NATIONAL UNIVERSITY of SINGAPORE

Founded 1905

Reflections on teaching

Dr Daphne Pan, Director, CDTL

"Good teaching is particularly valued and **is** [original emphasis] expected in NUS."[1] But what is good teaching?

In this issue, *CDTLink* solicited views from the NUS population—teachers, students and alumni—on this subject and a selection from the many thoughtful and thought-provoking responses received is presented in subsequent pages. We hope the opinions shared inside will promote dialogue and help to raise awareness about how we educate our students.

As evidenced by the variety of responses we received, there is no single, simple definition of good teaching, but there is common ground. For example, a study[2] asked NUS teachers, students and employers to rank a list of educational objectives. Most respondents from the three groups ranked *developing analytical thinking skills* first. Other objectives like understanding main principles, obtaining a structured overview of the subject and developing practical application skills also ranked highly, while gathering detailed information was considered a fairly low priority.

Obviously, higher education must do more than provide information and training. Far more important is to help students move beyond the acquisition and reproduction of facts to focus on knowing *how* rather than *what*. We need to develop our students' faculties for understanding, using and creating knowledge. Process and application skills are critical in a rapidly changing world and will empower our students for continued independent learning, equipping them not only for the immediate workplace but also enhancing their lifelong viability.

The bottom line is that good teaching should bring about effective learning. In part, this depends on students being competent learners with the necessary skills to deal with the demands of higher education. But while good students will learn in spite of, rather than because of, their teacher, most students learn better with a competent teacher. The good teacher recognises that telling is not teaching, and listening is not learning.

Effective teaching requires mastery of and keen interest in one's subject—sustained by research and keeping abreast of developments and new knowledge—*as well as* the ability to communicate the knowledge and equip learners with the ability and desire to go on learning beyond formal education. Some pedagogical skills are helpful here. Effective communication of knowledge and stimulation of student interest involve such practical considerations as adequate preparation, a clear statement of objectives, systematic presentation, the use of appropriate techniques to facilitate student learning and the ability to work within time constraints and other realities. Paying attention to such practicalities will contribute significantly towards good teaching.

This requires continuous effort, but good teachers are unlikely to be daunted. Professionalism—part of NUS's culture of commitment to excellence—is undoubtedly demonstrated in our teaching community and I would like to take this opportunity to salute the many excellent dedicated teachers at NUS. ∎

---

[1] Registrar's Office, internal memo to all staff dated 27 March 1995 (R90–44B).

[2] "The Effectiveness of Different Teaching Methods at NUS: A Campus Wide Survey", a multidisciplinary research project (RP 910097) undertaken by Daphne Pan (principal investigator), Martin Betts and Susan Liow. Copies of the report are available at the library.

Many thanks to all the teachers, students and alumni who shared their views on the characteristics of good teaching that deserve more attention. We hope the following pages will help make a difference in teaching and learning at NUS.

For the next issue of *CDTLink,* we'd like to hear your thoughts on the characteristics of a *good student* that deserve more attention [see page 5].

Teachers on good teaching

The main function of educators is to impart 2 Rs: *reading* and *writing* skills.

—*Laurent Metzger, FASS*

A good teacher:
- has complete mastery over what he/she is teaching.
- does not cut corners and avoid difficult topics and concepts.
- prepares and re-organises the material and does not copy wholesale from existing textbooks and references sources.
- allows sufficient time for the audience to follow and digest the gist of a theorem or concept.
- checks on the effectiveness of his/her teaching with regular periodic quizzes.
- does not joke too much or waste valuable time.

—*Leong Mook Seng, ENG*

A good teacher should *never* promise students an "A", ask tutors to give more marks to students or spoonfeed students by solving all problems for them.

—*Anonymous*

One can not be a good teacher if he/she just pleases the students and does not *drive* or *lead* them to learn. Many of us complain that today's students are more interested in scoring than in learning. But what were we more interested in 10 or 20 years back? Don't you agree that we were driven to learn by the less popular but good lecturers? How many of us gave those lecturers a bad comment? Who can tell me that a popular lecturer is a good lecturer?

—*Wendell Q. Sun, SCI*

Good teaching is infection rather than injection, osmosis rather than hypnosis, organic rather than mechanical, heuristic rather than algorithmic. Good teaching is sharing what you know with your students *not* showing off. It entails love for the subject and the student. It should empower students to think for themselves. It requires humility (to say "I don't know. But I'll find out and get back to you.").

—*Sunita A. Abraham, FASS*

Good teachers have the following 3 Cs. *Character*—good teachers are exemplary in their moral conduct and behaviour. *Commitment*—they have strong convictions about what they teach and are able to motivate the students because of their enthusiasm. *Compassion*—they are firm but fair and try to understand students problems during the process of learning.

—*Winston Lee, FBA*

What deserves more attention is the ability to elicit comments from students in classes and tutorials and to encourage or enable them to think on their feet. So many teaching situations are so structured that students feel that only one response fits into the tutor's "scenario". Teachers who make students feel that their comments or speculations are potentially valuable, and who lead students to think about the implications of their comments, are sometimes made to feel that they are too "unstructured" in their approach. Students should have some influence on the interpretation of the course's basic subject matter.

—*John N. Miksic, FASS*

A good university teacher should have first-rate and firsthand insights to impart in order to inspire and motivate novices. Hence a good teacher must be first a good research worker and, second, a teacher with teaching skill. A so-called good teacher without involvement in any significant research activity is often one that would constantly court the favours of students at the expense of educational principles.

—*Anonymous*

Good teaching should excite the learner and inspire him/her to seek more knowledge and delve further into the subject. The result of good teaching is a motivated and independent learner.

—*Grace Ong, DEN*

What deserves more attention is the specific measures a teacher has taken:
- to find out what students should remember and understand in order to handle new situations,
- to deliver what needs to be remembered,
- to train students where skill matters,
- to illustrate concepts,
- to force students to apply concepts creatively and
- to test students' ability to recall, demonstrate skills and apply concepts to new situations.

What deserves less attention is the teacher's popularity among students on a one-person-one-vote basis, because it can deceive (has been deceiving) many.

—*W. A. M. Alwis, ENG*

2

A good teacher:
- prepares his/her course as a whole, rather than piecemeal.
- is able to follow the student's train of thought and identify with the student's problems.
- is able to demonstrate to the student how the course is relevant to real working life.
- stimulates the student to continue to ferret for information for lifelong learning.

—*Winston Seah, ENG*

Comments sometimes made by students such as "challenging", "makes us think" and "I feel mentally drained after his/her class" are worthy of more attention.

—*Anonymous*

Good teachers inspire students to know more about the topic. They guide students to be independent and creative thinkers. They are effective communicators and they teach students how to apply knowledge to solve current problems.

