

*This issue of CDTL Brief is all about **Cultivating Active Learners: Applying Scenario-Based Learning and Other Teaching Strategies to Enrich Classroom Learning**. Whether it is utilising “real-life” or non-analogous scenarios to stimulate students’ interest in complex life science concepts such as metabolism or the human immune system, or using role-play to build students’ confidence in tackling commercial real estate issues, the colleagues who have generously shared their teaching experiences here are united in their common goal of equipping their students with the skills to become active learners.*

## Contextualised Teaching Towards Active Learning

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### Introduction

I taught LSM2101 “Metabolism and Regulation”, a core module in the Life Sciences curriculum, in Semester 1 of Academic Year 2009/2010. The module comprised twice-weekly two-hour lectures and the class consisted of 252 students. This module involved helping students learn the biochemistry concepts of metabolism, and the regulation and integration of the major biochemical pathways that constitute Life. Students tend to have a preconceived idea that biochemistry is a difficult subject to learn, and this is exacerbated when metabolism is involved in the curriculum; this translates into a detached learning experience resulting in a dearth of learning. Prior to this teaching experiment, I had already taught the same module in the previous first semester of AY2008/2009, and the feedback from the majority of that 315-strong class led me to propose the use of contextualised teaching methods to enhance the learning experience of Life Sciences students. This is so that they may proceed on with active learning in their course and in doing so, go toward fulfilling the intended learning objectives of the integrated Life Sciences curriculum. This article relates my teaching experiment that was part of my Teaching Practicum in the Professional Development Programme (Teaching).

### Contextualised teaching theories

Since LSM2101 involved a considerably large class, and the delivery of content was solely through lectures and mass tutorials (i.e. tutorials held during lectures), I felt that the pedagogical tool to be used during these sessions should motivate students to learn in an active fashion. The common questions posed by students in this class range from “Why do I need to know this?” to “When am I going to use this information?”, and ultimately, to “Will this be on the exam?”. If these fair and commonly encountered questions can be addressed during the course of teaching the module, students should be motivated to want to learn and actively participate in the learning process.

Contextualised teaching is a concept of relating subject matter content to meaningful situations that are relevant to students’ lives. Proponents of contextualised teaching feel that “students who learn in a contextual environment are simultaneously introduced to the relevance of the learning content, which commensurately improves motivation” (Baker, Hope & Karandjeff, 2009). As such, “contextual learning has the potential to motivate and effectively engage students who view school as boring or non-essential, or who have struggled

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to make the connections between the demands of the classroom and their own personal goals and aspirations” (p.10).

### The contextualised approach

A translation of the prior quotes would mean that contextualised teaching should, in essence, enhance the overall learning experience of students with preconceived “negative” views of the lecture content; as such, I set forth to try to engage students taking LSM2101 to gravitate towards “liking” biochemistry and its metabolic pathways by using the following contextualised methods:

1. Using “real-life” scenarios to encourage students to reflect on various metabolic events that occur in the body.
2. Using well-timed quizzes to allow students to relate to lecture content.
3. Using “pre-tutorial” questions to prepare for future lectures.

### An example of a contextualised teaching method

To enhance the relevance of the learning content, especially with regards to the various metabolic pathways such as the glycolytic pathways, the glucose-alanine cycle, and the Cori cycle etc., I tried to present events or “real-life” scenarios that students would encounter, so that they can appreciate how these pathways work in the human body to allow them to perform tasks that they can relate to. Two such examples are: 1) a power-shopping trip along Orchard Road during the Great Singapore Sale, and 2) a fitness run round the track covering a distance of 2.4km. Both of these scenarios can be classified as aerobic exercises, and this provided an association with the impact of various metabolic pathways (such as lipolysis, glycogenolysis and glycolysis) that were covered in LSM2101. Recognising that certain gender preferences and stereotypes still hold, the shopping trip was meant for the female students to reflect upon, whilst the 2.4km run was a physical activity that the male students (especially the local Singapore guys who have served National Service) could relate to. The

use of these scenarios required the students to understand the relevance of certain individual metabolic pathways taught in LSM2101 and how these pathways are integrated to satisfy the metabolic needs of the body during events as common as a shopping trip or a fitness run.

### Reflecting on the impetus of the methods

As a previous student, I recognise that sitting through a two-hour lecture can be a daunting task, considering the need to assimilate and relate lecture content at a pace set by the lecturer. Hence, I introduced a series of quizzes (which I called “the Thinker slides”) throughout the two hours to break up the monotony of lecture delivery, and at the same time, allow them to reflect upon and relate to the lecture content. An example of such a slide is shown in Figure 1.

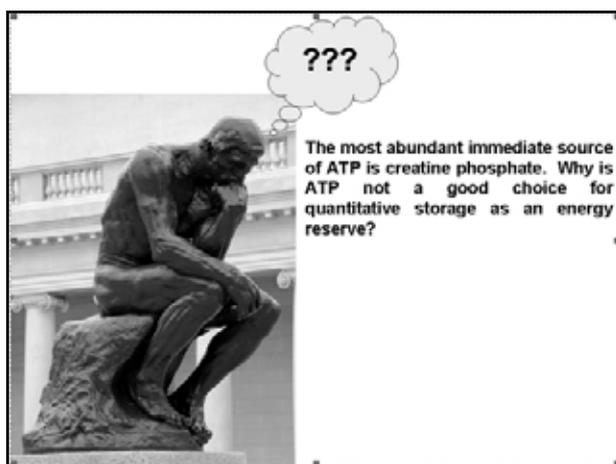


Figure 1. An example of a slide from the “Thinker” series.

I made it a point not to blatantly give the quiz answers to the class, but instead, actively engaged the students to discuss their thoughts and to relate them to the questions posed during the “Thinker” quizzes. Although one may argue that total student participation in a large lecture class may be impossible to achieve, I believe that student engagement is as important as content delivery, and as such, the stimulatory environment afforded by the series of “Thinker” quizzes would serve not only to break the monotony of the usual pace of the lecture, but also helps to stimulate the students’ interests and thoughts toward relating to the lecture content.

