL, I found the publications by Don Woods of McMaster University to be especially useful. In his separate guidebooks for students and instructors (information and downloads available at his website at <http://www.chemeng.mcmaster.ca/pbl/pbl.htm>), he not only provides extensive information on issues of student preparation, problem design, assessment and possible pitfalls, but also shows ways to introduce PBL gradually and partially into existing courses. ■

## Some Thoughts on Problem-Based Learning

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Implementation of PBL, however, is not easy. The first difficulty one would encounter is misconception of PBL itself. Among those who claim to have practised PBL, many have not realised that problems drive the learning in PBL. This is different from the lecture-tutorial scheme where problems exist to illustrate the material covered. Giving a series of lectures to cover some knowledge considered to be required and then assigning a problem or a project to apply that knowledge is not the same situation as where a problem drives the learning.

Students need to be thoroughly trained on the practice of PBL in order to learn through PBL. Not all who attempt to conduct PBL sessions pay attention to this serious requirement. Indeed the teachers need to be thoroughly trained too before they start designing problems for PBL, or for that matter, designing any kind of a curriculum. Education is a domain far too complex to presume that someone with a PhD in a subject area can effectively teach that subject.

One major barrier to successfully implementing PBL is that for PBL to be successful, an institution cannot have the learning of some things happen via PBL while the other subjects are taught in parallel via the conventional instructional way. The focus and reflection needed for learning through PBL are unlikely to happen meaningfully in a mixed mode environment where 'memorise-and-regurgitate' is also valued. ■

## Re-writing Problem-based Learning for Literary Studies

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*"It really made us think for ourselves with the constant awareness of an invaluable support network behind us."*

*"Every contribution is valued and encouraged."*

*"...got a lot of feedback and inspiration from other students."*

*"...actually want to attend seminars..."*

*"It felt more like learning and contribution than dictation..."*

*"...I do still hate elegiac poetry..."*

We shall be analysing student evaluations and our written and visual records of the group work procedures with a view to the publication of the outcomes. An unanticipated early (and continuing) demand for information on the project has led to the development of a stand-alone web site to act as a forum for the exchange of ideas within the Arts and Humanities nationally and internationally. This year, building on papers already delivered and published in the UK and Australia, we have been asked to speak at the PBL2002 conference in Baltimore, the joint SEDA/AISHE conference in Dublin, the 2<sup>nd</sup> UK/Carnegie Fellows Scholarship of Teaching Conference in London and the 2<sup>nd</sup> ILT Conference in Edinburgh.

To contact Dr Bill Hutchings or Ms Karen O'Rourke for more information, please write to the Department of English and American Studies, The University of Manchester, Oxford Road, Manchester M13 9PL, England; or email [bill.hutchings@man.ac.uk](mailto:bill.hutchings@man.ac.uk) or [karen.o'rourke@man.ac.uk](mailto:karen.o'rourke@man.ac.uk). ■

## Call for Registration

# TLHE Symposium

2<sup>nd</sup> Symposium on Teaching and Learning in Higher Education

4–6 September 2002

Theme: **P**aradigm **S**hift  
in Higher Education

CDTL will be conducting its Second Symposium on Teaching and Learning in Higher Education to increase awareness of pedagogical issues that enhance teaching and learning. The theme is on the changes in learning processes and outcomes caused by the shift from the instruction to the learning paradigm. The official language of the symposium is English. Two pre-symposium workshops will be conducted respectively by Marshall Lih and Barbara Gross Davis on 3 September 2002.

### Guest of Honour:

- Shih Choon Fong, President, National University of Singapore, Singapore

### Keynote Speakers:

- Barbara Gross Davis, Asst Vice-Chancellor, Student Life-Educational Development, University of California, Berkeley, USA
- Chong Chi Tat, Deputy President & Provost, Office of the Provost, National University of Singapore, Singapore
- Marshall Lih, Senior Advisor for Engineering Education & International Research Collaboration, National Science Foundation, USA

### Invited Speakers:

- Denise Chalmers, University of Queensland, Australia
- Tim Hill, University of Bristol, United Kingdom
- Ora Kwo, University of Hong Kong, Hong Kong
- Gabriele Lakomski, The University of Melbourne, Australia
- Jean Michel, Ecole Nationales des Ponts et Chaussees, France
- Susan C. Piliero, Cornell University, USA
- Malcolm Tight, University of Warwick, United Kingdom
- Peter Jarvis, University of Surrey, United Kingdom
- Ivan Png, National University of Singapore, Singapore
- Belal Baaquie, National University of Singapore, Singapore

