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# Field Course Fundamentals: To Generalise, Specialise or Compromise?

*Figure 1. Prof Peter Ng briefs students on their first night on Tioman Island*

**Dr Peter A. Todd, Dr Darren C.J. Yeo, Professor Chou Loke Ming & Dr Tan Heok Hui**
Department of Biological Sciences

Field courses are an important component of a wide range of university degrees. Although our experiences are restricted to biology field courses, we hope that some of our observations will resonate with teachers in other disciplines. The fundamental choice when designing the learning outcomes of a field course is whether to focus on one particular topic (or area, subject, habitat and so on) or to explore a range of topics. There exists a trade-off between providing students with a deeper understanding of a narrower subject-area versus more superficial experiences but with greater exposure over a broader subject-area. Of course, this dichotomy is true in the classroom too, but the issue seems to crystallise under field conditions where extracting maximum benefit from a limited period is desirable.

We were inspired to write this article after running an annual week-long biodiversity field course, LSM4263 "Field Studies in Biodiversity", to Tioman Island, Malaysia, in July 2006. In previous years, students would be divided into groups that each concentrated on a particular habitat for the duration of the field course and conducted pertinent thematic in-depth studies, for instance a mock Environmental Impact Assessment (EIA). This year, however, we decided to expose all the students to a wider range of learning activities by running mini-projects in four habitats (i.e. freshwater, marine, mangrove and terrestrial). The class of 43 was divided into eight groups, which were rotated around the four habitats in pairs. Each habitat had two Teaching Assistants assigned to it, taking a group each for the day's activities. The lecturers circulated among groups or among habitats as and where additional help/supervision was required.

From informal discussions with students and staff, we realised that there were advantages and disadvantages to both field courses that "generalise" and those that "specialise"—hence the title of this article. Both scenarios are worth examining in detail.

## To generalise

A typical 'generalist' scenario would aim to expose students to a range of environments (this would also hold true for other disciplines). This exposure will

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likely be short (e.g. just one day per environment). The benefits include: (a) students get hands-on experience in a range of habitats; (b) they are introduced to a diversity of field techniques (without the burden of being expected to become very proficient at them); and (c) more variety in activities and locations, making it overall more experiential and stimulating for students.

*Figure 1. An evening exursion into the forest to explore nocturnal fauna*

### *Experience a range of habitats*

It seems a shame to spend an entire 'general' field course focussing on just one specific aspect. If students were fortunate enough to undertake many field courses, this would be less of an issue, however, the great majority of them will likely do just one residential field course, if any, during their undergraduate years. Thus, it seems a wasted opportunity if they do not get equal exposure to the various habitats available and all the ecological and biodiversity components normally associated with them. This will give students a broader knowledge base, which they can then use for further investigations if the desire/opportunity arises.

### *Learn a range of techniques*

This is probably more applicable to biology/environmental type field courses where there are specific scientific techniques for conducting research in particular habitats and field conditions. If the objective is to survey the fauna or flora, then the methods used in woodland are quite different to those employed in the sea or in a freshwater stream. Although students will not become experts at these techniques in just one day, they will at least be more aware that numerous approaches exist and will have a foundation on which to build upon.

### *Have more stimulation and fun*

The importance of this should not be underestimated. Under field conditions, tedium and dissatisfaction can get exaggerated and escalate rapidly. The intensive nature of a field course means little opportunity for the student to escape and recuperate (e.g. having to go into the field at odd hours of the night to observe nocturnally active creatures or when tidal conditions are favourable). If a few students really do not like the task they are doing, but have to continue regardless for a number of days, they may get restless, distracted, and disruptive. This can in turn have a knock-on effect to the rest of the group who might otherwise be quite enthusiastic or at least content. It also raises health and safety issues as unhappy students may get careless in the field as they are perhaps not concentrating as hard as they could be. Changing environments each day provides little opportunity for students to get bored or fed up.

## To specialise

The principle argument for concentrating on a single habitat is that it is possible to: (a) really learn some skills in specific field techniques; (b) learn much more about the ecology and biology of the habitat; (c) collect better quality data; and (d) it makes the exercise more 'real'.

*Figure 2. LMS4263 field course 2006 instructors and participants*

### *"Really learn some skills"*

This includes getting involved in the design and implementation of a study/experiment/survey, and, in our case, learning to identify relevant organisms. A student working on one topic for a few days will probably gain some real ability, at least regarding execution and understanding of the study and techniques. Designing surveys and identifying organisms might be more that can be conveyed in a few days. However, the student will at least feel they have learnt something in detail.

### *Learn more ecology and biology*

By focussing on just one habitat, the student should gather a greater understanding of its characteristics and nuances. As long as the knowledge and teaching skills are present, there is a real opportunity to explain in detail how a particular habitat functions. There is more time to find out how to identify species and learn about their ecology, behaviour and role in that ecosystem.

### *Collect better data*

If the first day is used purely for training, there is an opportunity for students to subsequently gather some real, usable data. When analysing the data, they will know exactly how they were collected including any

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# Bring Back the Whiteboard Charms into PowerPoint Presentations

**Dr Soo Yuen Jien**
Department of Computer Science

Over the past few years, presentation software programs like Microsoft PowerPoint have virtually taken over the classroom from the traditional black/white boards or slides from the overhead projector. There is no doubt that these new software add value to both teaching and learning. On the one hand, not only are students able to obtain neat and organised notes from the lecture slides, they are also 'entertained' by the lecture itself, as it is filled with animation, sound and special effects. On the other hand, lecturers too find it easier and faster to prepare slides with PowerPoint or other similar software.