—*Boon Yean Leong, FAB*

Good teaching involves the student. It moves him/her to question, contribute, extend and subscribe to the views of the teacher.

—*Janet Lim, CELC*

I would have thought that a basic requirement for teachers—in an international class university—is that they are highly research active in the area in which most, if not all, of their teaching falls. Good teachers should also be aware of the needs of the students they teach, and of the full range of traditional and modern methods of teaching available to them. The teaching method they choose to use in a particular case should depend upon the circumstances (e.g., the level and number of students, availability of equipment, time, etc.). There is no prescribed method of teaching that fits every case.

—*David Taylor, FASS*

A good teacher is one who is able to reach out to students in the middle range of the bell curve (about 60% of the class) and motivate them to think about the issues dealt with in the module and develop an adequate understanding of those issues.

—*Tan Ern Ser, FASS*

Good teachers impart higher-order learning and reasoning skills in their students. They may appear at first to be merely delivering content-specific lectures (like any other teacher) or explaining concepts in textbooks (like any other teacher) but their agenda is deeper and they make a conscious effort to direct the students' thoughts, mould their thinking habits....and help them develop the habit of self-monitoring their progress.

—*Lee Kwok Hong, ENG*

Effective teaching need not correlate with effective learning. A diversity of teaching methods as represented by different teachers engaged in teaching diverse courses and subject matters form the very basis of a university education. What makes teaching and learning effective is the total result of a two-way interactive process in which both teacher and student engage actively and intellectually in making the classroom or lab session an inspiring and enlightening experience.

—*Cheu Hock Tong, FASS*

Teaching is a two-way communication process. Teachers should try to understand students' needs and problems. I think it is easier to make the student understand by relating the subject matter to things or events the students are familiar with and to give them "hands-on" practice whenever possible.

—*Lim Kah Bin, ENG*

Popular conceptions of teaching do not include the view of teaching as empowering students to learn on their own. From this perspective, a good teacher is one who poses challenges and questions and gives a few tips when needed, but never does for students what they can and must do on their own.

—*K. P. Mohanan, FASS*

Effective teaching instills a life-long yearning to keep on learning!

—*Herbert Eleuterio, ENG*

3

Good teaching is the end result of a process. On the teacher's part, it comprises serious study and authoritative understanding of one's subject, the humility to acknowledge what is yet to be understood, unselfish love for students and an understanding of their capacity for understanding.

—*V. V. Bhanoji Rao, FASS*

O THER COMMENTS RELATED TO G O O D TEACHING

We could find out more about the kind of feedback (if any) teachers give on student assignments and what use (if any) students make of this feedback.

—*Desmond Allison, FASS*

We need objective evaluation of our teaching. Peer reviews may be part of the solution.

—*Tan Chay Hoon, MED*

We could survey employers for their experiences with and expectations of our graduates. We could also survey our alumni for feedback on their NUS experience and where it needs to improve.

—*Raj Komaran, FBA*

Students and alumni on good teaching

It was assumed that good teaching was not essential. Rather, an individual's ability to go it alone mattered.

—Richard Fung '73, SCI

The after class consultation and tutoring by tutors was the best, most appreciated time I had. This should be encouraged and not seen as a chore and disturbance by some tutors.

—Wilson Teo '95, SCI

Teachers need to:
- inculcate interest in their students. If students fall asleep in the halls, part of the failure lies with the lecturer.
- format questions for thinking students. Don't regurgitate questions from past years.
- speak English with enough polish not to have to struggle teaching an already difficult subject.

—Anonymous (alum)

Good teachers should have patience and be willing to explain one-to-one, but quite a few teachers lack this aspect. Maybe this is because undergrads are not to be "spoonfed". However, this should not give them the idea that they are not responsible for our growth. Although we should have more initiative in terms of reading and research, yet we are still human and learning ones too.

—Ow Gan Pin, ENG

Good teachers present in a clear and logical sequence.

—Tok Kiat Siong, ENG

Teachers should be more kind to students, that is, make students like to have contact with him/her.

—Anonymous (student)

Good teaching entails a student–teacher relationship maintained by trust, mutual respect and openness. The teacher is more like a friend who shares knowledge with us, a friend with whom we aren't afraid to share our views and even disagree with, a friend who is willing to not just help us learn but to learn him/herself. In this way, we can work and learn together as a team.

—Goh Yong Wah '91, FASS

A good teacher is one who thinks that he/she has not taught if the student has not learnt.

—Ho Yew Wee, ENG

Good teachers have great insights into the subject they teach. They pose challenging questions for us to ponder and can explain abstract concepts so they are easy to grasp.

—Anonymous (student)

Good teachers are also good facilitators. They draw out quiet students, keep good time and manage the discussion so it doesn't digress or become dominated by a few people.

—Tan Song Lip, FBA

A good teacher is funny enough to keep you interested but not overly so. He/she is to the point without beating around the bush.

—Anonymous (student)

My teacher's glamour is most embodied by his academic thoughts. His viewpoints are sharply controversial yet strong enough to convince me that they are supported by substantial research. His directness and excellence generated our inspiration, imagination, participation and, most importantly, independent thinking.

—Li Shubin, FASS

On good teaching:
- Teachers should not simply be told to improve their teaching methods. They should be motivated to do so by rewarding teachers who show innovation in teaching.
- The curriculum should be designed in an interesting way so students have fun in class and want to learn.
- Memory work should be kept to a strict minimum.

—Anonymous (student)

Good teachers have charisma, show individualised consideration and encourage intellectual stimulation. Their lectures have full-house attendance every week. Boring teachers with negative predispositions toward their students—always criticising us and complaining that we are lousy and lazy—usually get more of the same kind of response from the students.

—Tan Zheng Da, FBA

Lecturers should spend the first ten minutes of every class recapping what was taught in the previous class.

—Grandi Srinivasa Deva Gupta, ENG

My tutor is friendly but not too friendly so that he loses respect. He never gets angry when we don't pay attention in class or do the tutorial. He gives us advice so we realise our mistake by ourselves. He is very patient. If we did not understand the subject, he will try his best to explain it. If we still can't understand, he offers his free time to discuss the problem. If someone didn't get a good grade on his quiz or test, he will ask the person to meet him in his office, discuss the problem and find a solution. Being taught this way helped me build initiative to learn more.

—Budi Juswardy, ENG

4

In my experience, no matter how hard teachers try to fill up their students, the acceptance of knowledge depends only on whether a student learned it actively. I recommend "active" teaching. For example, leave some chapters to be studied in advance by small groups of students, and then it's the teacher who answers their questions in class!

—*Zhaohui Chen, ENG*

Good teachers help the student build a microstructure that links up different aspects of a module, and a macrostructure that links together different modules.