### Registration:

The registration fee for the symposium after 1 July 2002 is S\$450. (Cheques/bank drafts should be made payable to National University of Singapore.) The fee will cover a copy of the symposium proceedings, admission to all sessions, lunch and refreshments. The registration fee for each pre-symposium workshop is S\$50. For more information and/or to register online, please refer to <http://www.cdtl.nus.edu.sg/tlhe> or contact:

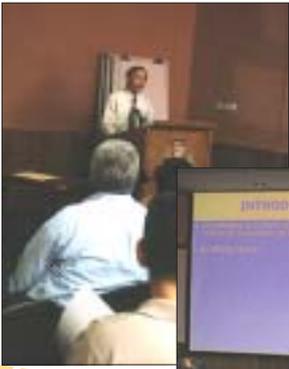
Ms Rita Roop

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Email: [cdtrrk@nus.edu.sg](mailto:cdtrrk@nus.edu.sg) ● Tel: 65-6874 2071 ● Fax: 65-6777 0342 ■

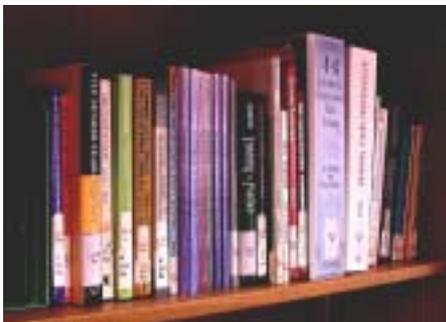
# Top Management Discuss Teaching Evaluation



On 19 April, various Deans and Heads of Department gathered at the CDTL Seminar Room for a forum/workshop on the issues surrounding the new teaching evaluation format implemented in the past year. Provost Prof Chong Chi Tat, opened the session; Vice Provost Prof Ivan Png next discussed the challenges of academic management; A/Prof Lily Kong, Dean of the Faculty of Arts & Social Sciences, then spoke about 'Developing a Culture of Teaching Evaluation'. A healthy discussion ensued during which many concerns of those present were aired. ■



## The CDTL Library Goes Online



Books on teaching and learning topics within the CDTL Resource Library are now more accessible than ever before! An online search can now be made for books and other resources by title, author, call number and subject via <http://www.cdtl.nus.edu.sg/library/>. To borrow any library material, any NUS staff member or student must visit CDTL in person. Loan periods and fines for overdue materials, similar to those allowed/imposed by the NUS Libraries, will apply. ■

## Welcome to CDTL/ Farewell

We would like to extend a warm welcome to:

- Ms Lisa-Angelique Lim, who joined CDTL as a Research Assistant on 12 April 2002, and
- A/Prof Hugh Tan (Dept of Biological Sciences) and Asst Prof Anne Magdaline Netto (Dept of Building) who assumed the post of CDTL Affiliate on 24 May and 24 June 2002 respectively.

We would also like to thank:

- Ms Christina Low, Publications Officer, who left on 28 June 2002, for all her invaluable support in the past and wish her well for her future endeavours. ■

# TEACHING & LEARNING highlights



*FASS Teaching Technology Fair,  
16 April 2002*

## *Faculty of Arts & Social Sciences*

### Teaching Technology Fair

The Faculty of Arts & Social Sciences (with the Centre for Instructional Technology) held its first Teaching Technology Fair on 16 April 2002. At the event, staff discussed the new discussion models that will be put in place in AY2002/2003. These models aim to make small-group discussion more meaningful and effective in light of limited spatial resources and growing class sizes. A/Prof Paulin Straughan described the first model: 2-hour alternate-week discussions that compliment 2-hour weekly lectures. During each session, the 25-member discussion group is divided into sub-groups of 5–6 students; each sub-group is given 1 of 2 topics (under which specific problems are highlighted) to argue for; after 15 minutes of preparation, the sub-groups are encouraged to ‘debate’ the issues with each other; the lecturer acts as a discussion facilitator and summarises key issues raised during the 2-hour discussion. Dr Ryan Bishop presented the second model: a 3-hour seminar style option, which allows smaller enrolment level-3000 modules to ease students into the honours seminar model. A/Prof Ian Gordon shared his experience on how he successfully used the Integrated Virtual Learning Environment (IVLE) within his own module and discussed the pros and cons of managing IVLE student discussions to compliment classroom interaction; he cautioned that the success of IVLE discussion groups depends on the type of module and managing an IVLE discussion forum is time consuming. Dr Pundarik Mukhopadhaya from Economics discussed the problems of teaching large classes comprised of cross-faculty students from various backgrounds. ■