With all the apparent advantages, it seems that we should embrace these new software tools and forget about the 'old' ones. However, some have pointed out (McDaniel, T & McDaniel, K, 2005) that these software tools do have shortcomings that affect the teaching and learning experience. One of the more serious problems is that they induce a more 'leisurely' attitude in both lecturers and students. Lecturers tend to follow whatever is on screen and hence pay less attention to the flow of the content. Since the slides have already been prepared in advance, there is no space for spur-of-the-moment materials to be added during lectures. Students, too, may feel that attending lectures is no longer necessary as the entire lecture can be reproduced from the handouts. Furthermore, overusing certain features of the presentation software (e.g. animation in PowerPoint) may make the lecture tedious and boring.

Presentation software tools also lack some of the charms of the white/blackboard. From my experience as a teaching assistant, I find that using the whiteboard seems to get better responses from students. They claimed that because the diagram is drawn on the whiteboard and explained in real time, the answer is easier to understand and absorb and they have a better grasp of the logical flow of the topic. I also find that this style of presentation can retain students' attention longer. Since then, I have been thinking about ways to bring these advantages into software tools. In Semester 2, AY2005/2006, I tested some of these ideas in my course, CS2103 "Software Engineering". Below is a brief report on the setup and techniques used.

## Setting up

The basic idea is to transform the PowerPoint presentation slides into a whiteboard so that drawing or writing can be added during the lecture. To achieve this effect, a touch screen monitor with a stylus pen (or Tablet PC) is required to allow real time drawing or writing. Usually, the lecturer would use the same set of lecture slides for handouts and presentation but this would discourage students from attending the lectures. Instead, two different sets of lecture slides are prepared. The differences between the two, as described below, are the main thrust of my scheme.

## Intentional omission

For students' handouts, the following should be left out:

- The rationale behind a statement
- The answer to questions asked in the slides

These omissions should be made clear on the slides, possibly with a footnote to ask students to attempt the questions before the lecture. During the lecture, these omissions are filled in by the lecturer, preferably by a stylus pen. Additional explanation can also be given at the same time. Figure 1 is a simple example: student's handout is on the left and the lecturer's is on the right.

## Explanatory notes

Additional explanatory notes can be added to the slides during the lecture. This technique is usually more effective with diagram-intensive lecture slides as the lecturer can explain parts of the diagram or show the action on the diagram (see Figure 2).

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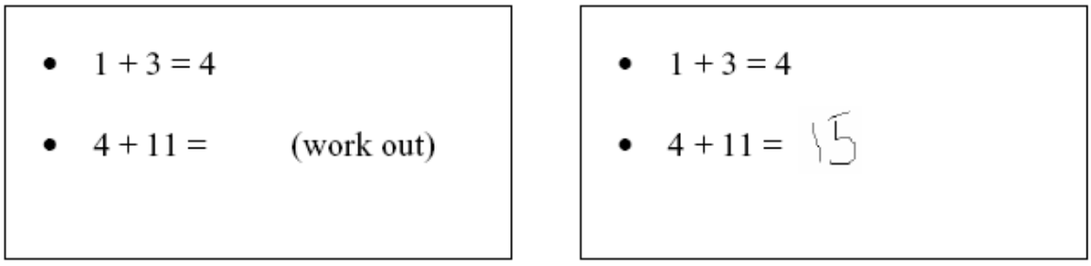


*Figure 1. Students' handouts vs lecturer's 'live' version*

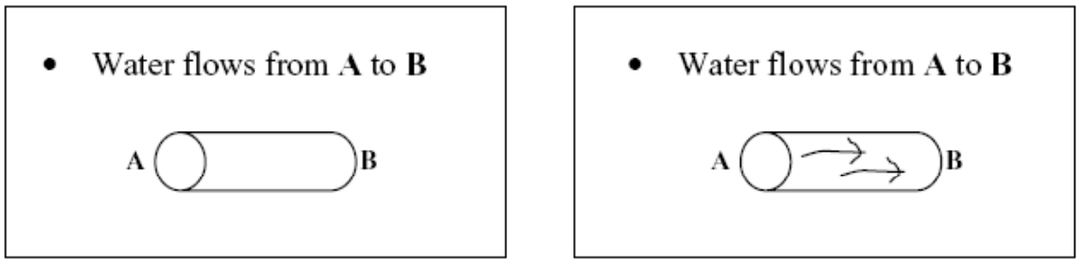


*Figure 2. Students' handouts vs lecturer's 'live' version*

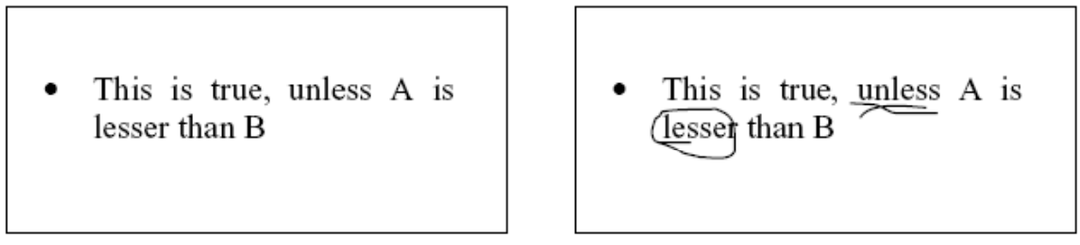


*Figure 3. Students' handouts vs lecturer's 'live' version*

## Emphasis on important points

Lastly, if there is a need to emphasise particular points on the slide during the lecture, the stylus pen can also be used (see Figure 3).