—*Soon Chun Siong, FASS*

A critical skill many lecturers lack is how to handle a lecture when there is a shortage of time. Many merely compress the lesson, not wanting to waste the materials they prepared. A better method is to select only the crucial points that need to be delivered, make them very clear to the class and provide well-filtered references for further study.

—*Amos Loh, MED*

I wish some lecturers would give us less things to copy, and make us copy the important concepts, notes and formulae so we can learn faster, instead of throwing everything onto us.

—*Steven Ong, ENG*

On good teaching:
- Do your homework too. Prepare questions and exercises that will stimulate debate and make your students think on their own feet!
- Rediscover your first love for teaching. Teach with passion and conviction! These traits are sure to rub off with the students.
- The general environment should allow teachers to break from the orthodoxy of teaching.

—*Eduardo K. Araral Jr., FASS*

My tutor's informal style led to many lively and interesting debates in class. And by the end of the semester, the entire group became quite close through the group projects and presentations. Without such friendly environs, students will indubitably feel alienated. Kudos to her hands-on style.

—*Anonymous (student)*

On good teaching:
- Use "discovery" exercises. Students discover how to use and apply a method in a particular case with the help of early, guided assignment given *before* the concept is taught.
- Give well spaced, well planned assignments and avoid the lumping effect nearing exams.
- Give feedback about assignments (and midterm exams) so we can learn from our mistakes or the lecturer's comments.

—*August Rusli, ENG*

It is the ability to help students relate to actual situations in the industry or working environment. Pure textbook knowledge does not help a student see the big picture.

—*Stanley Tay, ENG*

Although independence is a requirement for survival in NUS, sometimes this becomes an end rather than a means to an end (tertiary education). In such an environment, only the extremes of the spectrum of students— the elites and the incorrigibles—stand out and many who stand in between are forgotten. More should be done to eliminate the gulf between teachers and ordinary students that form the bulk of the population.

—*Anonymous (student)*

Good teachers transfer their ideas about research, their own interests and perspectives and related "real world" experience. They challenge students to form individual perspectives and generate ideas for research. Some sort of synergy whereby idealism (us youngsters) and experience ("them") form solid research.

—*Evan Yap Boon Heng, FASS*

One feature of good teaching is the stimulation of students to do their own reading-up, and not just relying on the notes provided in lectures.

—*Lim Yeow Heng, SCI*

Good teachers are able to simplify difficult theories into easy-to-understand concepts.

—*Edwin I. Sutedjo, ENG*

Some teachers teach well and some teach badly. This discrepancy should be due to a lack of communication among them. With communication, they can share their experiences and learn from one another.

—*Anonymous (student)*

Good teachers never let his/her students feel stupid.

—*Anonymous (student)*

5

Research, teaching and tenure at NUS

Adapted from a CDTL seminar presentation entitled "Tenure=Good Teaching+Good Research?" by Prof Lee Soo Ying.

Before 1980, NUS was primarily a teaching institution equivalent to a four-year high prestige college like Oberlin, Smith or Haverford in the US. At that time, we were classified as a Comprehensive University according to the Carnegie Classification of Institutions, or CCI. [See top right box.]

But since 1980, we have put more resources into research. Today, the number of PhDs we produce (95 last year) and the research funds obtained from the Government (US$50 million) place us at the top of the CCI scale at Research Universities I. We are perhaps the fastest growing university in the world in terms of academic status. That's why you all are feeling the pressure and you are going to have to work smarter in the time to come.

RAPID GROWTH

Figure 1 shows our publication history in Science Citation Index (SCI) journals. In 1980, we were comparable to the University of Malaya—we shared a common history with it for a while. Today, we have overtaken all the universities in New Zealand and most of the universities in Asia. If you put us in the Australian basket, we will rank in the top five. In terms of annual growth in SCI journal publications, more mature universities like Tokyo, Harvard and Cambridge are growing at a much slower rate than Asian universities like Taiwan, Hong Kong, Singapore, and even Korea. Still, we are far from Cambridge University, which produced over 3,300 papers in 1995, and Harvard, number one in the world, with about 8,000 papers annually.

IMPACT FINGERPRINTS

What about quality? I chose an area for which NUS has strength— the physical and chemical sciences with contributions coming from the Faculty of Science and some from the

Figure 1. Publication trends in SCI journals by # of papers, year and university

Legend: Southampton, NUS, Western Australia, Hong Kong, Otago, Simon Fraser, NTU, Malaya
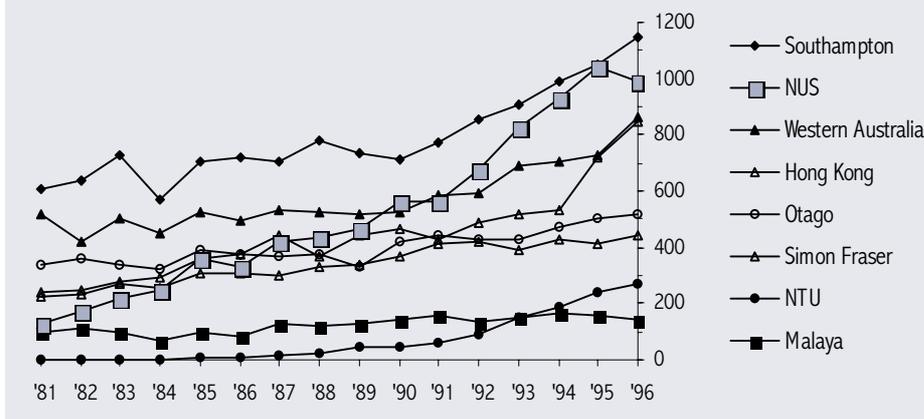
Faculty of Engineering and looked at a basket of about 94 journals. Figure 2 shows our growth and impact distribution over the last ten years. Our distribution used to peak on the low impact journals (**LIJ**). Then it slowly shifted toward the medium impact journals (**MIJ**). When we become a world-class university, perhaps in 15–20 years, our fingerprint should look like that of MIT (see figure 3). Growth is flat and the peak is always in the high impact journals (**HIJ**). ANU has the same pattern. This is a good indicator as to whether or not a university has reached world-class status in a particular field.

Now, how do we fare against British universities? In a count of high and medium impact journal publications in 1996, we rank as #13 (96 total), slightly ahead of Warwick (92 total), way ahead of universities like Essex (31 total) and Open (21 total), but far behind Cambridge (497 total) and Oxford (454 total). Part of what separates us from the latter is their large number of post-doctoral fellows—about 5 times more than what we have. And that makes a big difference. Figure 4 compares our impact distribution to those of some other universities.