## *Faculty of Engineering*

### Customer-Oriented Education

Education in NUS is now considered a service industry and the students our customers. Consequently, if teaching is a form of customer service, then it must be student-centred, focusing on the student’s learning process instead of just delivering subject matter. To fulfil this aim and stimulate students to think and apply concepts and fundamentals learnt in class, typical engineering tutorial problems to which there are often multiple solutions (depending on starting assumptions, arguments and the choice of data) are set for the modules *CN5172: Biochemical Engineering* and *CN5173: Downstream Processing of Biological and Pharmaceutical Products*. The emphasis is not the solutions to the problems, but their implications. Students are probed with further questions based on their initial answers. Students are also encouraged to discuss among themselves (by forming sub-groups within the tutorial), compare and critique each other’s thoughts and arrive at a consensus solution. The students then present their solutions to the class and answer/rebut all relevant questions/criticisms posed. Through this process, students are more able to accept criticisms and uncertainty in solutions as well as become more resourceful and more willing to question established knowledge and controversial views. ■



*A SCC3301 class in session*

## *Faculty of Science*

### Why Read SCC3301?

*SCC3301: Scientific Data Management, Evaluation and Communications* is one of the nine modules within the Minor in Scientific Computation and Multimedia Communications (SCMC) programme in the Science Faculty. Since its inception in 2000, it has benefited many Cross Faculty Module students. The following feedback is from Jerel (an Arts & Social Sciences student majoring in Economics): “*SCC3301* is the first SCMC module I took. This module comprises 2 parts: (1) Data Management; (2) Data Analysis. The value of this module lies in the opportunity to learn MS Access. This provides me an extremely useful foundation for database

management. The module is relatively demanding but enriching. Students of little computing knowledge are always given the chance to catch up. The MS Excel part is practical. It trains students to make use of different presentation tools in data analysis which is central to almost all modules since students will need to make presentations of quantitative nature at some point in their studies. The hands-on assignments and projects are of a different dimension from the typical NUS written assignments. I would say that this module is a must for students who wish to acquire computing knowledge that is useful in both their studies and future careers.” For more information on the SCMC minor, please visit: <http://www.physics.nus.edu.sg/~scmc>. ■

### MA2101 Lecture Quiz

If a lecturer throws a question to the floor of a lecture class of 100 or more students, there is usually no response or some responses from the same few persons (unless the question is a really trivial one) as most students feel too intimidated to speak up. Consequently, it is usually not easy for the lecturer to collect feedback on learning outcome from the students.

In the second semester of AY 2001/2002, the *MA2101* course lecturer implemented a lecture quiz as a continual assessment (CA) component. 3–5 short questions in the form of multiple-choice, True/False or computation were asked in each lecture quiz. Students were allowed to discuss the questions and hand in the answers in small groups. A grader helped to mark the

quiz. As long as a student has answered 50 questions correctly throughout the course, he/she was given full marks for this CA component. The main aim of the lecture quiz is to let the lecturer have a better gauge of whether the students have grasped the main concept taught in each lecture. It also promotes cooperative learning among the students as well as allows them to relate to and reflect instantly on what they have just learned. ■

### *Faculty of Medicine*

#### **Exploring Beyond Borders & Breaking Boundaries**

The Faculty of Medicine introduced the Special Study Module (SSM) for Year 1 and 2 as part of the new curriculum in 1999 and 2000 respectively. SSMs are compulsory (for Year 1) and complementary to the core curriculum; topics range from the specialised to the non-specialised and may be related to medicine, the biomedical sciences and non-medical fields. As SSMs can be selected from a wide range of options, students are given the choice to study and experience areas of personal interest in greater depth. The SSMs also aim to enable students to: (a) learn through curiosity; (b) develop generic skills such as report writing and data handling; (c) develop familiarity with advances in scientific methodology; and (d) review current literature to develop a view on current controversies within a subject. By exploring beyond the confines of a traditional curriculum, SSMs not only bring depth to the medical course, but also provide a balance between scientific, clinical and non-medical aspects of medicine. Each year, students present their outstanding work in the forms of oral and poster presentations at the SSM Symposium to faculty and invited guests from other faculties and external organisations. Our feedback over the last three years show that the students and the staff who participated in SSM enjoyed it very much and thought it was a worthwhile exercise. ■