## Advantages

Since students will have a slightly different version of the lecture notes, they now have an incentive to listen closely to the lecture to fill in the intentional omissions. These omissions should be designed in such a way that it can both be an exercise before the lecture and as an example during it. Using the stylus pen transforms the lecture slide into an *ad hoc* white board. Careful design of the lecture slides allows additional diagrams and explanatory notes to be added spontaneously during lectures. Additionally, explanation given at the same time should deepen students' understanding. The stylus can also serve as a pointer, which allows better emphasis on important points in the lecture by underlining and highlighting.

## Disadvantages

The major drawback of this scheme is the need to maintain two versions of the lecture slides. When there is a need to update the slides, the change must be consistently applied to both sets which could be a lot of work. Further, the use of a stylus pen and touch screen monitor or Tablet PC is a hefty investment.

## Conclusion

Getting students' attention is key to any successful teaching. Passive PowerPoint presentations can easily lose the battle for students' attention as they expect everything to be already in the lecture handouts. The scheme attempts to actively involve students in the lecture by getting them to fill in the omissions in their notes. Although there is no quantitative measure of the scheme's usefulness, students' comments and feedback have been encouraging. Hopefully, the scheme presented in this article can help you to retain students' attention and interest in the lecture topic.

## References

McDaniel, T.R. & McDaniel, K.N. (2005). 'The Perils of PowerPoint'. *National Teaching and Learning Forum Newsletter,* Vol. 14, No. 34, reproduced in http://ctl.stanford.edu/Tomprof/postings/663.html. Last accessed: 27 October, 2006. ■

# Students and Medical Education—An Exciting Exchange of Ideas

**Associate Professor Khoo Hoon Eng, Associate Professor Tan Chay Hoon and Ms Lee Su Mei**
Medical Education Unit, Yong Loo Lin School of Medicine

The First NUS Student Medical Education Conference (9–10 September 2005) was organised by the Medical Unit, Yong Loo Lin School of Medicine, NUS. SMEC 2005 was specially designed for and with medical students and in this respect, we believe that it is the first conference of its kind in Asia. SMEC 2005 had the following objectives:

- Facilitate students' understanding of the major paradigm shifts in the teaching and learning process;
- Help enhance and enrich students' learning experiences;
- Empower students to become self-directed learners all throughout medical school.

The conference attracted 134 participants of which 89 were NUS medical students and academic staff. 34 were from local Junior Colleges and 11 were students from Australia, China, Germany, India, Indonesia, Japan and USA.

*Figure 1. Participants of the first SMEC 2005*

One of two invited speakers for the conference, Professor Frank Christ (Ludwig Maximillians University of Munich, Germany) described a student exchange programme between his university and Harvard Medical School which not only contributed to major curriculum reforms but also enabled student participants to become academic staff and champions of the curriculum in their own right.

*Figure 2. Captive audience at SMEC 2005*

The second invited speaker, Professor David Newble (Flinders University School of medicine, Australia) captured students' attention by closing the conference with a talk on the trends of assessment, curriculum teaching and learning methods, information technology and the learning environment.

One important innovation in this conference was the use of a live audience response system. Several participants commented positively about the "interactivity with the audience via "KEEpad". To demonstrate the speed with which surveys could be done, students

*Figure 3. The KEEpad to increase interaction with the audience*

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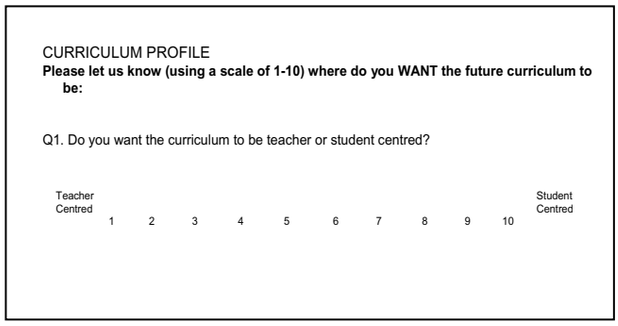
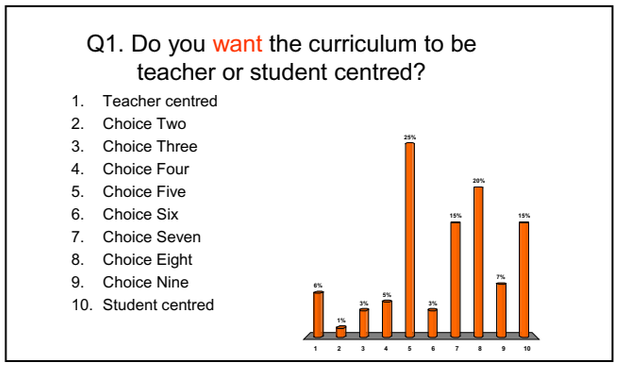
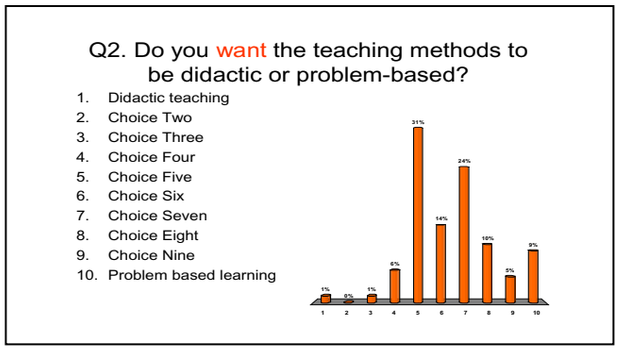
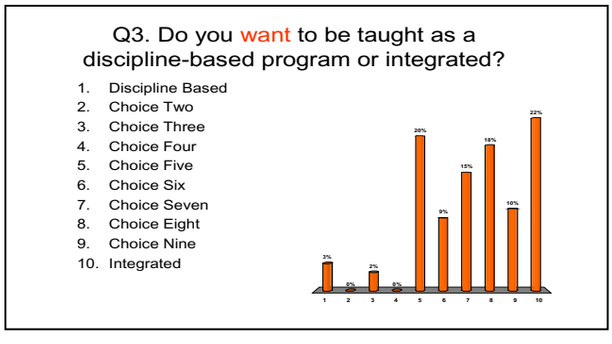
*Table 1. The survey results on "Where do you want future curriculum to be" via KEEpad*