I also introduced a series of “pre-tutorial” slides to motivate them to prepare for future lectures, so that learning becomes active rather than passively instructional. An example of such a slide is shown in Figure 2.

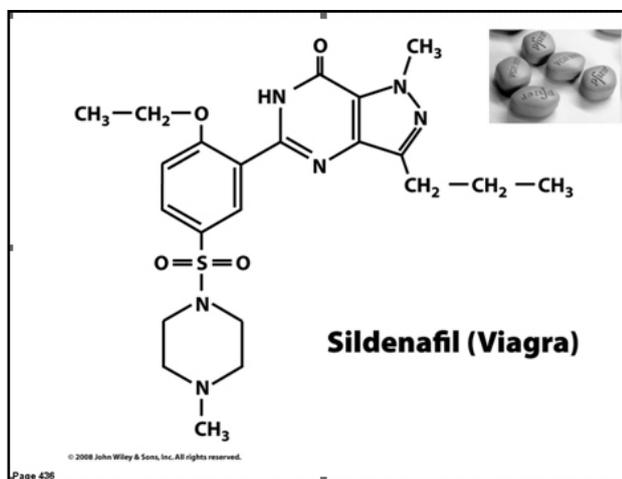


Figure 2. An example of a “pre-tutorial” slide.

In this slide, the chemical structure of a drug (commonly known as Viagra) used in the treatment of erectile dysfunction is illustrated. This slide follows a series of lectures on amino acid metabolism, with particular reference to the amino acid arginine. I provided some clinical background to the mechanism of the drug, mentioning to the class that “Viagra potentiates the effects of nitric oxide, alleviating erectile dysfunction”. Their “homework” was to research on the metabolic link between arginine and nitric oxide, and how nitric oxide can alleviate erectile dysfunction. As with the quizzes, I got the students to participate in formulating the answers, and guided them towards appreciating how lecture content taught during the class can be applied and related to various settings, and in this case, understanding how the mechanism of a drug is related to the metabolism of a common amino acid such as arginine.

## Assessing the impact and success of contextualised teaching

Assessing the impact and success of contextualised teaching on such a large class takes considerable effort and time, requiring advanced planning as well as detailed surveys and statistical examinations. Rather than undertake this daunting task, I relied on the mandatory student feedback exercise taken towards the end of each module to weigh in on the efficacy of my contextualised teaching methods. A quick comparison of my teaching scores from feedback from the previous two semesters (Semester 1 of AY2008/2009 and AY2009/2010 respectively) suggested that the introduced methods were well-received, as reflected by a rise of 0.692 in the overall teaching score in AY2009/2010, compared to AY2008/2009. A sample of the comments from the students is listed below:

- “Made lectures of a dry subject enjoyable.”
- “Asks questions that stimulate students to think.”
- “He is also able to link the concepts with real life examples.”
- “He makes great effort to link concepts in amino acid, nucleotide and integrated metabolism with real life examples.”
- “Brings across ideas really clearly. Notes are very useful and lecture is fun.”

Although it is certainly difficult to ascertain if my contextualised teaching methods have encouraged active learning amongst the students, the consensus derived from the student feedback indicated that they seemed to have appreciated and enjoyed learning about the subject matter. Taking this positive feedback in stride, I hope to continue developing contextualised teaching methods to encourage active learning by my students.

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# Using Role Play to Enhance Classroom Learning: A Case Study in Real Estate

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## Background and Introduction

Role play is an effective tool to help students learn from real world problems in the classroom. Not only does role play encourage student participation, it simulates the problem solving processes in the real world. Through role play, students undertake a range of activities: identifying and defining problems, collecting and analysing empirical data, proposing workable strategies and options, and evaluating them and making recommendations. In a role play session that uses the same case facts, I divided the class into four sub-groups to encourage competition. Each group (with six to seven students) would then provide the most innovative solutions to differentiate themselves from their peers, and most importantly, convince the management to buy their recommendations.

In RE5009 “Commercial Real Estate Appraisal” and the MBA (with specialisation in Real Estate) courses which I taught in Semester 1 AY2008/2009, I developed a case study on CapitaCommercial Trust (CCT), a listed commercial office Real Estate Investment Trust (REIT) in Singapore, using a hypothetical story supported by facts. I collated financial information from various sources including company reports, newspapers and reports from analysts, and contextualised the information to reflect the liquidity problems that CCT was facing in the depressed markets. Thanks to the support of the Chief Executive Officer of CapitaCommercial Trust Management Limited (CCTML), Ms Lynette Leong, an alumni of the Department of Real Estate, I was also able to gather and incorporate comments from CCT’s senior management into the case study.

## Scenario for the Assignment

The following is a brief summary of the case: the financial turmoil in the US has caused significant liquidity crunch in the capital market. Many public listed REITs face strong resistance in their efforts to raise funds, either equity or debt, to support their growth strategies. CCT, the subject of the case study in the RE5009 module, has not been spared from the financial crisis. I simulated a board meeting scenario, where the board directors and the CEO of CCTML have elaborated on the challenges they face amidst falling stock prices and rising financing costs. An oversupply of office space and decreasing rents in the office market also cause the company’s stocks to tumble. The board has discussed its mid-term growth strategies, which include managing its portfolio of commercial properties, negotiating the renewal of current office leases, refinancing of short-term notes and medium debts, and their overseas investments such as a 30% stake in Quill Capital Trust (QCT) and 7.4% in Malaysia Commercial Development Fund (MCDF). Following Overseas Union Bank (OUB) Centre’s announcement of its extension plans, the CCT board has to make a strategic decision on whether to go ahead with the estimated \$1.5 billion redevelopment of the Market Street Car Park, which has been granted the outline planning permission by the Urban Redevelopment Authority (URA).