*Dean, judges, faculty members and students during the SSM Symposium, 30 March 2002*

#### **The Medical Education Unit**

The information explosion in medicine, the rapid introduction of new technology, and the rapidly changing demands and priorities in healthcare delivery to society, have led to major reforms being recently undertaken in both the NUS undergraduate and postgraduate medical curricula. To ensure and enhance the quality of medical education that we provide to our students, the Faculty of Medicine must strategise, plan, coordinate and monitor our on-going educational programmes. Consequently for purposes of quality assurance, the Medical Education Unit (MEU) was established in December 2001 to continually appraise the effectiveness of our programmes through rigorous evaluation of the input, process and outcome of our chosen pedagogical strategies. The MEU aims to provide: (a) Faculty Development (training and education of medical teachers in medical pedagogy, problem-based learning and clinical teaching skills); (b) Medical Curriculum Development (providing consultation for curriculum design and innovation in medical education, assisting faculty curriculum committees in designing clinical teaching activities, evaluating on-going educational strategies); and (c) Research in Medical Education (research into curriculum models and new/innovative clinical teaching strategies, evaluating the performance of clinical skills). The MEU structure consists of a Director (A/Prof Rethy Chhem) who reports directly to the Dean, a Deputy Director (to be appointed), four Associates (Prof Matthew Gwee, A/Prof Khoo Hoon Eng, A/Prof Lee Szu Hee, A/Prof Tan Chay Hoon), an ex-officio member (A/Prof Koh Dow Rhoon) and an administrative officer (Ms Sarah Ng). With the setting of the MEU, the NUS Medical Faculty is now better equipped to further enhance excellence and professionalism in medical education. ■



*From left to right: Prof Matthew Gwee, Dr Margery Davis, Prof R.M. Harden, A/Prof Khoo Hoon Eng & A/Prof Rethy Chhem during an Assessment Workshop organised by the MEU & the University of Dundee, 9 April 2002*

### *NUS Business School*

#### **Class Project with a Touch from the Market Place**

Nothing stimulates a business student more than knowing his/her decisions result in measurable dollars and cents. In the continuous push towards the use of IT for teaching by the School of Business, Dr Ho Yew Kee, in collaboration with Ms Ivy Tan and Mr Loke Wai Yin from the Centre for Instructional Technology, came up with an Online Stock Trading System for the course in *Corporate Finance (BZ3301)*. This software allows students to track the performance of their hypothetical portfolios of Singapore companies that were formed after students had learned how to apply the capital asset pricing model (CAPM) to assess the risk and return for companies. Students, working in 28 groups of 4–6 students, were given \$100,000 in the Online Stock Trading System to invest in 10 companies over the duration of the course (beginning of February to end of April). The performance of their portfolios was tracked electronically daily through the Internet and the performance of each group was available to the whole class.



*Online Stock Trading System website for BZ3301*

A questionnaire survey of the 142 students who participated in the class project gave the following encouraging statistics: 72.5% of students agreed that they are more enthusiastic about their project when they use the system; 85.9% thought that such a system is necessary in the course; and 83.8% of students agreed that this system is a more convenient way of tracking portfolio performance. To view this Online Stock Trading System, please visit: <http://courses.nus.edu.sg/course/bizhoyk/tradingsystem/>. ■



Sample elements from GDSS website

to mock up a GDSS: the IVLE chatroom and discussion forum functions were used for *Brainstorming* and *Idea Categorizing*; space in the discussion forum was created to display the *Agenda*; and an assessment in IVLE was created to mimic *Vote* with the result again displayed in the discussion forum. In essence, the lab was turned into a *War Room* and the IVLE discussion forum was used as the *Public Screen* for the group meeting. Two student helpers were first appointed as ‘human’ categorisers, each representing a side of the debating motion and responsible for moving ideas across from the chatroom to an appropriate category in the discussion forum. However, during one debate, the discussion became so heated in the chatroom that the helpers were unfortunately not fast enough to move the ideas across to the forum. During another debate, the chatroom did not work due to a system fault and discussion could only be conducted in the forum. Before the lab session ended, students reviewed the shortcomings of IVLE features when used as a GDSS. ■



RECS students doing project work

evolved into having its own life as the students took their own initiative to post and debate various issues, with the moderator monitoring the site daily to keep updated with the discussions threads.