THE $4 MILLION QUESTION

At NUS, we tell our academic staff the ABCs of what they are supposed

Figure 2. NUS pubs in the physical & chemical sciences by impact*

Legend: HIJ, MIJ, LIJ
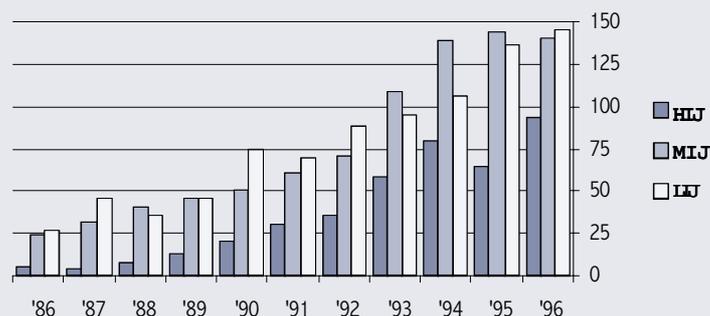
to do: teaching (we **all** must do), research (you'd **better** do) and administration (if you **can**, please do). In most cases, tenure is a $4 million dollar question and ought to be taken more seriously than we do today. Currently, the Personnel Department initiates the process by sending a letter and assessment forms to the head of department. The head and the dean have about two weeks to meet with the candidate, complete the evaluation and reach a decision. Assessment parameters include teaching quality and workload, laboratory development (for Science and Engineering), research quantity and quality, administration, relationships with staff and students, proficiency in English and other duties and services. We normally expect the candi-

Figure 3. MIT pubs in the physical & chemical sciences by impact*

date to have good, very good or outstanding overall performance in order to be recommended for tenure or contract renewal.

SUGGESTIONS FOR CHANGE

But should we, because of this $4 million dollar question, change the tenure process? Here are some changes we can make. While teaching and service can continue to be assessed internally, research can be better assessed externally.

The first step is for the candidate to produce the curriculum vitae and a list of eight reviewers. The head and the dean together can supplement the list and seek the consent of reviewers to look at the complete dossier. In parallel, the candidate will produce the whole scholarly package which includes the teaching portfolio, significant published works and any reviews the candidate has already obtained for his or her work.

With all this material, and assuming that eight reviewers agree, the package is sent out by the head.

Based on the letters received, a decision is made—in conjunction with tenured staff in the department—and forwarded to the dean's office for ratification as well as to the vice-chancellor.

SMARTER TEACHING

Another question has been raised: Since promotion and tenure are both based very heavily on research, what is going to happen to teaching? How do we avoid damaging the quality of our teaching as we progress on our enormous growth path? I think we have to be aware of what effective learning means from the student's point of view. We need to focus on the student's mind, not the subject matter, and make learning a part of real life situations. Lectures alone are not enough; we must use an apprenticeship approach involving mentorship and coaching (e.g., the Research Opportunities Programme in Science and Engineering).

We have to be aware of the skills and competencies required for students to operate in the real world and we need to make sure they have the basic skills of listening and speaking. Thinking skills and the core competencies of managing resources, interpersonal skills, managing information, managing systems, managing technology, team-working skills and cross-border skills are critical.

The academic workplace is evolving—from lecturing to coaching, passive learning to active learning, textbooks to customized materials, and even from tenure to contract work. Be ready for change. The university is not what it used to be. ■

* Data run on 11 Jan 1997 when 1996 totals were not yet complete—another 5 to 10% increase was expected.

Carnegie Classification of Institutions (CCI)

NUS '96	Research Univ. I	2.5%
	Research Univ. II	2.5%
	Doctoral Univ.	5%
NUS '80	Comprehensive Univ.	10%
	Liberal Arts Colleges	30%
	Community Colleges	50%

CCI levels are determined by the amount of government funding for research and the number of Ph.Ds produced.

NUS in 1980...

817	Academic staff
8,634	Undergraduates
433	Postgraduates
~120	SCI journal papers

NUS today...

~1,600	Academic staff
~18,500	Undergraduates
~5,500	Postgraduates
>1,000	SCI journal papers

NUS academic staff profile 1995–1996

|		
70	Professors	5%
277	Associate Professors	18%
533	Senior Lecturers	33%
399	Lecturers	25%
132	Senior Tutors	
121	Visiting Staff	19%
60	Adjunct Staff	

Total: 1,592

7

Figure 4. 1996 pubs in the physical & chemical sciences by impact and university
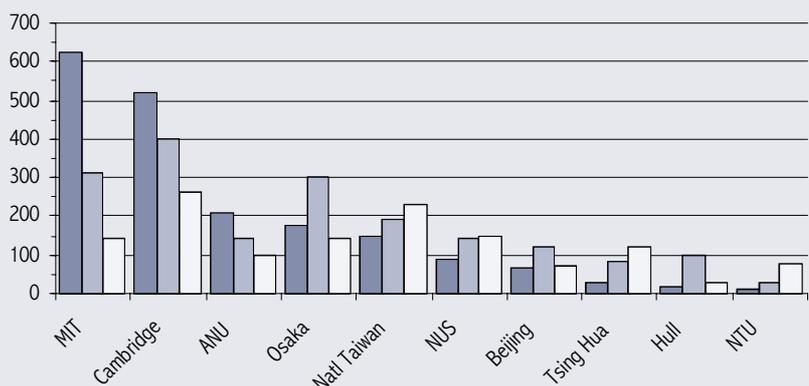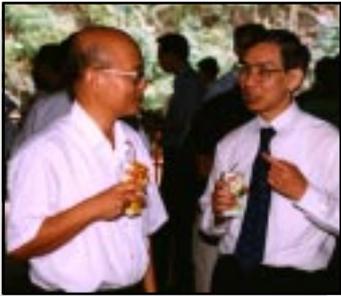
CDTL's educational programmes
Lifelong learning for teachers

In the two years since our change of name and expanded scope, CDTL's programmes have helped NUS staff enhance skills, share ideas and nurture a teaching community.

In 1997 alone, nearly 650 NUS staff participated in 2 induction programmes, 8 seminars and 21 workshops. Total attendance at these programmes was over 1,200. CDTL staff also led 10 additional workshops for specific groups on request.

We've tried to bring you a wide range of programmes on effective teaching and learning and we hope these sessions have contributed to positive change on campus.

8

Our efforts have been greatly helped by strong support from Deputy Vice-Chancellor Chong Chi Tat and others in the administration, but the programmes would not have been as successful without your keen interest and participation. We look forward to serving you, and to even greater participation from you, in 1998! ∎

Faculty participation rate in C...
1997 educational programm...