Based on the above information, the assignment requires the students to role play Ms Leong, the CEO of CCTML, and a team of senior managers of CCTML assembled to study the effects of a volatile stock market on CCT’s

stock prices, identify priorities for key CCT growth strategies and assess their feasibilities. Students have to justify their recommendations and provide proper execution plans for such strategies, which may include funding/financing structure, the joint-venture parties involved (if any) and the timeline for implementation. Risks and possible impact of the proposed strategies on CCT's stock prices would also be analysed. As the module also covers the pricing of stocks and bonds, students were expected to make use of CCT's financial data and assess the potential impact of proposed strategies on CCT's stock prices using relevant stock pricing models.

Time is money in the business world, and time pressure was included in this exercise by requiring the students to complete the study within one month. To add realism to the whole exercise, I arranged for each sub-group to give a presentation on 7 November 2008 to Ms Leong together with her head of investor relations and communications and head of asset management. She started with a brief update of CCT's stock market and financial performance. Then, students in all four sub-groups took turns to present and defend their recommendations before the CCT representatives.

### Feedback

Ms Leong commended the students' on having done a good job and indicated that she would bring back some of the strategies for further evaluation. What did students learn from the exercise? Many of them felt that the case study helped improve their grasp of the theoretical concepts. Students also learnt from their peers during the class discussions. The following is a summary of feedback received:

- “Definitively, the case study does help to comprehend the concepts taught. While lectures bring a more general and academic view, case studies are the practical sides of it where concepts are applied.”
- “I enjoyed the case study very much. It is very real life and the take-away from doing the assignment is good. On concept-wise, not everything is applicable only

some parts. I suppose it can't be a perfect fit in term of applications but rather having an understanding and thus framing our thought process, which then applies into the assignment.”

- “Yes, it does add realism to what is being taught.”

Another take-away from the exercise is that it helps to remind the students of the uncertainties in a rapidly changing world:

- “I suppose there is a quite a big difference between boardroom role play versus academic content. The former needs to be short and concise, while the latter needs more justification. Perhaps, if the market condition has not changed suddenly, most of what you have lectured could be further illustrated in the case studies rather than the heavy emphasis to solve the immediate issues.”

Lastly, this exercise hopefully could help to build up students' confidence when they face real problems in their future careers. An amateur's prediction is after all not very far off from that of a professional, as reflected by a student's comment in the post-assignment:

- “Libor + 250bp is almost 5%.... close to our estimates.” ■

# Effective Cancer Pharmacology Teaching Through Guided Self-learning and Students' Short Presentations in Small Group Tutorials

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## Introduction

Teaching in small groups affords distinct benefits over the more widely used lecture and one-on-one methods (De Villers, Bresick & Mash, 2003; Jacques, 2003). Through questioning, the exchange of experiences and ideas, the members of the group are able to discuss issues, clarify points and obtain immediate feedback on their doubts and questions (Jacques, 2000; McCrorie, 2006). Through small group tutorials, students are better able to hone their critical thinking and problem solving skills; they also gain substantial interpersonal and communication traits (de Jong et al., 2010). During the tutorials, considerable emphasis is placed on students developing an ability to communicate ideas and on the improvement of their self-confidence and critical analysis of the subject (Mamede, Schmidt & Norman, 2006; Dolmans & Schmidt, 2006; Lohman & Finkelstein, 2000). Small group tutorials also provide opportunities for learning that are difficult to establish in large group settings. They are particularly useful in enabling learners to actively participate in discussions, provide feedback and reflection, and also help students to consolidate their learning, clarify understanding, and explore ideas and concepts (Costa, van Rensburg & Rushton, 2007; Dochy, Segers, Van de Bossche & Gijbels, 2003). Small group events place a greater emphasis on active learning (as opposed to teaching), a specific task or focus, and require the students to interact and actively participate.

Hence, most of the modules offered in NUS involve small group tutorials that promote active involvement by all the participants.

However, it has been observed that quite often, a small group tutorial often translates into a 'mini lecture'. The tutor tends to present all the tutorial solutions to their students most of the time. It is basically a one-way communication between the tutor and the students. Most often and unfortunately, students tend to end up becoming passive listeners with no actual participation during the tutorial. Students hardly prepare for their tutorials and only a few would dominate the discussion. They also want to be given the solutions to problems rather than discuss the issues in depth.

To overcome some of these problems in the cancer pharmacology module I teach, we introduced an innovative method of having student presentations during small group tutorials. Each subgroup, comprising two students, was assigned to prepare a short talk (20-25 minutes) on a relevant topic related to the syllabus and to lead a discussion after their presentation. Our experience and outcome clearly indicates that having student presentations during the tutorial plays a critical role in the all-round education of students, as compared to the more traditional academic scenario of lectures and tutorials. When well-conceived and organised, presentations allow students to read and understand, do in-depth

analysis of a given topic, express themselves in the language of the subject, and they are able to establish closer contact with academic staff than more formal methods permit. Discussions during presentations can also help students develop the more instrumental skills of listening, presenting ideas, persuading and working as part of a team. Most importantly, we find that presentations give students an opportunity to monitor their own learning and thus, they gain a degree of self-direction, independence and self-confidence during the course of the module.

## Methods

The concept of having presentations during small group tutorials was introduced in an undergraduate module LSM4214 “Cancer Pharmacology” which was offered to a medium-sized class of around eighty students for the first time in Semester II AY2009/2010. LSM4214 is considered quite a ‘dry’ subject requiring memorisation of the complicated mechanism

behind the action(s) of different drugs being used for the treatment of cancer. Hence, in order to make this course more interesting and innovative, we tried a novel method that involved dividing the class into four groups of twenty students each. As shown in Table 1, the group of twenty students in the tutorial were divided further into ten subgroups of two students each; each subgroup was assigned to study a particular topic related to the class of drugs/signaling molecular targets/mechanism(s) involved in cancer and to summarise their findings in fifteen slides. In each subgroup, the students can choose to present their selected topic separately for ten minutes or they can do a joint twenty-minute presentation followed by ten minutes of discussion.