In total, 107 topics, covering topical issues reported in daily newspapers, were posted and discussed in the IVLE forum over the semester. In the feedback gathered at the semester’s end, students said that the forum was useful in stimulating discussion and helping students to be aware of new developments and their implications. Judging from the comments offered, the intensity of the discussion and the high participation rate (the average posting per student was 5 and 92.2% of the students made at least one posting in the forum), the RECS property forum was a unique and effective learning experience. ■



Probing the brain functions by Magnetic Resonance Imaging, 3 April 2002



Kranji Beach Park, a Battlefield Tour site visited by students, 25 February 2002

## School of Computing

### An IVLE Mock-up of a GDSS

The Department of Information Systems has been offering *CS3250* to introduce students to the various concepts of computerised management support systems. One lab session was spent learning about Group Decision Support Systems (GDSS) that can support group meetings with tools such as *Agenda*, *Brainstorming*, *Idea Categorizing* and *Vote*. As students were already familiar with the Integrated Virtual Learning Environment (IVLE) that supports the course, features in IVLE were used

## School of Design & Engineering

### The RECS Property Discussion Forum: Its Effectiveness

The *Real Estate Case Studies* (RECS) module is taken by final year B.Sc. (Real Estate) students before they go out into the working world. It aims to facilitate the application and integration of knowledge acquired by the students over the past four years through project proposals, feasibility studies, tutorial discussions and role-play based on actual real-world scenarios. To encourage the students to broaden their perspective and keep abreast with developments in the real estate industry, a RECS property forum was conducted during the first half of 2002 on the Integrated Virtual Learning Environment (IVLE). At the start, some pertinent questions on current issues were posed to encourage student discussion. The forum eventually

## University Scholars Programme

### Learning Outside the Classroom

Many Scholars Programme modules offer students opportunities to learn outside the classroom, apply theoretical concepts learnt in class, and have these concepts challenged through practical application. During the second semester of Academic Year 2001/2002, students taking *Cyberarts* and *Representing the Interface* modules were introduced to immersive Virtual Reality and Cave™ Technology (as part of their studio-based classes) at the Institute of High Performance Computing. At the Raffles Museum of Biodiversity Research, *Cyberarts* students observed different biomaterials used by both scientists and artists in Singapore. Under the Programme’s *Cyberarts* Research Initiative, students could also work and learn with scientists and artists-in-residence. *Brain and Cognition* module students visited Singapore General Hospital, the Institute of Mental Health and Tan Tock Seng Hospital to learn more about functional Magnetic Resonance Imaging, psychiatric conditions and neuroscience. Students in the compulsory *Making a Nation* module took a Battlefield Tour, looking at significant sites during the Japanese invasion of Singapore, while *Culture and Contemporary Societies* modules engaged students in visits to mosques, temples, museums and even boutiques, to study different ways of life and religions. External visits were developed into attachments in one module; for six weeks, students in the advanced module *Civil Society in Singapore* were attached to civil society organisations, undertaking a project to gain an insight into the organisation’s life, invaluable experience working in the organisation, and chances to apply and modify theoretical concepts learnt in the classroom. ■

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## Ethical Guidelines for Researchers

collected about research subjects must remain confidential. In some instances, there may be certain forms of information, which are so sensitive that they should not be collected, especially if they expose the research subject to any type of risk.

Researchers should always strive to protect the confidentiality and anonymity of research subjects, whether or not specific guarantees of confidentiality have been made.

Research data must be stored in a secure manner. Efforts must be made to preserve the privacy of the data. This specifically includes removing any specific identifiers, such as distinguishing social traits, place of employment, addresses, or combination of social factors, which would make it easy to identify the research subject.

Researchers should also take care to prevent data being released in a form that would permit the identification of research subjects. Some research subjects possess social attributes that make them identifiable. These subjects should be advised that it may not be possible to protect their anonymity.

**In general, individual names or identifying characteristics of research subjects should not be used in data collection or data presentation, unless specifically authorised by the research subject.** When names of confidential and/or anonymous sources are used in the draft report or final thesis, they should be clearly identified as being pseudonyms.