were asked for their responses on the current position of the medical school curriculum and where they would like to see it, ranging from a teacher-centred, discipline-based curriculum to one using the SPICES model (Table 1).

The survey generated results in minutes rather than the few hours when a similar paper-based survey was done with teaching faculty a few months earlier.

Throughout the conference, speakers shared visions of both the medical profession and the future of medical education. There were lively discussions on the importance of good communication, professionalism and ethics, as well as the changing technology and models that impact the medical education curriculum.

NUS alumni were also invited to share their practical tips on how best to do well in their courses. The audience were also treated to student lives and perspectives on the innovations of medical schools all around the world, courtesy of foreign students in the audience.

Finally, the President of the International Federation of Medical Student Associations (IFMSA), Ozgur Onur, spoke about the important role of the IFMSA and shared how much he had learnt by being part of its standing committee on medical education which could help shape future medical education. He urged the medical students present to get involved more actively.

On the whole, participants appreciated this new, exciting and inspiring educational venture. They highlighted that the "strong sharing sessions with medical students all over the world is one of the positive aspects of this conference and should be held annually to enhance collaboration between medical students from various countries."

The feedback on the conference was very encouraging. 95.5% of the participants rated the plenary and symposia sessions from "quite to extremely important". 90% found the conference relevant and useful. A majority of the participants found the sharing sessions by the overseas medical students "extremely informative, enlightening and enriching as they provided differing views on the same issues as well as allowed exchange of ideas and stimulated thinking". These sessions also "provided a better perspective and understanding of what the medical students all over the world are going through". There was a unanimous request for these sessions to be repeated next year. ■

# Prior Knowledge: A Prerequisite for Thinking?

**Dr Hilary Thean**
Department of Restorative Dentistry

**Question:** How does a denture hold its position in the mouth without falling out when the person is talking?

**Answer:** A well-made denture is one that has a good peripheral seal and is held in place by negative pressure very much like a suction cup.

How does one explain the basic principles of denture retention to a group of young and aspiring dentists? Based on the answer to the above question, can you understand or visualise the principles of denture retention?

One way to illustrate the basic principles of denture retention is to use prior knowledge or experience. For example, some of us may have tried pulling a large rubber bung from a sink outlet only to discover that it does require quite some effort; others may have tried opening a refrigerator door immediately after slamming it shut only to find that it does not give way to a small tug.

In the first instance, once the rubber bug's seal is disturbed, it comes off the sink outlet easily. Likewise, when the pressure on the outside and inside of the refrigerator door is equalised, it swings open effortlessly. The same principle applies to denture retention; no matter how tight the denture is, one sneeze is all it takes to send it flying!

To explain the principles of denture retention, a teacher can go by way of physics and show students equations for pressure and surface tension and so on, or use prior knowledge or experience (e.g. the rubber bung and the refrigerator door) to help learners draw a parallel between the two situations. However, teaching such a new idea will be challenging when learners have neither knowledge of physics nor any prior experience with 'negative pressure'. While a person with some prior knowledge can get the idea immediately, someone without such knowledge may not know how to direct his/her thoughts and will probably never arrive at the answer.

The university is a place for students to learn how to form opinions and synthesise information by drawing from their past experiences and knowledge through discussion, interaction, exploration and *thinking*. As many subjects in science are evidence-based, students often need to rote learn basic facts and formulae to direct their thoughts in the right direction. However, in this information age, there is a misconception that it is no longer necessary to memorise facts as one can easily get them from the Internet and books.

Nevertheless, I believe that a good clinician must have a thorough knowledge of his field so that he can arrive at an accurate diagnosis promptly. For example, when someone walks into the consultation room with a toothache in the upper right molar, the dentist does not have the luxury of time to type 'toothache on upper molar' into a search engine on the Internet and wait for the relevant information to show up. The dentist has to quickly *think* through the possibilities: Pulpits? Tooth decay? Cracked tooth? Gum infection? Sinusitis? Headache? Mumps? Heart attack? Then, he has to mentally sieve through the list of clinical signs and symptoms of each ailment as he examines and questions his patient. A skilled dentist can usually arrive at the answer within seconds for the run-of-the-mill diagnosis of pulpitis due to tooth decay. Mumps may take the dentist a little longer to diagnose. Sometimes medical practitioners treat the

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TLHE 2006

6–8 December 2006

# Quality in Higher Education

CDTL will be organising its International Conference on Teaching and Learning on 6–8 December 2006. The Conference will examine the problems and challenges of assuring quality in higher education. What is quality in higher education? Who are the stakeholders in education who participate in defining quality? How do we achieve and assure quality?