The slides and oral presentations were evaluated by all the tutors and each student’s performance was assessed out of a total of 10% of the overall grade (five for slide preparations and another five for the oral presentation). In general,

Table 1. Example of a tutorial class that has been divided into subgroups for their presentations

LSM4212 Tutorial Grouping		
Tutorial Group 1	Student	Tutorial Topic
LSM4214 Tutorial Group 1	Ann Qi Ying	T1. Chemoprevention – myth or fact?
LSM4214 Tutorial Group 1	Chan Hui Hua Elizabeth Sarah	
LSM4214 Tutorial Group 1	Chan Tze Khee	T2. Inflammation and cancer – the intimate relationship
LSM4214 Tutorial Group 1	Chang Guang Qi Joanna	
LSM4214 Tutorial Group 1	Chang Mei Ling	T3. Cancer epigenetics and HDAC inhibitors
LSM4214 Tutorial Group 1	Chang Yee Yan	
LSM4214 Tutorial Group 1	Chew Zhan Hong Benjamin	T4. Targeting growth (cMET/Wnt) signaling
LSM4214 Tutorial Group 1	Chua Hui Wen	
LSM4214 Tutorial Group 1	Chua Shien En	T5. Targeting survival (Akt/PI3K) signaling
LSM4214 Tutorial Group 1	Chung Vin Yee	
LSM4214 Tutorial Group 1	Daphne Wong Pei Wen	T6. Targeting angiogenesis (VEGF/FGF) signaling
LSM4214 Tutorial Group 1	Deng Shuo	
LSM4214 Tutorial Group 1	Devica Apriyani	T7. Cancer invasion and metastasis targets
LSM4214 Tutorial Group 1	Dong Di	
LSM4214 Tutorial Group 1	Edison	T8. The future of cancer gene therapies
LSM4214 Tutorial Group 1	Fadlina Binte Musa	
LSM4214 Tutorial Group 1	Fong Sheng	T9. Cancer biomarkers – diagnosis, prognosis and drug responses
LSM4214 Tutorial Group 1	Goh Hui Min	
LSM4214 Tutorial Group 1	Goh Ping Ping Amy	T10. Genome-guided therapy in cancer medicine
LSM4214 Tutorial Group 1	Guan Shihui Melissa	

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the presentation topics were geared towards providing students with a better understanding of the concepts, such as how scientists discover new drug targets against cancers and how pharmaceutical industries develop and evaluate the candidate drugs from animal models to clinical trials. For example, presentation topic two (T2), as seen in Table 1, was included to make students understand the concept of the dysregulated inflammatory response which plays a pivotal role in the development and progression of cancer. The students presenting on T2 primarily focused on the role of various pro-inflammatory mediators in cancer and provided novel insights on the intricate link between chronic inflammation and cancer which were well-received and appreciated by all the tutors. Similarly, for the presentations on T8 and T10, the students discussed the various pros and cons of gene therapies and novel paradigms in the field of cancer stem cells. Most of the presentations were highly interactive and the slides prepared by the students were of good quality; at the same time, they learnt from each others for the other topics. Overall, it was clear that during the course of the presentations, the students were making a sincere effort to apply the knowledge they gained during the lectures and from reading various research papers in the best possible way.

## Discussion

We observed that there were numerous advantages of introducing the concept of student presentations during small group tutorials. The close contact between tutor and student during such sessions provided tutors with a more effective method of continuous assessment and of monitoring their students' progress rather than solely relying on the traditional method of a formal written final examination. Considerable emphasis was placed on developing the participating students' ability to communicate ideas effectively and to improve their overall self-confidence. Moreover, the presentations allowed for a more comprehensive discussion of the presentation topics assigned and thus enabled the students to understand them more deeply and with greater clarity.

However, we also faced a number of challenges in the implementation of this approach. First, the students were not very forthcoming when it came to preparing slides and making the presentations; they had to be convinced by the tutors to actively participate in the presentations. Second, a number of students felt that the workload for the module had increased greatly due to the introduction of presentations. Third, a few students felt that allocating only 10% of total marks for presentations was quite low and should be increased. Fourth, some students felt that it would be better to conduct the tutorial as a cohort instead of splitting them into four groups so that the groups can work on the slides and present together. However, most of them acknowledged the fact that the presentation topics for the tutorials provided a more in-depth understanding of the treatment therapies for cancer and there was a greater focus on understanding than memorising in this module. Some examples of the feedback can be seen below:

- “I think that the research for the presentation has allowed us to find out more about the different markers in cancer and the links between certain conditions and cancers... Overall, I think the module has enriched me in the knowledge of drugs and treatments available to battle the different types of cancers.”
- “One more thing I really enjoyed is the group presentations, which expose us to the most recent findings in cancer research, and which allows us to gain hands-on experience on research work through searching [for] information and preparing slides for the presentation.”
- “The tutorial presentations have also been really helpful to gain an in-depth understanding of [a] specific topic. That knowledge can be related to the other modules and form the network of information”
- “[The presentations] provided useful feedback and interesting insights for each tutorial topic.”



Figure 1. Members of one of the LSM4214 tutorials.

- “Encourage [*sic*] to ask questions. Comment on each presentation and give suggestions.”
- “[The tutors] gave immediate and useful feedback, and was encouraging.”

Overall, we found that the concept of having presentations during small group tutorials indeed helped to develop our students’ skills in the areas of critical thinking, analysis, mutual cooperation, teamwork and their self-confidence; this approach also promoted intellectual interaction among the students and also between students and tutor. This format also provided us with a great opportunity to learn from the students as they shared an enormous amount of critical and novel information during the course of their presentations.

In conclusion, we believe that by using this approach, we all were able to guide and motivate students to learn a complex module in a simple, conducive and friendly environment. At the same time, it also serves to enrich our knowledge of the subject.