Faculty	%
FAB	23
FASS	26
FBA	32
DEN	50
ENG	50
LAW	12
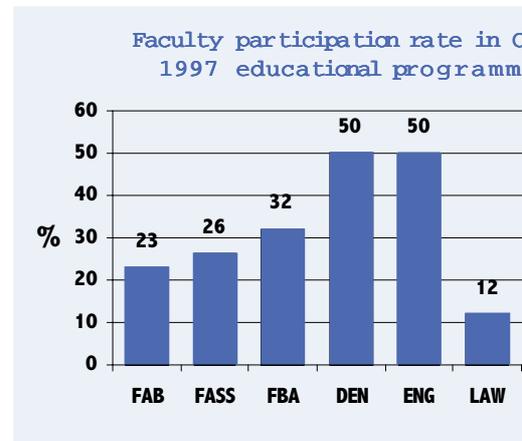
CDTL's 1997 se...

	SEMINAR	PRESENTERS	NOTED
J A N	Conduct of Open Book Examinations	A/P K. P. Mohanan (FASS) A/P Winston Seah (ENG) Prof S. M. Tang (SCI) A/P Walter Woon (LAW)	Students being intelligent people will jump through the hoops no matter where you put [them].... What open book examinations allow us to do is put the hoops in a real life position rather than an arbitrary place. —A/P Water Woon
F E B	Using Project Work to Enhance Learning	Dr Marcelo Ang (ENG) Dr Michael Chew (FAB) A/P Tan Chew Lim (SCI)	Successful project work must have well-defined objectives. They can be specific or general depending on the kind of project but the advisor must very clear on what he or she expects of the student. The student must know the deliverables for the project. —Dr Marcelo Ang
M A R	Enhancing Student Learning: Foundation Programmes	A/P Belal E. Baaquie (SCI) Dr Daphne Pan (CDTL) A/P Augustine Tan (FASS)	Many students think they're prepared for university because they assume it's just more of what they've been doing. We need to disabuse them of of that notion. It's not *more* of it. It's a different *kind* of learning they need to engage in. And many are not aware of that. —Dr Daphne Pan
A P R	Curriculum Review: How much ground to cover?	Dr Grace Ong (DEN) Mr Stephen Phua (LAW) A/P Yeo Swee Ping (ENG)	TQM of the university's curriculum: There's a risk that we'll have a university full of features but no total quality because there is insufficient integration of the...improvements we are making....They [need to] work as a coherent whole. —Mr Stephen Phua

A cause for celebration
# IMCB's trail blazing video

When he first agreed to produce a corporate video for Singapore's prestigious Institute of Molecular and Cell Biology (IMCB), CDTL's Senior Media Producer Noli Gamboa didn't know it would become his proudest work to date.

But IMCB projects have a knack for success, and when Director Chris Tan told Noli, "I'll be Michael Crichton and I want you to be Steven Spielberg", he knew something good was going to happen. And it did.

The 11-minute video was released last November to help IMCB celebrate its 10th anniversary. Four segments—*good science*, *high tech*, *people* and *launch to industry of the next century*—tell the story of its growth and give viewers a real feel for its culture.

The formula for its success? An abundance of material, minimal narration, great graphics and special effects, the right music, compelling interviews (including two on-location in Montana and San Diego) and, of course, a committed team of people from IMCB and CDTL to put it all together! ∎
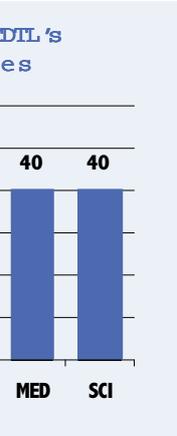
Multimedia CD to keep JC students informed
Science struts its stuff

The choice of where to go for an undergraduate education and what to study just got easier. New this January, JC students will have access to a CD designed to introduce and attract them to the world of Science at NUS. In collaboration with the Faculty of Science, CDTL's team—led by Analyst Programmer Kiruthika Ragupathi—designed and integrated text, graphics, audio and video clips into a comprehensive multimedia package. Fun and interactive, students can learn about the faculty in general and get a feel for the different departments, course requirements, research, facilities, career prospects and more. Special sections on FAQs and student life are sure to be a hit. ∎

9

minar round-up

	SEMINAR	PRESENTERS	NOTED
M A Y	Creative Thinking	Dr Lam Khee Poh (FAB) Prof Ng Soon Chye (MED) Dr Wayne Patterson (FASS)	The challenge for teachers is to find means of identifying and rewarding creative thinking, which so often contradicts conventional thinking, while at the same time requiring that conventional wisdom be absorbed and mastered. —Dr Wayne Patterson
A U G	Creative Thinking Revisited	Prof Herbert Eleuterio (ENG)	The key to creativity is problem visualization and formulation....Most people are not prepared to handle ill-defined problems because they have learned to solve problems by defining problem causes too narrowly and then proposing solutions that are too short-sighted.
S E P	Educating for Life: IQ and EQ	DVC Prof Hang Chang Chieh	Are you willing to sacrifice short-term rewards and try to achieve something more substantial?....[The ability to delay gratification] is a very important emotional strength....Many scientists and scholars fail to undertake the really big projects that could make the critical difference in their careers.
O C T	Tenure = Good Teaching + Good Research?	Prof Lee Soo Ying (SCI)	The tenure process is not perfect. Sir Geoffrey Wilkinson was at Harvard as an Assist Prof from 1950–57...There was a tenure review and Harvard said not good enough. Wilkinson went back to Imperial College...took up the first chair in inorganic chemistry and won the Nobel Prize in 1973.

Cultivating *Creative* thinking
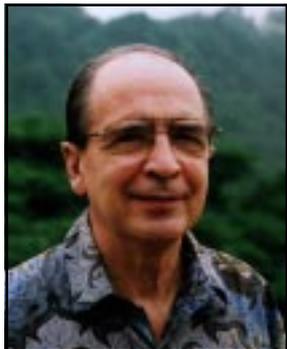
We met with Professor Herbert Eleuterio from the Faculty of Engineering to seek his help in demystifying creativity. The following article is a collection of his thoughts on the creative thinking process.

There is a misconception that analytical thinking and creative thinking are opposites. They aren't. They are part of a process and the key is when to use which. Most of us look at problems and try to find solutions right away. That's what the analytical process entails. But when we get analytical too quickly, the odds are we won't come out with a creative solution in the end.

Nobel laureate Professor Herb Simon says that, in the basic physical sciences, "creative thinking involves the willingness to accept vaguely defined problem statements and gradually structure them, a continuing pre-occupation with problems over a considerable period of time and extensive background knowledge in relevant and potentially relevant areas."

OPEN ENDED PROBLEMS

The request I get from 95% of my students is, "Prof, tell me what to do." They want me to spell out the problem, to define it. I give them vaguely defined problems in my classes deliberately—to encourage them to think more creatively. It doesn't *necessarily* make them more creative, but it challenges them to think in different ways.