As institutions of higher education develop frameworks for assuring quality, educators will need to ascertain how their role in education will fit in within these frameworks. Existing quality assurance frameworks for Universities are problematic because they focus on processes rather than learning outcomes. It is imperative that we judge the quality of education in terms of the goals of education.

Please also join us for pre-conference workshops on **5 December 2006**.

**'Describing and Influencing Student Learning'**
Professor Barbara Cambridge,
*President,* International Society for the Scholarship of Teaching and Learning, USA

**'Conducting Research on Your Students' Learning: Developing Research Questions and Workable Methods'**
Dr Gary Poole
*Director,* Center for Teaching and Academic Growth
University of British Columbia, Canada.

**'Improving Teaching: Lessons from Doing Research'**
Dr Gregory Light
*Director,* Searle Center for Teaching Excellence
Northwestern University, USA.

Pre-conference workshop registration fees are **S$50 (US$30)**.

For more information,
please visit the TLHE website at http://www.cdtl.nus.edu.sg/tlhe or
contact the Conference Secretariat, Ms Rita Roop Kaur,
at cdtrrk@nus.edu.sg. ■

From 6–8 December 2006, we have lined up the following experts to examine the problems and challenges of assuring quality in higher education:

## Keynote Speakers

Professor Barbara Cambridge
*President,* International Society for the Scholarship of Teaching and Learning, USA

Dr Gregory Light
*Director,* Searle Center for Teaching Excellence
Northwestern University, USA

Professor Lily Kong
*Vice Provost (Education),*
National University of Singapore, Singapore

## Invited Speakers

Dato Dr Sharifah Hapsah Syed Hasan Shahabudin
*Director,* Quality Assurance Division
Department of Higher Education,
Ministry of Education, Malaysia

Dr Gary Poole
*Director,* Centre for Teaching and Academic Growth
University of British Columbia, Canada

Professor Adrian Lee
*Pro Vice Chancellor (Education and Quality Improvement)*
(Retired), University of New South Wales, Australia

Professor Matthew Gwee
National University of Singapore, Singapore

## Regional Panel Session - Speakers

Professor Dr Sudjarwadi
*Vice Rector for Education and Quality Control Affairs,*
Gadjah Mada University, Indonesia

Professor Dr Supachai Yavaprabhas
*Director,* SEAMEO - Regional Institute of Higher Education Development (RIHED), Thailand

Associate Professor Ho Shi-huei
*Director,* Teaching and Learning Centre
Soochow University, Taiwan

Dr Emerlinda R. Roman
*President,* University of the Philippines, Philippines

Professor K.P. Mohanan
*Deputy Director,* Centre for Development of Teaching and Learning, National University of Singapore, Singapore

# Calling All Writers

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

- CDT*Link* (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:

**Sharon Koh**
Email: cdtsksp@nus.edu.sg
Tel: (65)-6516 4692 • Fax: (65)-6777 0342 ■

# CDTL's Multimedia Initiatives

In keeping with the shift in NUS's educational value system where the goals of teaching are now focused on facilitating learning, nurturing critical, independent thinking and inculcating lifelong learning skills in students, there is an increasing need to develop quality learning content—materials that present content in an engaging and interactive manner, thus requiring significant student input and interaction. CDTL can assist faculty members to design innovative solutions by taking advantage of the potential of ICT (Information Communication Technologies) so as to enhance the quality of student learning experience.

For more information, please log on to http://www.cdtl.nus.edu.sg/mmi/summary.htm. ■

# Teaching Development Seminar

**Associate Professor Alice Christudason**
Department of Real Estate

Each semester, the Departments of Building and Real Estate organise a teaching development seminar which provides an opportunity for faculty members to gather together, listen to an invited speaker, and share tips and ideas on teaching. On 30 August 2006, Assistant Professor S. Lakshminarayanan, winner of NUS Outstanding Educator Award Winner (2005/2006) from the Department of Chemical and Biomolecular Engineering, was invited to share his ideas on what he termed as the 'favourable' and 'unfavourable' directions in the learning process.

In his talk, Dr Lakshminarayanan suggested the use of teaching strategies which can help guide the learner along favourable directions. He drew an analogy between learning and a shopping trolley system. A shopping cart is characterised by directionalities. It has some preferred directions in which it easily moves, and also a tendency to avoid certain other unfavourable directions. While it takes very little input effort to move this system along its preferred directions (such as moving the shopping cart forward/ backward), a very large input effort is required to make it move along its unfavourable directions (e.g. try moving the cart sideways or upwards).

As education is a complex and multivariable process, Dr Lakshminarayanan suggested that the teacher should first decide on the desired outputs from students. Based on the outputs identified, specific practices can be built into students' teaching and learning process, right from the first year that they enter NUS. Students cannot be expected to exhibit the desired outcomes without being taught how to achieve these outcomes. Dr Lakshminarayanan suggested the following directions for teaching that could lead to favourable learning outcomes: (1) setting out instructional objectives, implementing teaching practices to achieve those, and providing feedback to students; (2) when possible, using the inductive method to help students to learn; (3) promoting active learning such as getting students to 'say as they do something'; (4) designing appropriate tests and examinations that are consistent with the objectives; (5) providing students with reasonable workload, (e.g. by coordinating with other lecturers teaching the same level within the department); and (6) providing students with choice over their learning tasks.