### Acknowledgements

We also want to sincerely thank Dr. Alan Prem Kumar and Dr. Eliana C. Martinez for their help and support to conduct the small group tutorials for LSM4214 students.

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# Application of a Novel Non-analogous Scenario for Introducing Human Immunology

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*Science is much more a way of  
thinking than a body of knowledge.*

— Carl Sagan (1986)

## Introduction

One of the most powerful tools available for the formulation of new scientific theories is the ability to think in abstract terms about observable phenomena, and applying these abstractions to the available empirical data to conceptualise explanations for the phenomena. In my experience, the degree of ‘abstraction’ applied when formulating theories to explain immune phenomena represents a continuum from simply applying knowledge from related scientific disciplines such as anatomy, cell biology or organic chemistry to using information from unrelated fields such as engineering, mathematics and beyond. This is often referred to as a multi-disciplinary approach, but this term is too narrow to fully encapsulate the breadth of influences, many of which are not classically ‘scientific’, that can impact upon the formulation of a new idea or theory. Hence, in this practicum, I expose students in a simple and direct way to this mode of thinking by presenting them with a scenario and set of problems which in superficial terms, have no connections to immunology (MIC2108 “Introduction to Immunology”). This tutorial requires students to draw knowledge and experience from outside the biological sphere. It is delivered as a tutorial exercise where the

class is divided into groups of 5–6 students. They are encouraged to work cooperatively to discuss and provide solutions to the scenario presented.

The background to the tutorial is as follows: towns and cities are often compared to living organisms (e.g. roads and railways are likened to veins and arteries, and parks are referred to as the ‘lungs’ of a city). To introduce human immunology and host defense I extend this metaphor to the immune system by asking the students to design the defences of a medieval village threatened by a company of bandits. The scenario is based on a classic Japanese film *The Seven Samurai* by Akira Kurosawa. Each group of students is provided with an outline of the village on a piece of A3-size paper and asked to sketch their defensive measures. To help the students formulate their own ideas, we ask them to consider a number of key questions that have influenced the formation of defences for towns and cities. Since the students are expecting a lecture/tutorial detailing immune cells, antibodies and so on, they will have to think about unrelated defence systems and how they can be compared to the immune system. This exercise requires a degree of inquiry and creativity from the students. It forces them to consider the immune system in the context of anatomy, cell biology and physiology (i.e. as part of an integrated host defense network). The scenario provided to the students is detailed in Figure 1.

## Conducting this tutorial

This tutorial is optimal for classes of no greater than 30 students (5–6 groups). The session is conducted over 110 minutes. Whilst the students are discussing their ideas during the initial 20 minutes, I move amongst the groups to answer their questions and provide promptings where necessary. At the end of the discussion period, I ask the groups to translate their defence plans from the A3-size papers to the whiteboards

in the front of the class. I ensure that there is enough whiteboard space plus markers for all groups to do this simultaneously. After allowing 10 minutes for this, each group takes turns in describing their defensive measures (a further 10 minutes per group). The group presentations can take up to a total of 50–60 minutes.

I find that by providing the students with a list of considerations and allowing them to articulate their ideas based on their visits to

### The Seven Samurai Tutorial

Inspired by Akira Kurosawa's (1954) *Shichinin no Samurai*

#### Tutorial Exercise

In 15th century Japan, an isolated farming hamlet is threatened by a large company of bandits who have been pillaging the countryside. The hamlet villagers have discovered that the bandits plan to attack them when they have finished harvesting their crops. In desperation, the farmers decide to recruit professional warriors (science students) to help them defend their village. Your task is to plan the village's defenses. You have 20 minutes to complete this task. Please overlay the village plan below with your defensive measures and nominate a representative who will present your ideas for 10 minutes using the whiteboard provided.

Please assume that you have access to extensive building material/workers and consider the following questions:

1. How do you prevent the bandits from coming into the village whilst allowing the villagers access to their fields/crops?
2. How do you prevent the bandits from making a sneak attack?
3. If you establish a town guard, where would you station them in the village?
4. Where are the weak point(s) in your defences and what measures would you take to protect them?

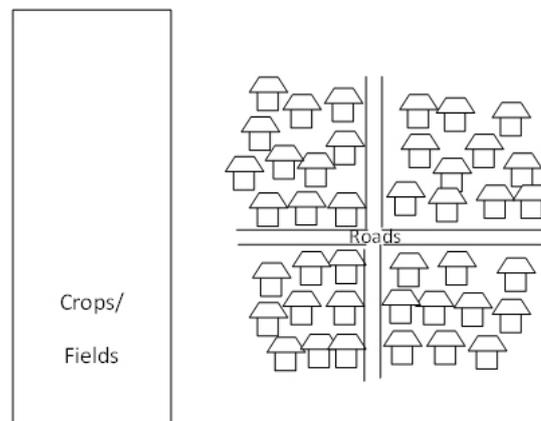


Figure 1. Student's copy of the tutorial exercise.

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castles and viewing war films, they can usually come up with a plan that is in principle similar to the one detailed in Figure 2. This is unsurprising given that the simplest solutions to the questions provided are the ones that have already been widely used by human communities. For instance, the answer to the first question (in Figure 1) is to construct barrier defenses such as moats and walls. Barriers also need doors or gates to allow the villagers access to their fields. The stationing of sentinels and alarm systems that alert the villagers to the presence

of bandits is the obvious answer to the second question. With regards to the positioning of the guard houses (question 3), most groups opt to site them near the gates whilst others place them in a central position near the crossroads in the town centre. For question 4, most groups managed to identify the holes in the barriers (i.e. the doors or gates) as the weak points in the defence as they potentially allow the bandits to bypass the barriers constructed. Most groups would station their strongest defences, such as their guard houses and soldiers, near the gates.