AN OPEN MIND

The first step—and perhaps the most difficult—in the creative thinking process is to keep an open mind. One of the problems of educated people, particularly well-informed people, is that they don't really have open minds most of the time. An open mind is important because we need to defer judgement. We make a lot of assumptions before we start solving a problem and, very often, we don't go back and challenge those assumptions. For most routine problems, that's not a problem. But for complicated, non-routine problems, we may end up answering the wrong question. So try to keep an open mind and to defer judgement.

PROBLEM VISUALIZATION

The second step is to visualize the problem. At this stage, we are looking for possibilities, not solutions. Generate options by diverging on the problem. Then you'll be ready to converge on the problem by getting critical, making choices and evaluating the product.

KNOWLEDGE BASE

I don't belong to the school that says throw all memorization away—you don't need it. That's nonsense. You can't look everything up all the time. You have to have a memory bank and you need some basic concepts before you really get into problem-solving. The question is when and how to use the information.

THE LONG HAUL

To gradually structure a difficult problem takes a lot of time, thinking, reading and processing. We need a fair amount of background information and much of that tells us what the problem is *not*. Rarely does it tell us what the solution is, it just narrows the field of where we ought to look. In the physical sciences, this involves a lot of trial and error experimentation and wrong assumptions but we use that data to keep going. This is counter to the idea that exploring and producing negative data is failure.

RESILIENCE

Regarding such experiments not as failures but as *learning* experiences is an important quality. When you work months or even years on something and you think you have it figured out and then it doesn't work out, you've got to bounce back. This is an emotionally difficult undertaking and you have to have a certain amount of resilience and self-confidence.

COMMITMENT

Very often people have interesting ideas but are afraid of being wrong, of being challenged. We don't like to be bait and we don't like to sell our ideas. But we have to do some selling of our ideas—to ourselves and to other people.

Creative thinking is not the chaotic process that some people describe. To say that people who are creative don't follow rules is not correct. What is correct, is that they don't accept a lot of the limitations that other people take as a given. ■

10

Reaching out with video conferencing

Mr Joe Peters, Assistant Director, CDTL

Video conferencing is undergoing one of its most dynamic and exciting phases of development yet. The field is moving from a state of cacophony and high cost to one in which merging technology (i.e., audio, video and data) seems clearer and surer as world standards are followed and hardware price reductions become a reality. Responding to requests from various lecturers, CDTL has already exploited some of these new developments. This article explores three examples in which we met teachers' needs by moving beyond the original capabilities of our video conferencing system.

THE ORIGINAL SET-UP

CDTL's system was configured in 1992 when video conferencing was a new idiom in academic technology and world standards were not yet formally established. Our PictureTel 4000 Model 200 was a sophisticated system then, but it only served a basic rate of 128 kbps (1 ISDN line). However, using a network of optical reflectors and fibre options, we set up five video conferencing sites on campus, with a control hub at CDTL to facilitate connections and conferences.

Most of these conferences have been specialised lectures from overseas sources to NUS. The system has also been used for research meetings, to interview prospective staff and, lately, to conduct course-work. The talents of NUS specialists have also been "exported" overseas via video conferencing.

A NEW ACQUISITION

CDTL recently acquired a second video conferencing Codec which provides better quality video and transmission rates of up to 384 kbps (3 ISDN lines). The new Codec is portable and easy to operate. Once faculties configure their video conferencing rooms with ISDN lines, remote cameras, projection and audio systems, it can be brought over and connected when needed. Until then, the new Codec can be used at CDTL's studio, where we have installed four ISDN lines.

The following examples show how teachers have used video conferencing to achieve educational goals. In each case, the configuration involved a combination of asynchronous and synchronous media and computing facilities.

EXAMPLE 1: FASS'S LONG-DISTANCE LINGUISTICS

Dr Vincent Ooi from the Department of English Language and Literature requested an Internet connection to run synchronously between Professor John Sinclair at the University of Birmingham and students at NUS reading a Computational Linguistics course. For several sessions, Dr Ooi's class needed a computer cluster with

...continued on back page

11

VIDEO CONFERENCING SPECIFICATIONS

I. EQUIPMENT

PictureTel 4000 Model 200
Video standard: H.320
Video coding: H.261
Audio: G.711/G.722
Transmission: up to 128 kbps
Gandalf T. A.

RSi Systems Video Flyer
Video standard: H.320
Video coding: H.261
Audio: G.711/G.722/G.723/G.728
Data T.120
Transmission: up to 384 kbps
Bonding

Other
Cameras, AV system, recording and video projection equipment.

II. SITES (CAPACITY)

CDTL Studio (35)
FBA Conference Room (70)
Computer Centre Auditorium (80)
Science Auditorium (200)
CRC (200)

Video conferencing request forms are available at CDTL and through our homepage. Two weeks advance notice is preferred. For more information, contact Joe Peters at 874-2473.

III. COSTS

ISDN line per hour: Current Telecom rates of $144 for USA, $168 for UK, $180 for Japan.

Testing: Approximately 15% of the line charge.

Local sites: No charge for official NUS users. Other users can obtain a schedule from CDTL.

Foreign sites: Charges vary for studio rental and technical support.

Other costs: Additional charge of $50–100 if the conference occurs after office hours. VHS recordings are also available at a minimal charge.

Teaching & Learning

HIGHLIGHTS

FACULTY OF ARCHITECTURE AND BUILDING

HELPING TEACHERS HELP STUDENTS

FAB recently conducted a series of four in-house teaching seminars on the theme of critical and creative thinking. All staff were required to attend at least one seminar in the series. In addition to promoting excellence in teaching, the seminars offered tips and tools on helping students' enhance their thinking skills. Topics included:

- Creative and critical thinking: Investigating its significance to ABEM studies
- Assessment as a vehicle for creative teaching and learning
- Strategies to promote value-added learning
- Creating professionals for the 21st century

FAB staff, who are themselves recognised as good teachers, served as the convenors and external speakers were invited to share their expert views. FAB intends to publish the proceedings as a teaching guide for its staff. ■

12

FACULTY OF ARTS AND SOCIAL SCIENCES

SURFING AT THE SUMMIT

In June 1997, FASS launched an electronic magazine, or e-zine, called SUMMIT to serve as a source of information on IT developments, know-how and resources at FASS and beyond. Conceived and implemented by members of the faculty's IT committee, the inaugural issue includes articles on:

- Organising a conference in cyberspace
- Welcome to a foray into IT
- The entangled web: Surfing with a purpose
- The biggest bug of them all
- Creating and enhancing your web page

You can find SUMMIT through the FASS homepage or at http://www.nus.sg/NUSinfo/FASS/webarts/FASS.html. Watch out for the January issue on IT in research. Contributions from all staff and students are welcome. ■

