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CURRICULUM FOR COLLABORATIVE LEARNING IN SUSTAINABILITY AT QUT

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ABSTRACT:

Academic staff from four disciplines formed an interdisciplinary team to develop a curriculum for collaborative learning across three schools. The curriculum focused on the ability of students to translate the principles of sustainability into practical design solutions for the Gardens Point campus of QUT. The teaching and learning opportunities associated with the project encouraged students to investigate the sustainability issues within a precinct of the campus, produce a concept plan to improve the site and study a particular issue in further detail to inform detailed proposals for QUT. Most students said they had a positive experience in working with colleagues and staff from other disciplines and further joint projects should be developed to involve students from allied disciplines. This paper describes how the curriculum for collaborative learning in sustainability was designed and the lessons learned from its implementation.

KEYWORDS:

Sustainable campus; collaborative curriculum; interdisciplinary teaching.

INTRODUCTION

Although the area of cross-disciplinary collaborative *research* has received considerable encouragement in higher education policy in Australia, comparatively little attention has been given to cross-disciplinary collaborative *teaching* within universities. Demand for courses that prepare students for work in cross-disciplinary teams and sustainable development is expected to increase with the growth in employment opportunities related to multi-disciplinary land development projects.

In April 1998, the West Review of Higher Education Financing and Policy was released by the Commonwealth Department of Employment, Education, Training and

Youth Affairs. It recommended that student-centred funding be used to encourage universities to become more responsive to students' choices and preferences as they, their parents and their employers develop greater expectations of courses at universities. At QUT, the Faculty of Built Environment and Engineering responded to this challenge by incorporating in its Five Year Strategic Plan 1999 - 2003 the objective to optimise students' learning experiences so that its graduates become lifelong learners and highly employable. As one strategy to meet this objective, the Faculty offered Teaching and Learning Grants to academic staff to develop new opportunities for cross-disciplinary collaboration in addressing sustainability issues in the built environment.

The information presented in this paper describes a successful interdisciplinary collaboration project involving staff and students from three schools and disciplines. A Faculty Teaching and Learning Grant allowed staff from landscape architecture, environmental engineering, planning and architecture to develop a common curriculum for three units that focused on campus sustainability issues. The three units, PSB 104 *Elective for second year landscape architects*, PSB 105 *Elective for second year urban & regional planners* and CEB 471 *Environmental Design Project for third year environmental engineers*, were chosen as having the flexibility to develop a common core curriculum for cross-disciplinary teams of students. Each unit focused on the translation of the principles of sustainability into practical design solutions at the Gardens Point campus of QUT. The details of the project are summarised and discussed in the following sections.

AIM AND OBJECTIVES

The major aim of the core curriculum was to foster an appreciation of sustainability concepts, while recognising the practical difficulties of applying these concepts to a site at the Gardens Point campus of QUT. The common teaching and learning objectives for the three disciplines were:

- to identify, analyse, and resolve sustainability issues which were vital for the survival and development of university campuses,
- to work with allied professions with diverse expertise and to integrate knowledge and skills to achieve a common objective; and
- to develop and use problem-solving techniques to respond to a range of multi-faceted issues and problems.

The collaborative project also offered an opportunity to evaluate new teaching and learning approaches that involved cross-disciplinary communication, teamwork and practical exercises. The collection of new resources for future classes and the development of a web site to assist student learning were also components of the curriculum.

PROJECT BRIEF AND UNIT OUTLINE

A hypothetical project brief was developed for the project by the authors, based on the controversial footbridge proposal linking QUT Gardens Point and Southbank Parklands in central Brisbane. The project concentrated on the 'back door' to the QUT campus that presented a neglected collection of buildings, open space, road access,

vehicle parking, service facilities, and inaccessible areas. The project brief aimed to encourage students to become familiar with sustainability issues relevant to a university campus, develop a cross-disciplinary concept plan for redevelopment of the study site and focus on a specific issue for detailed investigation. A studio approach was taken to develop the concept plans, a familiar learning environment for the landscape architects, planners and environmental engineers. Finally cross-disciplinary teams worked together to produce creative works for an exhibition of student work for campus users.

After the development of concept plans, time was allocated for the environmental engineers to work with the planners on detailed studies of transport, technology and building issues in the studio and the landscape architects on plant-water interrelationships in the 'outdoor laboratory'. The 'outdoor laboratory' was an under-utilised outdoor space, at the base of the engineering building that had access to the hydraulics laboratory for experimentation. Both learning environments provided opportunities for 'hands-on' learning experiences for students including growing plant material using hydroponic systems fed with synthetic grey water, testing water quality, surveying campus users on modes of transport and use of campus facilities. This provided a new approach to learning for some students unfamiliar with this practical approach to learning.

Following extensive discussions between the authors, a joint unit outline was produced that supported the teaching and learning objectives of the three disciplines. The program focused on three critical tasks:

- providing support lectures for the collaborative group work,
- studio time for students to work in their respective groups, and
- completing practical tasks each week in support of the students' written work.

The final unit outline comprised lectures, workshops and practical sessions as presented in Table 1. The latter varied depending on the detailed studies undertaken by each group and the practical requirements of the week.