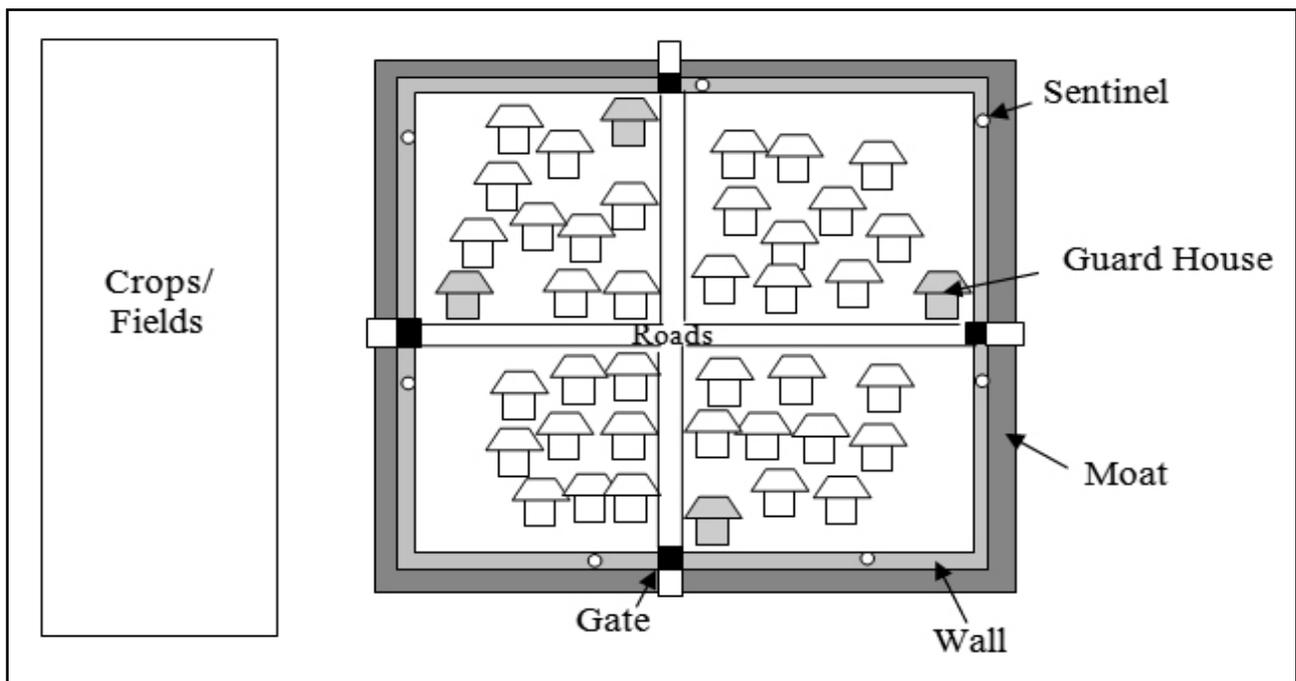


Figure 2. Students' defence plan for the Village

### Linking the village defences to the human immune system

In the final 20 minutes of the tutorial, I conduct a presentation plus discussion on how the defensive mechanisms that we have as human beings are extremely similar to those employed for the village (Table 1). I provide a cross-section of some of my ideas and those raised by the students during these discussions. Our immune system has evolved to protect us from invading pathogens (bandits). Innate immune cells such as dendritic cells and

macrophages make an immediate response to commonly shared microbial molecular patterns (Lipopolysaccharides [LPS], teichoic acid, patterns of sugars) and alert the body to the presence of a threat, like how the sentinels detect the presence of bandits and alert the villagers/guards.

In summary, the many parallels between the village's defences and those of the human immune system suggest that there may be some universal principles guiding the defence of cells, organisms, houses, towns and cities.

Table 1. Parallels between the human immune system and the village's defences

<b>Human Immune System</b>	<b>The Village's Defences</b>
Innate immunity includes chemical (Defensins, Immunoglobulin A) and mechanical barriers (skin and mucus) to entry.	The moat and wall are the first physical barriers that the intruders will encounter.
Innate immune cells such as phagocytes attack, engulf and digest invading pathogens.	The town guard attacks and kills invading bandits.
Lymph nodes are anatomically clustered around mucosal sites (our links to the external environment) where we have persistent pathogen exposure.	The guard houses are placed near town gates which represent the town's link with the outside world.
Inflammation caused by pathogen invasion attracts leukocytes to the infection site, where innate immune responses occur.	The town guard is mobilised to the site when there is a breach in the defences.
Adaptive immunity is the slower, more targeted response to specific antigens which vary from pathogen to pathogen.	After gaining intelligence about the bandits, defences can be adapted to combat-specific aspects of their military approach (e.g. using spikes to target horses and horsemen)
Adaptive immunity includes: <ul style="list-style-type: none"> <li>• antibody</li> <li>• B-cells</li> <li>• inflammatory (macrophage-activating) helper T-cells</li> </ul>	Weapons used in defence include: <ul style="list-style-type: none"> <li>• arrows</li> <li>• archers</li> <li>• army officers</li> </ul>
Haematopoiesis, the differentiation of stem cells into mature leukocytes, occurs in the bone marrow. T cell maturation is completed in the thymus. Bone marrow and thymus are the primary (central) lymphoid organs where our adaptive immune cells develop.	The training camps equip and prepare the town guards and soldiers to defend the village in the event of an intrusion.
Leukocytes re-circulate between lymphoid organs and the blood via the lymphatic vessels, which also collect antigens from the lymph that bathes the tissues.	Guardsmen patrol the villages and inspect its defences.
Immune memory is the faster, more efficient immune response made on repeat contact with an antigen. Memory B- and T-cells can persist for a long time in the body	Once the villagers have learnt the bandit's tactics, their response will be more targeted when they are attacked again.