Dr Lakshminarayanan's talk was followed by a thought provoking Q&A session in which he responded candidly to the many delicate questions that arose relating to balancing teaching and research. ■


*Figure 1. Dr Lakshminarayanan, invited speaker for a Teaching Development Seminar at the Departments of Building and Real Estate, 30 August 2006*

*Figure 2. Interactive Q & A session with Dr Lakshminarayanan*



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## Field Course Fundamentals: To Generalise, Specialise or Compromise?

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additional issues that need to be considered. If students have to write a report, they can have more faith in the data (as opposed to relying on that of other students when using pooled data).

### *Experience 'real' fieldwork*

During longer trips, it is possible to undertake larger and more realistic projects. A classic technique for capturing students' attention is to give them a mission (e.g. conducting an EIA). The 'to specialise' approach lends itself much more to this type of activity as it reflects how rapid EIAs are often done in reality (i.e. a number of specialists concentrate on their own habitats and complete the work within a few days). There is no real life scenario where one group studies all habitats at a rate of one habitat per day.

### To compromise

Is there a middle ground between the two extremes presented above that can exploit the advantages of both approaches? What if students do not spend all their time in one habitat nor do they spend very short periods experiencing all of them (four in the case of our field course)? For example, an alternative may be to split their time between two habitats. Unfortunately, as is often the case with compromises, this seems to capture few of the benefits of both options—the learning outcomes are much less clear cut. Another potential compromise is to take the 'specialist' route but make an effort to briefly expose students to the other habitats through an additional single day set aside for guided walks and exploration. This would essentially be the 'specialist' learning outcome with added value! Alternatively, spending more time preparing students before setting off will enable them to 'hit the ground running' when they arrive, thus getting more from the generalist approach (e.g. they could attend pertinent lectures followed by laboratory sessions and practice on short half-day fieldtrips/practicals before the residential one). Students' backgrounds should also be considered.

### Conclusion

The final trade-off will probably be based upon goal minutiae that push the decision one way or another. For instance, there might be one special skill or topic that is considered essential that can only be incorporated if one particular approach is adopted. These more detailed learning outcomes can sometimes be at odds with one another and priorities need to be worked out. The whole exercise can become a somewhat 'chicken and egg' scenario—which comes first, the overall thrust of the course or its finer objectives? Of course, students' previous knowledge levels will be a major factor, with those without any biology or ecology background likely to gain from the generalised approach and learn much from the broader exposure, while those with a stronger foundation in biology and ecology will gain more from a specialised and deeper approach. Also, taking into account students' expectations further muddies the water as these will undoubtedly be highly diverse. Perhaps, both approaches could be adopted within the same field course by separating students into two groups depending on their backgrounds, aptitudes and attitudes. The preparatory phase will be important towards formation of the two groups, one of generalists and the other of specialists. With such exposure, students are ultimately given the choice of the learning level that they desire. This will require more resources as it essentially translates to running two courses simultaneously, each with its own emphasis and own group of students. The desired learning outcomes of either approach are offered and students select what they wish to acquire. ■

## Prior Knowledge: A Prerequisite for Thinking?

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patient for mumps when they actually have pulpitis! (this happened to one of my close friends when we were in university). Sometimes dentists perform a root canal procedure for pulpitis instead of prescribing treatment for sinusitis.

How do these mistakes happen? Prior knowledge or the lack of it! If the medical practitioner has a good knowledge of his field these mistakes can be avoided. A knowledgeable doctor will be able to diagnose a toothache and refer the patient to a dentist. By the same token, a well-informed dentist should be able to diagnose mumps or sinusitis and refer the case to a doctor.

In any field of study, one must strike a balance between two extremes—processing skills without sufficient knowledge and rote learning facts without application. Do not go overboard with too much emphasis on 'thinking skills' and forget that mastery of facts is fundamental to *guiding* the *thinking*. ■

# The Anatomy of Reflection in Cognition—A Principle, Process and Practice for Developing Socratic Understanding During Lectures, Tutorials and Meetings

**Associate Professor Frank Voon**
Department of Anatomy

Professionals think in a number of ways that are unique to their professions. An important part of professional education is to learn from professionals how they think in their own professions and one way to attain this is through the practice of reflection.

## The practice of reflection

It is possible to model the practice of reflection during a lecture, tutorial or meeting while engaging the audience in the understanding of an underlying concept. One can do this by a rhetorical form of Socratic dialogue (i.e. talking about it to an audience while going through it in one's mind). This helps to mirror for the listeners your own thought processes as you go through the three phases of reflection—definition, divergence and convergence—that will be described in detail further in this article. To demonstrate the process of reflection, specifically in the context of an Embryology lecture, the basic concept I would like students to understand is "The ribs are notched because an artery is narrowed". However, instead of walking through this process on a specialised topic, I would like to start off with a more general statement "The notes are sour because the seams are split".