Research data (unlike information relayed in confidence to other professionals, e.g. doctors, priests, lawyers), when relayed to researchers does not enjoy any legal protection. A court or a judge may subpoena research data. Research subjects may need to be informed that it may not be possible to protect data from legal attacks.

Research on criminal activity also does not enjoy any legal privilege, whether in Singapore or many other countries. In most countries, prior knowledge of a specific criminal activity is considered as being an accomplice to that crime. In many countries the knowledge that a crime has occurred requires that one report it to the authorities.

**In Singapore if you are conducting research about a crime that is going to take place (i.e. if you have prior knowledge of the crime), you are considered an accessory to the crime and may be charged in varying degrees of being a criminal accomplice. If you observe a crime and do not report it you**

**may be charged with varying levels of non-disclosure and fined up to S\$8000.**

If you are conducting research about criminal activity and you do not have the consent of your research subjects, you may suffer threats or injury to your person by those engaged in criminal activities.

### 4. Limits to Confidentiality

Researchers need to fully inform themselves about all laws and regulations which may affect or limit their guarantees of confidentiality (e.g. Singapore's laws of non-disclosure) and to fully inform their research subjects about the limitations of any guarantees of confidentiality that they may offer.

There are unanticipated situations that may arise in the course of research in which information is clearly threatening to someone's life or well-being (i.e. planned suicides, rapes, assaults or murders). In these cases, researchers must balance the importance of guarantees of confidentiality with the importance of the other principles offered in these ethical guidelines, societal values regarding moral behaviour, and legal requirements.

Activities that are conducted in public spaces, or activities that are conducted in settings open to the public, or settings that are not protected by law or custom are not protected under the principles of confidentiality and informed consent. Subsequently, observations may be made in these settings without the requirement of confidentiality or informed consent of the subjects. Similarly, information available from any form of public records does not require confidentiality or informed consent. However, the researcher should still strive to ensure that no harm or risk should occur to the subjects from which the data is collected.

**If you are at all unclear about whether or not any of the above issues apply to your research, be sure and discuss this more fully with your advisor or supervisor.**

For a complete and extensive listing of all ethical guidelines employed by the American Sociological Association and British Sociological Association, please consult the respective website listings: <http://www.asanet.org/members/ecostand.html> and <http://www.britisoc.org.uk/about/ethic.htm>.

\* Special thanks to Dr. Ganapathy Narayanana for his invaluable assistance and contribution in providing information on observing criminal activities in Singapore. ■

CDTL invites articles on any teaching and learning topic for 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:

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Calling All  
Writers...

# Education for a Digital World

**Mr Christopher Cheers**

Visiting Lecturer, Educational Courseware & Design Development  
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Our world keeps changing and evolving. With the rise and spread of information and communication technologies, virtual teams and communities of practice have become an integral part of the lives of professionals in many industries. Consequently, our job as educators is to effectively prepare our students for entry into a digital workplace by mirroring this world in our curricula.

To succeed as professionals in a digital world, our students will need:

- initiative, self-reliance and independent learning skills
- the ability to collaborate effectively in teams
- creative, higher-order thinking and problem-solving skills for analysing and solving real-world problems
- competent levels of discipline-related and relevant interdisciplinary, technical and professional knowledge
- effective communication skills
- Information and Communication Technology (ICT) skills

When we bring methods such as Problem-based Learning, the Case Method and e-Learning together, we have an excellent way to get our students using the tools of our digital world while developing the necessary flexible cognitive skills to succeed in it. Through the use of interactive narrative, multimedia, simulations and discussion groups, courses using e-Learning can illustrate problems effectively and support the communication and collaboration necessary for effective problem solving.

## Blended e-Learning

Learning is a social activity; people need people. The initial bonding and setting up of relationships is more effective face-to-face. Once this is done, the relationships can continue to develop online using discussion forums and email, with occasional face-to-face sessions to touch base as required. Online asynchronous activities allow time for reflection and provide a platform for process modelling, support and the presentation of media-rich content within a set context. An online environment also makes activities transparent which encourages independent learning.

## Problem-based Learning & the Case Method

In a world where everyone is constantly bombarded with information, the ability to integrate new data and to understand the underlying connections and their implications is essential. But traditional courses, in which students are first given large amounts of material to read and then asked to solve problems using that information, do not facilitate such skills. Traditional problem-solving activities often take the form of presenting neat, verification-style problems with an expected model answer: this practice does not effectively prepare our students for the professional problem solving they will face in the workplace where an often ill-structured problem comes first and is a catalyst for inquiry and learning.