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## Feedback from students about this tutorial

The majority of students responded positively to the tutorials. The following are some students' feedback on the session:

- “The last immunology session was a very thought provoking and interesting one. It's the first time I attended a tutorial of such format. It really brings out the need for studying out of textbooks...thanks!”
- “...held the tutorial in an interesting way.”
- “Good readings in addition to lecture. Helped in my learning interesting problem based tutorial.”
- “He makes lessons interesting and simplified by using common analogies.”
- “He is patient and listens to all our queries during tutorial.”
- “I enjoyed the tutorial on ‘defending the army’ very much. I can remember the concepts and linking the body's defence mechanisms to that of the army made me understand better.”
- “He makes the tutorial fun and interesting.”
- “He is well prepared for his lessons.”
- “I understand his lessons.”
- “His tutorial is interactive.”
- “Excellent tutorial which I found interesting as it was a different and rather effective way to learn.”
- “He did a very good, fun and interesting tutorial with us. To make us understand the overall about our body immune defence.”
- “Very good tutorial conducted by the tutor. One of best I have ever attended.”
- “Very engaging and interesting tutorial. Good at directing the students and relating the activity to the content of the module. The only tutorial I have enjoyed and feel that it's useful.”

## Conclusions

From a review of the student feedback for the module, it is clear that this format of teaching stimulates their interest in immunology in a way that is different from tutorials conducted using the conventional didactic format. Based on this practicum exercise, it is clear that making our students think in a different (or abstract way) about the subject that I teach will continue to benefit me as a teacher and mentor in the following ways:

1. It allows me to teach my subject in an extremely enjoyable way,
2. It inspires the students to think *creatively* about immunology, and
3. It ensures that I have a student cohort that remains engaged and interested in my subject. I would strongly recommend this tutorial format for other disciplines. ■

# Embedding Graduate Attributes Into Four Discipline Areas Using Scenario-based Learning

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## Introduction

An expanding student population, widening participation and the subsequent pressure on work placement opportunities where students, as would-be professionals, can articulate and present their experience has resulted in a re-evaluation of what is possible in embedding graduate attributes while studying at university. Added to this pressure is the Australian Government's insistence on institutions helping students bridge perceived gaps between subject theory and professional practice.

Scenario-based learning (SBL), based on situated learning theory incorporating contextual knowledge, may provide one approach for getting students nearer to the realities of their intended workplace through the construction and analyses of authentic learning experiences and the conscious embedding of graduate attributes—as the building bricks for employability. SBL is not used to replace work-based experiences but rather to supplement them.

This brief article summarises the journey made so far by five colleagues from four discipline areas and Teaching and Learning Development at James Cook University (JCU), whose collective aim is to embed graduate attributes into their four curriculum areas using scenario-based learning.

## The project and its purpose(s)

The working title of the project is “Embedding graduate attributes into four discipline areas using scenario-based learning”. Its purposes were fourfold: The first was to identify our team members' understanding of SBL and the extent

to which scenario-based learning was already being used in their professionally-oriented courses. Basically, we needed to know where we were all ‘at’ in our understanding of SBL before we could enhance SBL offerings in JCU as a team.

The second purpose was to build on the team's current knowledge of SBL and the embedding of graduate attributes through a shared process of peer review. Collectively, the team has a wealth of teaching and learning experience at all university levels so that respective peer reviews were rightly anticipated to be rich and productive.

The third purpose was to generate SBL resource materials for using scenario-based learning to embed graduate attributes, in particular, the creation of filmed exemplars of SBL delivery targeting specific graduate attributes and the construction of a dedicated SBL website (hosting a blog, the film, resources and useful links).

The final purpose was to disseminate the processes and outcomes of the project.

## The team

The team consisted of five members: Dr Ed Errington (Teaching and Learning Development, team leader and SBL specialist); Dr Marie Caltabiano (Psychology), Dr Reesa Sorin (Teacher Education); Amanda Nickson (Social Work & Community Welfare); and, Lynette Ireland (Australian Indigenous Studies). The team had worked together successfully earlier in 2010 where the project leader had edited an anthology of SBL praxis to which team members had contributed.

## Methodology

The project comprises four stages:

### *Stage 1: Reconnoitring the territory*

During the first stage of the project, team members examined their own ‘territory’ first: “What was our team’s understanding of scenario-based learning, and what role did we see for SBL in promoting graduate attributes?” Strategic conversations (Van der Heijden, 2002, p.3) were used to ‘unpack’ individual team member’s meanings of significant terms. In particular, terms such as

**a. Scenario-based learning.** The discussions provided a rich opportunity for team members from different disciplines to probe and share their understanding of SBL, noting that the term ‘scenario-based learning’ attracts various labels in the literature, such as ‘critical incidents’ (Tripp, 1993); ‘scripted role-play’ (Brislin & Yoshida, 1994), ‘triggers’ (Wilkie, 2000) or by the catch-all term ‘simulation’ (attributed to numerous authors).

Team members encouraged each other to note why, where and how scenario-based learning was being used within their own discipline area. Common to our deliberations was an agreement that SBL (which is usually delivered as a set of circumstances that students had to contend with) was a learning design underpinned by situated cognition (Lave & Wenger, 1991; McLellan, 1995) which is used by some educators to contextualise learning. The common purpose of SBL, regardless of discipline area, was the siting of learning within (simulated) professional settings, incorporating forms of technical and informal language, etiquette, ethical positioning, roles and responsibilities, challenges, tasks, problems, relationships, norms and values located within the profession, (Errington, 2009, p.585).

With SBL, students can explore professional worlds within the safety of the scenario simulation intent on dealing “with the repercussions of the precipitating and related events efficiently and effectively”,

(Naidu, 2010, p.5). The journey towards task completion, offered with each scenario, will ideally engage students in processes of problem-solving/setting, decision-making, acts of creativity, critical analysis, evaluation, and reflectivity—factors compatible with employability skills valued by employers, (Universities UK, 2009).