## Textual connections

The sentence appears to be made up of 2 separate facts which at first glance appear to be unconnected, even dissonant. The first phrase about notes being sour requires some reflection. Do the notes refer to bank notes, the notes of a song, or perhaps the written notes on a piece of paper? It may even be the name or a type of fruit that can taste sour, but which we have not come across.

Let us consider the things that we do know of first and see if anything makes sense. Pieces of paper are unlikely to have a sour taste unless some chemical has been spilled onto them. Can notes of a song be sour? We do hear of people singing sweetly, so it is likely that the notes can be sour if the singing is out of tune.

Let us take the second phrase which seems a little more straightforward as seams refer to edges of an object like a shirt or a box. Their separate pieces or sides are held together at the seams. What's held together, can be torn apart, which is presumably what the splitting of the seams is referring to.

Juxtaposing this idea with that of the first about something being not in tune, we get from the notion of singing to the idea of the object being an instrument producing the tune. If we think of this instrument as a wind instrument, it will contain air when it is played. The repeated playing of the instrument leads to a tearing at the seams which brings to mind the fraying of a piece of cloth.

There are of course different ways of making connections to think through this sentence, such as visual connections, where icons or imagery are used, or kinesthetic connections. Each way will help different groups of people in the audience to engage their minds more easily, either sequentially through textual connections, simultaneously through visual connections, or kinesthetically through motor connections in the brain.

## The process of reflection

Let's go back to our first example ("The ribs are notched because an artery is narrowed").

Most medical and dental practitioners will recall the condition of coarctation of the aorta, where the narrowing of the large artery forces blood to flow through other arteries that bypass the site of obstruction. Some of these enlarged arteries are situated just below the ribs. As the condition is a congenital one occurring while the bones are forming in the foetus, the affected ribs appear to be hollowed out in their lower portions, giving rise to the appearance of notching on an X-ray.

In order to make meaningful sense about the sentence, it is necessary to go through the three different phases of reflection—definition, divergence and convergence. First, students should be guided through an initial phase of definition to establish parts of the sentence that are true or already understood. For example, highlighting the differences between a vein and an artery will help students learn that veins generally have valves that regulate blood flow in one direction while blood in arteries can flow in either direction depending on the differences in blood pressure at different parts of the arteries.

At the stage of divergence where various possibilities are considered, these definitions are used as bases to broaden students' scope of thinking. X-ray images and illustrations of various arterial pathways can also be used to indicate the numerous routes that arterial blood from the aorta could have flowed in order to bypass the obstruction. The elimination of various possibilities should gradually result in a convergence towards a possible solution.

In the process of reflection, we went through 3 different phases of thinking using Tips, Hints, Icons or images, Notes, and Keys (THINK). One of the tips used was to evaluate the type of notes under consideration, such as bank notes or the notes of a song. Suggesting the possibility of a wind instrument is an example of a hint being given. It is not important to determine whether something is a hint or a note, or that all of them should be used together.

What is relevant is that they are brought in at various stages (Figure 1) to guide the audience through an initial phase of definition, where the parts of the statements that are known to be true or already understood, are used as the basis to broaden the scope of thinking. This is the stage of divergence where various possibilities are considered. Further development of the theme in different directions and the elimination of various possibilities should gradually result in a convergence towards a possible solution.

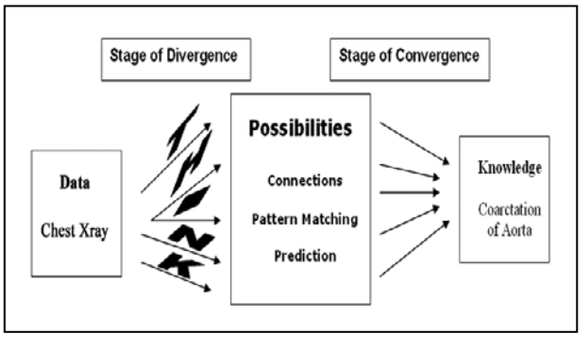


*Figure 1. Phases in the process of reflection*

## The principle

The underlying principle on which the preceding practice and process of reflection is based is that the neurons or nerve cells in the neocortex, the outer parts of the brain that humans use for cognition, are arranged in layers with connections to related regions that functionally enable the human brain to create patterns, classify, store and then match the patterns during the learning process.

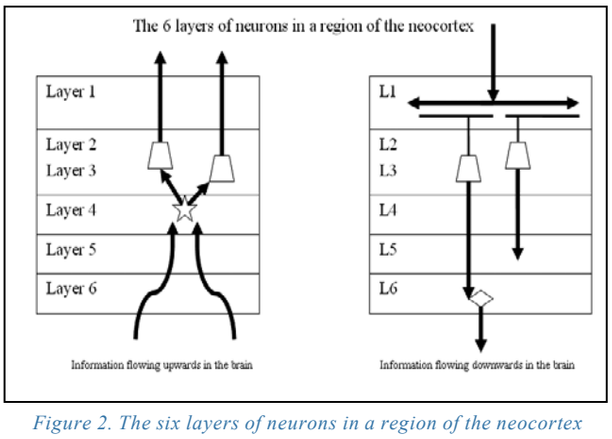


*Figure 2. The six layers of neurons in a region of the neocortex*

*continued next page...*

Figure 3 illustrates the internalisation of information in the human mind. When information is internalised in us, we begin to know new material (i.e. we learn or acquire knowledge). Further application of that knowledge leads to mastery and eventually wisdom.