Consequently, a move to student-centred learning requiring the learner's active involvement, where the learner plays an authentic role carrying out complex tasks using ICT, is needed across curricula. Problem-based Learning and the Case Method provide students with opportunities to grapple with realistic, ill-structured problems. Students are put in the role of professional problem solvers by designing instruction around the investigation of ill-structured real-world problems.

## Designing a Blended Activity

When designing a 'blended' activity, we must look carefully at the processes inherent in the activity and decide what are most effective online and what are most effective face-to-face. In the online component, we need to make the process explicit. Within the classroom, teachers can easily provide explanation and feedback to guide the students through various activities. But when learning moves online, such direct guidance often disappears: students are all too often thrown into an online environment and asked to just complete the given exercise. If the process is mapped out, this lack of guidance can be avoided.

Two possible blended examples are:

CASE METHOD	PROBLEM-BASED LEARNING
<ul style="list-style-type: none"> <li>● <b>Face-to-face</b> <ul style="list-style-type: none"> <li>- read case study</li> <li>- discuss &amp; identify issues</li> <li>- allocate tasks</li> </ul> </li> <li>● <b>Online</b> <ul style="list-style-type: none"> <li>- share findings</li> <li>- identify alternative strategies</li> <li>- make &amp; justify decision</li> </ul> </li> <li>● <b>Face-to-face</b> <ul style="list-style-type: none"> <li>- present recommendations</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● <b>Face-to-face</b> <ul style="list-style-type: none"> <li>- analyse &amp; define the problem</li> <li>- generate questions &amp; learning issues</li> <li>- allocate research tasks</li> </ul> </li> <li>● <b>Online</b> <ul style="list-style-type: none"> <li>- conduct research</li> <li>- share findings</li> <li>- propose &amp; justify solution</li> </ul> </li> <li>● <b>Face-to-face</b> <ul style="list-style-type: none"> <li>- present solutions</li> </ul> </li> </ul>

The final decision on the type of blending should be based on the nature and complexity of the activity and its learning outcomes.

## Implementation

For such an approach to be effectively implemented, careful preparation is required. Lecturers must be trained in e-moderation and a culture of collaboration must be nurtured. Initially models for a variety of blended designs should be provided to help meet the varied needs of subjects across disciplines. Educational design and technical support is also required. In this way, we will be able to be more effective in preparing our students to make the most of opportunities offered by the digital world.

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## Evolving Our Undergraduate Curriculum

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learning needs to expand beyond the classrooms and even beyond the walls of universities. Further examination of the outcome statements reveals the choice of action-oriented words, showing that ABET is no longer satisfied with activities aimed merely at the lowest levels of educational objectives such as knowledge and comprehension. Instead, it is promoting higher cognitive levels such as application, analysis, synthesis and judgement.

Keeping in mind the ABET accreditation, the NUS Faculty of Engineering curriculum has been evolving in the last few years towards satisfying the ABET criteria as well as matching the university's own recent thrust towards developing a more broad-based education for NUS students. The new curriculum aims to produce graduates who not only possess traditional skills (in terms of problem solving, analysis, communication, interpersonal relations, management and decision making), but also the modern attributes that will enable our graduates to practise their profession with competence and confidence in the ever-changing world. These modern attributes include independent learning, desire for life-long learning, innovativeness, creativity, IT proficiency, an international outlook, the ability to work in a team, as well as the abilities to muster knowledge from neighbouring disciplines and work at the interfaces between traditional disciplines.

The latest changes in the NUS engineering undergraduate curriculum include the following:

- The Year 1 engineering curriculum has been significantly revamped to give a firm grounding in basic sciences and mathematics. As remarked by Vice Provost Prof Ivan Png, "This will better prepare engineering graduates for a fast-changing workplace, also strengthen and further differentiate our programs relative to regional competitors and provide a stronger basis for graduate education."
- All engineering modules have been refurbished to clear learning objectives and outcomes. Many of the modules have been revised; a significant number of new modules have been created to enhance the quality of education. New modules have been created, such as the *Engineering Design* module, to satisfy ABET requirements and to meet current developments.
- The number of elective modules has been decreased to meet the ABET Requirements (comp...

General Education Modules, Singapore Studies Modules and Unrestricted Elective Modules) that will help our students to develop the aforementioned modern attributes.