**b. Graduate attributes.** In a similar vein, team members discussed the embedding of graduate attributes. Graduate attributes are the qualities, skills and level of understanding a university community agrees its students should develop during their time with the institution. These attributes include (but go beyond) the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. Examples of graduate attributes include teamwork, critical thinking, ethical understanding, an ability to communicate clearly and so on.

We asked ourselves: “How, and in what ways might SBL enrich the delivery of graduate attributes?” Through our strategic conversations, important conceptual and practical links were made between the construction, delivery and evaluation of SBL and the embedding of desirable graduate attributes in specified contexts.

### *Stage 2: Enhancing current offerings*

Following agreement on the potential value of SBL to facilitate graduate attributes, the team engaged in processes of the peer review of teaching. We wanted to know how we were using scenario-based learning *now* to achieve learning outcomes (intended and actual), and how we might enhance/add offerings to optimise chosen graduate attributes.

**a.** Each team member was observed by other members on the basis of negotiated observations (what was to be observed), specific feedback (that relate to the scenario and the embedding of attributes), and proffered advice (observations that could be accepted/rejected/built upon by the observed teaching member).

- b. Team members peer reviewed other members at least twice, providing valuable feedback to each observed teacher. It was important that team members were co-observers and co-workers in the process. In this way, all members had a sense of classroom/project ownership.
- c. Individual observations also generated conversations on current and potential scenario offerings with respect to the choice of scenario approach, scenario construction, single/accumulative scenarios and the 'goodness of fit' between scenario options and desired attributes.

### *Stage 3: Generating support materials/identifying SBL champions*

By design, the creation of scenario-based learning support materials has been ongoing. The intention is to create and update SBL exemplars periodically. Support materials will consist of:

- a. Filmed exemplars of scenario-based learning (soon to be mounted on the JCU website). Each film will provide one or more scenario examples accompanied by an explanatory teacher narrative and student reflections on scenario experiences.
- b. Added to the above, an SBL website supporting other resource materials has been established and includes links to visual resources, Powerpoint presentations, academic publications, links to similar (practical) teaching and learning sites, dialogue links to institutions/centres advancing SBL, and a weblog to encourage communication between/among SBL practitioners.

### *Stage 4: Disseminating the project and engaging staff within/across disciplines in SBL*

The project is to be disseminated via internal and external means.

## **Results/Discussion**

### *Stage 1: Reconnoitring the territory*

Where the strategic conversations took us:

- The team reached an understanding (not necessarily consensual) regarding the nature and purposes of scenario-based learning in advancing graduate attributes within each of the disciplines (teacher education, psychology, social and community welfare, as well as Indigenous Australian Studies). This understanding informs the team's SBL praxis.
- Shared understandings have led to continuing team support for work within individual teaching contexts, influencing the variety of scenario approaches used. There is a shared perception of the importance of graduate attributes in contributing to notions of 'professional identity'. All agree that scenario-based learning is an ideal vehicle for delivering real world, authentic, relevant experiences, where learning can be fun.
- There is an appreciation of team support to fulfil individual learning objectives, manifested via each team member's timely input and the valuing of each other's experience. Support by those working in other disciplines via the welcoming of other perspectives was also seen as a plus.

### *Stage 2: Enhancing current offerings*

Following the peer review, team members felt the following gains had been made:

- The value of having someone give feedback on aspects of teaching and learning management processes, with particular emphases placed on the construction, delivery, evaluation and reflections on SBL.
- Observing fellow team members created chances for observers in the team to link their personal and professional

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understandings with those being observed as well as opportunities to see other ways of approaching common challenges (e.g. organising learners to optimise learning).

- The value of feedback/input by team members—not simply in terms of what has happened, but in respect of what might happen (next).
- Four common kinds of scenarios were revealed in the peer review process:
  - **Skills-based scenarios** used to enable students to demonstrate acquired knowledge, abilities and skills;
  - **Problem-based scenarios** used to explore more demanding professionally-oriented circumstances driven by problems associated with challenging realistic circumstances, including uncertainty and ambiguity;
  - **Issues-based scenarios** invited students to investigate relevant issues, assume roles to discover vested interests, and to debate and justify positions on issues supported by evidence;
  - **Speculative scenarios** invited students to hone acquired skills, pursue/identify problems, understand issues/positioning, and deliberate on possible futures and factual/ alternative histories.

### *Stage 3: Generating support materials/identifying SBL champions*

The team members' filmed exemplars were released around the end of February 2011. The dedicated website is waiting on the completion of the films.

### *Stage 4: Disseminating the project and engaging staff within/across disciplines in SBL*

'Domestic' dissemination of the project began last year with two presentations for JCU colleagues on the progress of the project. Teaching and Learning Development will afford opportunities to disseminate findings at JCU in 2011-2012. International dissemination of SBL and graduate employability began with live presentations at the University of Hull, UK (2010), the University of Lincoln (2010) and proposed podcasts for SCEPTRE at the University of Surrey (2011).

### **Conclusion**

This is an ongoing project where the data collected from team members and their respective students (aspiring professionals) will continue throughout 2011. The first stage of the project was used to define and identify aspects of scenario-based learning that could be engaged to embed graduate attributes within four discipline areas via a clear and articulate understanding of the theoretical, conceptual and practical bases of scenario-based learning.

Peer review processes affirmed the view that practical endeavours are likely to prove more successful when specific kinds of scenarios are aligned with specific graduate attributes, and the role of the educator/facilitator in a scenario-based learning process is made explicit. The peer review process also revealed that the success of SBL would invariably rest on educators and students knowing *why* SBL is used (the rationale), knowing *how* to deploy it (deciding SBL is appropriate), knowing *which* options will facilitate desired processes/outcomes, knowing *when* and *where* SBL needs to be delivered within the curriculum (timeliness and placement), and knowing *that it can* make a difference to the lives of students in pursuit of professional meaning and identity.

# EMBEDDING GRADUATE ATTRIBUTES INTO FOUR DISCIPLINE AREAS USING SCENARIO-BASED LEARNING

..... continued from pg 18

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