WEB PAGE DESIGN

Using funds from the Faculty Teaching & Learning Grant, a web site was designed to assist staff and students in cross-disciplinary communication and collaboration. There were six key areas in the web site design. These included a collection of digital and paper-based resources available for use by students and a compilation of lecture notes, staff feedback and points for the students to note. The web site also included an electronic journal for group members to share their findings, a discussion forum for class discussions, sites for submission of student work and an area for evaluation of the unit outcomes.

GROUP AND INDIVIDUAL STUDENT ASSESSMENT

Despite the problem of the three units having different credit point values, 12, 8 and 6, it was possible to assess student learning based on both joint group and individual work. The assessment was divided into four components. These were:

- the collaborative group work involved in the concept plans;
- individual written reports on the detailed collaborative studies;
- group contributions to the public exhibition; and
- individual contributions to the web site and group discussions.

Table 1 Joint Unit Outline

Week	Lecture	Studio	Laboratory
1	Introduction to Unit	Introduction to Group Work and Project Objectives	Introduction to the Study Site and Discussion of Issues.
2	Joint Lecture: *Sustainability and Agenda 21*	Collaborative Group Work on Campus-Based Issues	Introduction to Detailed Project Work
3	Joint Lecture: *Valuing the Environment*	Collaborative Group Work on Site Analysis, Opportunities & Constraints	Detailed Project Work on Site Study & System Design
4	Joint Lecture: *Plant Growth & Sustainable Water Cycle*	Collaborative Group Work on Concept Plan	Detailed Project Work & Introduction to Web Site
5	**JOINT GROUP PRESENTATIONS**		
6	Introduction to Detailed Study	Introduction to Group Work on Detailed Study	Detailed Project Set Up
7	Joint Lecture: *Sustainable Building Technology*	Group Work on Specific Site Issues	Monitoring of Detailed Project by Students
8	Joint Lecture: *Environmental Health*	Group Work on Research for Detailed Study	Monitoring of Detailed Project by Students
9	Joint Lecture: *Plants & Urban Spaces*	Group Work on Research for Detailed Study	Monitoring of Detailed Project by Students
10	No formal class session (Engineers: project week)		Monitoring of Detailed Project by Students
	SEMESTER BREAK		
11	Discussion of Collaborative Group Work	Group Work on Detailed Study & Action Plans	Detailed Project Work & Sharing of Results
12	Conclusion and Review	Group Work on Detailed Study & Finalise Action Plans	Finalise Detailed Project Work
13	**PUBLIC EXHIBITION OF STUDENT WORK**		

After forming mixed groups of environmental engineers, landscape architects and planners, each group of students was asked to develop a problem definition statement that concisely expressed their preliminary understanding of the problems associated with the study site at QUT. This assisted in focusing the students on the general issues of concern within a short timeframe. These statements were posted on the web site for future reference and the tasks of analysing, evaluating and planning new uses for the campus spaces based on sustainability principles began. In week 5, each group gave a short presentation on their concept plan for the southern precinct of QUT campus. Each group was assessed on the content of their plan relating to sustainability principles, the feasibility of their options and the ability of the group to communicate the plan effectively.

Following the presentations, students again formed groups but this time they comprised landscape architects/environmental engineers and planners/environmental engineers. The first group focused on the growing of plant material in synthetic grey water to inform the redesign of one of the buildings within the precinct. The second focused on other issues such future needs in higher education and the role of the university and technology, alternative transport strategies to private vehicles, the influence of technology on campus life and intelligent buildings. Each approach was determined by discipline-specific objectives for the students' detailed studies. Students were asked to submit an individual written report that detailed their group's findings and their own conclusions. Each unit coordinator assessed their students' work based on the effective use of a literature review, analysis of results, application of sustainability principles and the standard of written communication.

In week 13, each group was encouraged to think creatively and construct a display of their work for public exhibition. The exhibition was designed to promote the concept of ecologically sustainable development to campus users at QUT. Many of the groups incorporated their displays of plant material grown in recycling synthetic grey water alongside poster, object and/or computer displays. Each group display was assessed jointly by the authors on its application of sustainability principles, problem solving ability and cohesive communication of a message.

Finally, individual contributions to the web site and class discussions were recorded and included as a participation mark for each person. Peer assessment was also used to confirm or refute the perceptions of staff regarding individual contributions to group work. Where all group members carried an equal workload, assessment was equally given to all members of the group.

RESPONSES FROM STUDENTS

Upon completion of the unit, the students were asked to evaluate the project. The survey responses presented in Table 2 indicate that most of them enjoyed working in cross-disciplinary teams and felt that lecturers should continue to develop joint projects involving students from various disciplines.

The response to working within cross-disciplinary teams indicated that the most rewarding aspect was the opportunity to negotiate, communicate and getting to know colleagues better. Students from the three disciplines believed they had to rely more on themselves than on the lecturers to translate broad objectives of sustainable development into practical recommendations and appropriate design solutions.

Only a minority of the group found working with the web site useful for sharing information and communicating colleagues. However, more students said that with continued development, the web site could become an effective way of supporting learning activities.