- Enhancement programs are offered to students to enrich their learning experiences in diverse areas.
  - The *Industrial Attachment and Vacation Internship Programs* enable our students to translate theories learnt in the classroom into assignments in a real world environment, instil in students the right kind of attitude and professionalism through interaction with people in organisations, and allow students to acquire soft skills such as teamwork and the use of IT in the workplace.
  - The *Technopreneurship and Incubation Program* prepares students for a career in technology-based entrepreneurship and teaches them how to start up and incubate companies.
  - The *Innovation Program* teaches students that existing schemes and procedures in engineering practice can be successfully challenged, and at the same time, that there are significant merits and strengths in existing engineering schemes and procedures.
  - The *Undergraduate Research Opportunities Program* provides an opportunity for students to do research at an early stage and helps develop a desire for life-long learning. The program also allows students to acquire skills involved in the intellectual process of inquiry, enhance their knowledge in the latest technology and interact with faculty members so as to foster closer ties.
- International educational programs are injected into the curriculum to provide our students with a learning experience in an overseas environment and help develop an international outlook.
  - The *International Exchange Program* allows students to study abroad for a semester or a year.
  - The *French Graduate Certificate Program* is a two-semester program that provides students with a strong foundation in French language and culture.
  - The *International Term Program* allows students to study abroad for a term.
- The engineering curriculum is made more flexible to allow students to take part-time courses and to take part-time jobs. This provides students with more choices in specialising their education.

## Evolving Our Undergraduate Curriculum

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The revised, modern engineering curriculum brings the Faculty of Engineering one step closer to obtaining ABET *substantial equivalency* for its engineering programs. Next, the Faculty will tackle the following: “How should engineering departments demonstrate that their students have the specified abilities at the time of graduation?”

To answer this question, the *Faculty Accreditation and Benchmarking Committee* (FABC) consisting of the Vice-Dean of Undergraduate Programs, Assistant Deans and departmental ABET program coordinators, was formed. The *Engineering Undergraduate Programs Advisory Committee* (comprising of the Vice-Dean, Assistant Deans and deputy departmental academic heads) backs FABC. FABC guides and coordinates each engineering department’s efforts in preparing for the accreditation exercise. The committee is now developing an assessment process system that includes the establishment of clear program objectives and outcomes, the collection of documented data/results from constituents, systematic analysis and feedback loops (see Figure 1).

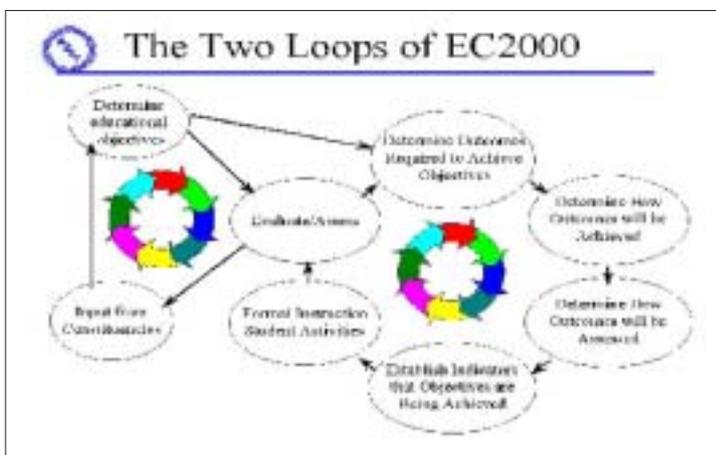


Figure 1. Two loops of ABET EC2000

The assessment is based on *Total Quality Management* (TQM) principles and the *Learning Paradigm*. In TQM, the emphasis is on continuous improvement and constituent orientation; as the engineering industry becomes more critical of our graduates’ abilities,



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it becomes even more crucial for us to close the gap between what we teach and what students need to learn. In addition, the focus of assessment on program outcome is based on the *Learning Paradigm*, which emphasises what students actually have learned rather than what teachers have taught. Instead of teachers simply disseminating knowledge through lectures, engineering professors will now coach, counsel and collaborate with students during the learning process.

There have been many changes within the NUS Faculty of Engineering in recent years and it is unlikely that the transformation will cease. Because the Faculty is committed to constant program improvement, we will continue to evolve our curriculum so that it will meet the demands of our constituents as well as provide an enjoyable educational experience for our students. ■