FACULTY OF BUSINESS ADMINISTRATION

THE BUSINESS OF EXECUTIVE EDUCATION

For the second year running, the 15-year old Stanford-NUS Senior Executive Programme has been offered in Hong Kong in addition to Singapore. The intensive, three-week course features distinguished faculty from both universities, an emphasis on managing companies in the Pacific Rim and the opportunity to work with and know a diverse group of executives from all over the world. The course is one of nearly 60 FBA programmes that have trained over 9,000 executives from 80 countries since 1981. As one of few institutions in this part of the world to deliver high quality programmes in English and Chinese, FBA continues to live up to its motto "The Best of East and West". ■

FACULTY OF DENTISTRY
PROBLEMS THAT MAKE LEARNING FUN

Two years ago, the Faculty of Dentistry introduced problem-based learning (PBL) into its tutorials. PBL tutorials are student-centred. The teacher plays the role of facilitator, not resource person. Carefully designed problems motivate student discussions. Together, students uncover what they know, what they need to know and where to find it. PBL develops research, reasoning and communication skills and students become better managers of their learning. Cases that cut across disciplines help them see the big picture and make connections. Students enjoy the tutorials and find the learning environment less threatening. PBL is a useful teaching method and we plan to incorporate it more widely into the curriculum. ■

FACULTY OF LAW
SKILLS TO LAST A LIFETIME

Several new courses—a Negotiation Workshop, Mediation Workshop, and Negotiation and Conflict Resolution course—introduced over the last few years help students develop skills and confidence. Workshop lectures are short and students are expected to absorb substantive knowledge from prescribed reading. The emphasis is on experiential learning. Every session involves on-the-spot simulations in which every student participates. Equal time is given to class review, a lively exchange of views and reactions. And written journals, required after every session and often returned with lots of teacher feedback, become valuable tools for self-analysis and improvement. From such strong reinforcement of theory with practice, many students complete the workshops with a new discovery—the power of self-learning. ■

FACULTY OF MEDICINE
PLASTIC DUMMIES JOIN SKILLS LAB

As a result of the curriculum review process, the Medical Faculty is making exciting new changes in its course content and approach. This includes setting up a skills training laboratory to help undergraduates learn basic emergency skills like first aid and cardiac life support. Plastic dummies, or mannequins, are a special feature of the new lab, enabling students to practice skills like tracheal intubation as many times as necessary to attain mastery. The lab makes training and assessment more structured and skill competency more uniform. In the near future, it will be expanded to include other core skills like venepuncture, lumbar puncture and chest tube insertion. Ultimately, the lab will also train postgraduates in advanced skills like microsurgery and laparoscopy. ■

13

FACULTY OF SCIENCE
WILL "BUCKYBALLS" SHAPE OUR DESTINY?

The topic of how "buckyballs" and nanotechnology will shape our destiny was discussed and debated in one of some thirty seminars presented by participants in the Science Talent Development Programme (Science TDP). The seminars, held in October 1997, covered a diverse range of subjects such as gene cloning, the physics of guitar playing and how to enjoy set theory. Science TDP aims to provide an intellectually challenging environment for students to pursue their scientific interests. Participants write academic essays, present talks, design experiments and conduct in-depth studies. They also have a chance to interact with leading members of science and industry. Last semester this included tea and lively exchanges with Professor Richard Ernst, Nobel laureate in Chemistry (1991) and Professor Jerome Friedman, Nobel laureate in Physics (1990). ■

The critical match between motivation to learn and motivation to teach

Ronald Teeples and Harvey Wichman, Claremont McKenna College

INCONGRUENCE

Students will be pleased with a course if educational outcomes match the expectation they had for taking the course in the first place. They may even experience extra delight if outcomes exceed their expectations, but they will surely be disappointed to the extent that the outcomes fall short of expectations. One way professors strive to avoid such disappointment is by providing a syllabus that lets students know in advance what they can reasonably expect. However, even a very clear syllabus won't avoid disappointment if there is a fundamental difference between what professors and students believe their courses ought to achieve. In a recent essay about the different cultures of professors and students, Lars Eric Larson (1993) discusses the problem of professors and students perceiving course purposes differently. In Table 1 we outline five perceptual conflicts that we observe in course interactions. They are based on some of the original professor/student differences identified by Larson. (See Table 1.)

MOTIVATION OF TEACHING AND LEARNING BEHAVIORS

Martin Covington (1993) and his research collaborators have for many years investigated motivations underlying learning behavior. Their conclusion is that course grades and self-image are far less important in motivating student learning than a student's own self-estimate of ability. In other words, the strongest motivation for learning is the perception by students that their personal abilities will be maintained or improved. Even though an expected course grade might be low, learning motivation will remain high if students believe that necessary personal abilities are being enhanced.

Although students enrolling in a specific course may verbalize a diverse set of motives for doing so, they are quite homogeneous in their overall desire to enhance personal skill and ability. Most college students see education as a way to enhance their positions in life. Given such a promise, students generally respond positively to learning challenges; but, as we know, they are easily bored if this promise weakens or is lost.

Students take a broader view of teachers than mere "knowledge transmitters." They evaluate course experiences by diverse criteria such as effect on grade averages; parental expectations; peer attachments; perceived importance for subsequent courses; usefulness in later life and career; and, yes, interest and entertainment content. However, we believe that their overriding, long-range concern is the appropriateness of course knowledge to personal growth and plans for skill formation relevant to their career aspirations.

A stark reality of higher education is that it is difficult for students to see direct links between course work and ultimate payoffs, particularly with regard to liberal arts endeavors. So how can the potential energy of student interests be engaged? Our own teaching experiences and understanding of learning show that student motivation to learn can be dramatically influenced by course structures, teaching methods, and instructor attitudes. Thus, we advocate institutional changes that encourage pedagogical modifications—that is, modify teacher attitudes and incentives as a means of ultimately stimulating student motivation and learning outcomes.

Traditionally, faculty members have viewed course material as something to be "transmitted to students." This is typically accomplished by lectures and demonstrations. The professor knows the material, and the students must learn it—a clear and simple learning model. There is a powerful underlying cultural environment that supports this style of teaching, particularly the pervasive notion that the student is solely responsible for educational outcomes, not the professor. That is, professors profess while students "assimilate" and get tested on the amount they retain. Students often feel that this pedagogy grades them for performance unrelated to personal growth and development of their abilities.

We believe that there already exists a broad-based awareness of this cultural predicament. We also acknowledge that we account for only two small voices within a very large chorus of advocates for adoption of "more active" learning methods. The problem is how to begin redirecting the inertial forces of our academic culture? How can the teaching/learning motives of professors and students be made more congruent in the existing environment? In our opinion, what is needed at the discussion table is general exposure to a wide variety of specific, successful tactics. We need to witness how various institutions are solving this problem—implementing new incentive systems that encourage faculty members toward pedagogic innovation, especially active learning options.