BENEFITS AND CHALLENGES OF A COLLABORATIVE CURRICULUM

The major benefit of this project-based approach to teaching and learning in sustainability was the opportunity for students to gain an appreciation of the strengths of other disciplines in working together to formulate solutions related to complex

Table 2 Combined Student Responses from Three Disciplines

QUESTION	RESPONSE (*n = 27*)*					
1. Overall, what did you think about working within a team of planning, landscape architecture & engineering students?	VB 3%	B 3%	N 8%	G 67%	GE 19%	
2. It is a good idea for the lecturers involved to continue to develop joint projects and involve students from various disciplines.	SD 6%	D 19%	N 19%	A 56%	SA 19%	
3. With continued development, the site on the Internet can become an effective way of supporting the learning activities in these joint units.		D 11%	N 42%	A 36%	SA 11%	
4. The project site within the Selby Collection on the Internet was useful for sharing information and communicating with colleagues.	SD 6%	D 19%	N 44%	A 14%	SA 14%	
5. The most difficult aspect of working within my team was:	A	B	C	D	E	F
A. organising group work between lectures	78%					
B. depending on team members to do their part of the work		39%				
C. dealing with difficult team members			8%			
D. not feeling part of the team				0%		
E. poor communication between students from the three disciplines					8%	
F. other						6%
6. The most rewarding aspect of working within my team was:	A	B	C	D	E	F
A. sharing responsibilities with others	22%					
B. opportunity to negotiate and communicate		50%				
C. getting to know colleagues better			42%			
D. having support from my team mates				17%		
E. learning from my team mates					36%	
F. other						11%
7. Which of the following is correct:	A	B	C	D	E	
A. This project required me to depend on myself and my team more than on the lectures and lecturers.	53%					
B. Without the exact information provided by the lecturers, I would not have known how to complete the project.		25%				
C. This project helped me develop a working understanding of the principles of sustainable development			36%			
D. Participating in this project helped me to translate broad concepts into applied criteria.				25%		
E. I have learned some things about working within a multi-disciplinary team environment.					44%	

* VB = very bad, B = bad, N = neutral, G = good, GE = great experience; SD = strongly disagree, D = disagree, N = neutral, A = agree, SA = strongly agree.

issues. Many students commented to staff that they enjoyed the recognition of their particular skills from their colleagues in other disciplines. They developed a wider network of future contacts among their colleagues and the academic staff. The students that acquired a positive cross-disciplinary learning experience during the project may go on to form productive partnerships within future multi-disciplinary teams.

Learning the principles of sustainability also required a view of the problem from multiple perspectives and again emphasised the need for team members to work collaboratively to achieve a common goal. The abilities to communicate, negotiate, compromise and learn from others were characteristics of the group work that students recognised as important in producing the final outcomes at each stage of theproject. These skills in university graduates are becoming highly prized by employers and should be made explicit in the curriculum

For staff, the major benefit of the collaborative project-based curriculum was the sharing of the teaching load. Lectures were divided between the authors, group work was informed by a number of staff and student work was thoroughly assessed. Stronger bonds were formed between schools and follow-on projects have been planned. Collaborative *teaching* encourages improvements and innovations in teaching just as it does in collaborative *research*.

Challenges for the staff in making the project work included major adjustments in class sizes, timetabling difficulties, an uneven mix of students from each discipline, differences in unit credit points and the time needed for communication and collaboration. All these issues were addressed but arguably the most significant challenge for each member of staff was the change in their expectations of their own students in each discipline. The amount and application of theoretical concepts covered by each discipline was substantially reduced due to the time required for student collaboration. This aspect of collaborative teaching can conflict with the expected progress of students working in their disciplines alone and so a balance between units within a course should be considered.

CONCLUSION

This teaching and learning project demonstrated how the collective efforts of committed staff and enthusiastic students produced a workable curriculum for collaborative learning in sustainability at QUT. It successfully brought together staff from three schools and four disciplines: architecture, environmental engineering, landscape architecture and planning. It aimed to foster an appreciation of the complexity of sustainability concepts and develop some practical approaches to applying these concepts to a university campus. It was an ambitious project that served to produce a number of outputs from each student team such as a problem definition statement, a concept plan for the precinct, a detailed study and exhibition display. In working collaboratively with other disciplines, students gained a far broader learning experience with opportunities for developing skills in teamwork, problem solving, communication and technological literacy.

The responses from students were generally positive with recommendations for staff to continue to work towards cross-disciplinary learning opportunities and better

electronic support for learning. The major benefit of the project for students was the recognition of the potential contribution of their discipline to a multi-disciplinary team. They developed abilities to communicate, negotiate, compromise and learn from others in allied disciplines when faced with a complex problem to solve.

The major benefit for staff was the sharing of the teaching load. As class sizes continue to increase in universities, this may become a significant incentive for staff to develop interdisciplinary curriculum. Staff faced a number of challenges in implementing the project but the most noteworthy was the change in staff expectations of their own students in each discipline. There may be a trade-off that must be recognised between the benefits of collaborative learning and the coverage of discipline-based content.

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