*Figure 3. The internalisation process*

It is the internalisation process that we are concerned with here. The practice of reflection allows for the formation of various possibilities and for mistakes to be made, considered and compared. This enables the neural circuits and pathways between the different learning centres in the brain to form different patterns. Where there is reciprocal feedback between the various brain centres, it allows for pattern matching and prediction (what is technically known as auto-associative memory formation). The end result is the development of new patterns in the neocortex. Learning has taken place and the new knowledge gained can then be applied to new situations. ■

# Mobile and 'Out of Class' Teaching: Reflections on Field Studies

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The ideas expressed in this paper are the result of our participation as coordinators of a six-week field studies module (GE3230 "Field Studies in Geography: South East Asia") in Thailand, which is now in its fifth year. Each time it involves about 30 students from the Department of Geography, various Social Sciences disciplines, other Faculties (e.g. Science, Computer Science and Engineering) as well as overseas exchange programmes. Thus, it is a cross-disciplinary and multi-cultural module even before we leave Singapore's shores.

We would like to highlight three key dimensions of field studies that make it a dynamic learning experience for students and staff alike.

## Mobile classes: Bridging the 'class' and 'field'

We are passionate in our belief that experiential learning methods are more than just "a complement to traditional education" (Singh, 2006) and are an extension of existing innovative *in-situ* teaching methodologies used in the class as well as providing opportunities for a whole variety of new ways of encouraging higher order learning skills in the field(s). Utilising Kolb and Fry's (1975) experiential learning cycle (Figure 1) involving an interplay between concrete experience, observation and reflection, conceptualisation, and application/ experimentation, we argue that such learning should be based upon a variety of teaching approaches, class and field activities. Inquiry-based and problem-based learning can be stimulated by field-based activities, but they should also be augmented, stimulated and supplemented by other forms of learning, including theoretical and conceptual work in the class. Our class is mobile.

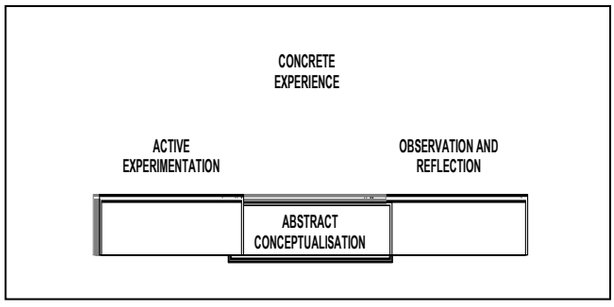


*Figure 1. Kolb and Fry's experiential learning cycle*

## Multiple 'fields', 'realities' and 'experiences'

In 2005, Alice Christudason raised an important question, "Whose 'real' world?" which has enormous relevance for field studies, because students are exposed to a variety of different 'fields', 'realities' and 'experience', each providing rich avenues for different dimensions of the "learning cycle" (see Briffett, 2001; Hirsch & Lloyd, 2005). Our Field Studies module provides differing kinds of exposure via the following:

1. Overland journeys and orientation fieldtrips in diverse sites
2. Working alongside Thai student buddies
3. Home-stays with local families
4. Having to work in small-group team-based projects, which differ from anything in NUS because students must share rooms, eat together and engage in projects lasting from one to three weeks.
5. Individual reflections evidenced in students' personal field journals, which are in fact highly indicative of the real value of field studies, as students begin to ask themselves questions like "what did I learn?" from all kinds of observations and experiences, including those that are not connected with assessed projects or organised fieldtrips.

*Figure 2. NUS Field Team in Baan Mae Ter, Akha Village, Chiang Rai Province*

## Research–learning–teaching as an on-going process

Scott (2002) argues that "in a 'knowledge society' all students—certainly all graduates—have to be researchers. Not only are they engaged in the production of knowledge; they must also be educated to cope with the risks and uncertainties generated by the advance of science". We believe that the field studies module links research, teaching and learning in intimate ways.

- Students apply different concepts and ideas learnt in the classroom in their field-based activities, or they see that there are problems and inadequacies in the concepts they have previously taken for granted;
- Students apply various methodologies in order to engage in primary research and data collection;
- Students become involved in the whole process of project planning, from proposal designs, preparatory study and implementation of plans, to actual report write-ups and presentations, with feedback provided from teachers, fellow students and invited guests;
- Coordinators are able to share their own research experiences, benefits and pitfalls, directly with students, and sometimes in the actual sites or places of research;
- Coordinators often become co-learners (Le Heron, Baker & McEwen, 2006) with students as field studies often throws up new problems, unexpected issues and immediate information sources.

Learning by doing in field studies helps to break down barriers between 'teachers', 'researchers' and 'learners' in a variety of ways. Thus, our Field Studies module involves shared experiences and learning moves away from the linear "information transmission / teacher focused" approaches into much more dynamic "research based", "conceptual change / student focused" approaches to education (Prosser & Trigwell, 1999: 155; Griffiths, 2004: 722). In this way, students are no longer simply "recipients of research" but key (co) actors "in its production" (Healey, 2005: 194). As such, we firmly advocate strong combinations of class or lab-based instruction with experiential, field-based learning as an effective way to help liberate student thinking in critical, practical and creative directions.

*continued next page...*

## Mobile and 'Out of Class' Teaching: Reflections on Field Studies

*...continued from page 15*

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*Figure 3. NUS and Thai students at the Second Friendship Bridge linking Thailand and Myanmar in Mae Shi*

*Figure 4. Dr Carl in Akha Village, Chiang Rai Province*


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