What we propose is more than bootstrapping more enthusiastic classroom presentations. Reform involves considerable revamping of traditional teacher incentives and eventual cultural shifts away from the incongruent attitudes displayed in Table 1. Given the great difficulty of making large cultural changes quickly, we have developed a special program that can be embedded within a traditional college curriculum. Our hope is that what is first *embedded* will eventually become integrated, sparking shifts in pedagogical preferences. The program is called "The Practicum Program'' and is described in detail elsewhere (Teeples and Wichman, 1997). It provides a framework in which it is appropriate and necessary for professors and their students to be jointly responsible for course content while not seriously jeopardizing the strong cultural norm that professors ought to exercise dominant control over course coverage.

An institutionally supported practicum program is just one tactic for implementing active learning methods and making the motives of professors and students more congruent. Fostering undergraduate

14

student/faculty research is another approach. In general, the incentives should cause professors to feel more responsible for the educational outcomes of their students. By "incentives" we do not refer exclusively to monetary rewards and reimbursement. If a course goal is to complete a project for an outside client, the professor's reputation (as well as the students' and the institution's) is a strong, congruent incentive toward effective learning. In joint projects, the professor is more likely to focus on each team member and make sure he or she performs well enough to meet or exceed criteria agreed upon by the group. Active learning approaches that foster teamwork are especially motivating because the professor can expect social pressures from within student groups to assist in monitoring individual performance levels. Above all, active learning approaches cannot appear to be pointless. The exercises ought to be aimed at clear learning objectives. A connection to students' expectations about improvement of personal abilities is paramount.

In the practicum setting, coursework is usually arranged so that professors and students share similar risks. Students are investing for skills relevant to their futures, and the professors see the project as facilitating professional advancement. Compared to lecturing, the teaching/learning motives are more congruent.

But how plentiful are such opportunities for consistent active learning at the undergraduate level? Other than perhaps some satisfaction from improved educational outcomes, what is a professor's payoff from implementing more active learning pedagogies? What if the tactic causes professors to relinquish some course authority and be exposed to greater risk of professional advancement?

Educational research seems to signal some clear benefits to students from the kinds of pedagogical changes that we are advocating. At least we can say that student motivation is elevated when belief runs high that students are gaining the skills and experience that employers and graduate schools are actively seeking. Positive feedback from these "outside sources" and former students clearly reinforces such belief. Undergraduate professors in our program have been quite successful in making this kind of teaching serve at least some of their scholarship aspirations. The question is whether this source of improved motivation can be made more consistent with the educational goals and professional motivations held by professors.

This article is reproduced with permission from Teaching Excellence, a member service of the Professional and Organizational Development Network in Higher Education.

CONCLUSION

Our personal experiences convince us that when courses are designed so that professors and students share responsibility and work together to achieve common goals, there are very positive effects on educational outcomes. Not only is learning more uniformly superior but harmonization of teaching/learning motives also improves the emotional quality of the educational experience for both professors and students. ■

REFERENCES

Covington, M. V. (1993). A motivational analysis of academic life in college. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research*, IX pp. 50–93.

Larson, L. E. (1993). The two classroom cultures: Challenge to instructors. *The Teaching Professor*, 7(10), pp. 3–4.

Teeples, R. K. and Wichman, H. A. (1997). Teaching theory and applications together: An exploratory teaching program in the liberal arts. *Innovative Higher Education*, 21, pp. 79–196.

Ronald K. Teeples (Ph.D., UCLA) is the Boswell Professor of Economics and Director of the Practicum Program at Claremont McKenna College. Harvey A. Wichman (Ph.D., Claremont Graduate University) is Professor of Psychology and Director of the Aerospace Psychology Laboratory at Claremont McKenna College.

15

TABLE 1. FIVE KEY DIMENSIONS OF STUDENT–PROFESSOR INTERACTIONS (DERIVED FROM LARSON, 1993)

DIMENSION	RESPONDENTS	RESPONSE
1. Control	**Professors**	**Feel authoritative and that they should exercise full course control.**
	Students	*Recognize that they are clients, however, feel that paying clients should share in control.*
2. Knowledge	**Professors**	**See acquisition of knowledge as an end in itself.**
	Students	*See knowledge as a means to an end.*
3. Method	**Professors**	**Match teaching style to the type of material being taught.**
	Students	*Judge teaching styles by criteria that are unrelated to course content.*
4. Motivation	**Professors**	**Feel a student's enrollment in course is tantamount to being motivated.**
	Students	*Feel the professor is compensated, at least in part, to motivate them to learn.*
5. Purpose	**Professors**	**See narrow purpose for taking a specific course, e.g., learning per se, and preparation for follow-on courses in the discipline.**
	Students	*Have varied purposes, e.g., course fits personal schedule, is a required course, raw curiosity, heard that teacher was interesting, wanted to be in course with a friend, parents insisted.*

Internet access and the ability to handle ISDN-based video conferencing. Since there weren't any clusters with this capability on campus, we configured a temporary one at CDTL's studio. The main problem was enough bandwidth to allow all the computers to access a database— thousands of miles away—simultaneously, and share them through a temporary router. What eventually worked was to have one computer do the accessing and to project that screen for all to view. Other interaction between Professor Sinclair and the students continued in the usual way through the AV system.

EXAMPLE 2: LAW'S CROSS-CULTURAL CLASSROOM

Dr Kevin Tan from the Faculty of Law ran an interesting series of "cross-cultural dialogues" between two classrooms, one in Singapore and the other at the University of Toronto in Canada. The class used the whole gamut of synchronous and asynchronous facilities available on campus. Synchronous communication was conducted via video conferencing and an Internet link. For asynchronous communication, students used the "Conferencing on the Web" (or COW) facility that the Computer Centre has configured within NUSNET, and plain old email. This package of technologies kept the dialogue and contact going successfully.

EXAMPLE 3: FBA'S MULTI-POINT CONNECTION

Associate Professor Lim Kian Guan from the Faculty of Business Administration requested a multi-point, multi-functional (audio, video and data) connection with Aoyama University in Japan and Korea University in Korea (see Figure 1). This was a complex and challenging

Figure 1. Video conferencing configuration between Singapore, Japan and Korea.

request and required close coordination between CDTL, the Computer Centre and Aoyama University. It was a totally synchronous event, involving a 384 kbps connection through our Video Flyer. A separate ISDN line, connected to an ISDN router and an electronic white board, facilitated interactive data sharing—the new feature in video conferencing now. Many participants in the Aoyama conference were inspired by this connection. Staff from Cho University are arranging a similar set-up with our Japanese Studies Department and Associate Professor Lim plans to have further sessions along these lines in the near future. ∎