

## **A multidisciplinary education framework that enables people from different disciplines to work together with community-based organisations on real-world projects**

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**ABSTRACT:** In this article, the authors review research relating to multidisciplinary education, provide a commentary on current research, and describe a collaborative education programme developed by the Faculty of Design, Architecture and Building, the Faculty of Engineering and UTS Shopfront at the University of Technology, Sydney in Sydney, Australia. The authors discuss theoretical approaches, methodology and mechanisms for evaluation and improvement. It is hoped that this article will be of interest to researchers and professionals who have interests in workplace learning and multidisciplinary education research.

### INTRODUCTION

The theoretical framework presented here is twofold. Firstly, it is a philosophy of *learning through experience*, where learners develop generic and technical professional skills while working together in multidisciplinary teams on community-based projects. Secondly, it is the philosophy of *scholarship of engagement*, where two-way interaction occurs between the university and the community – both work together in a manner that mutually benefits students, the university and the community.

The underpinnings of the first of these philosophies stem from work done by Mezirow, Rogers, Kolb, Dewey and Vygotsky [1-4]. Dewey held that education, in order to accomplish objectives both for the individual learner and for society, must be based upon experience. He wrote that although *all genuine education comes about through experience ... experience and education cannot be directly equated to each other* [4]. An appreciation of the relationship between learning and experience has frequently taken a significant role in the formation of programmes designed to develop professional expertise, and is particularly important for the Faculty of Design, Architecture and Building, the Faculty of Engineering, and UTS Shopfront at the University of Technology, Sydney in Sydney, Australia (UTS Shopfront is a University-wide non-profit programme that provides an essential component of the framework by which community groups link to, and interact with, students and staff).

The framework is also underpinned by the philosophy of *scholarship of engagement*. Several significant and influential schools of thought embody the central concept of scholarship of engagement, but refer to the concept using different terminology, such as *service scholarship*, *professional service* and *outreach*. It arises from a recognition that work of the university should relate to the world beyond the campus. This

approach is exemplified by Boyer's observation that if universities cannot help students to better understand the interdependent nature of the world, *each new generation's capacity to live responsibly will be dangerously diminished* [5]. A related philosophy of integrated learning and community service is that of *service-learning*, where, as Kendall said, *both the server and those served teach, and both learn*, and where there is *a sense of mutual responsibility and respect between individuals in the service-learning exchange* [6]. Jacoby describes the concept as students engaging in activities designed to promote students learning and development while addressing human and community needs [7].

With these two underlying philosophies in mind, the authors are particularly interested in the development of learning activities that are focused on students, a principle that is affirmed by Biggs, who held that educational objectives should be concerned with students' learning activities, not teachers' teaching activities [8]. Such learning outcomes are expressed by statements such as: *as a result of this project I will be able to ...*, as opposed to *in doing this project I will cover ...* Learning outcomes of this type are intended to be realistic and achievable, and might include general objectives such as:

- Work together on community-based projects in multidisciplinary teams;
- Develop skills and competences relevant to professional practice and research;
- Develop greater awareness of relevant research and gain experience in discovering their own resources;
- Develop a greater awareness of multicultural, gender, indigenous and other diverse perspectives;
- Engage with community groups regarding scope, requirements and design;
- Perform work that relates to the world beyond the campus;
- Engage in a manner that is mutually beneficial.

## COLLABORATIVE STRUCTURE

A collaboration between the Faculty of Design, Architecture and Building, the Faculty of Engineering, and UTS Shopfront has led to the development of a structure whereby students, community groups and staff participate in activities that are aligned with the principles of learning through experience and scholarship of engagement. Students from each Faculty jointly form multidisciplinary project teams that enable cross-disciplinary engagement and provide mutual benefits for the students and community groups involved. The collaborative nature of the joint-Faculty teams is intended to encourage the development of multidisciplinary competences in a context beyond that which could be achieved by either discipline in isolation.

The programme employed the following strategies for achieving the broad philosophical aims (being learning through experience and scholarship of engagement):

- Specific community projects are linked to multidisciplinary groups of four to five students, together with staff from each Faculty;
- The focus of each project and the learning activities encourages students to develop greater awareness of current best-practice and relevant research, and to gain experience in discovering their own resources;
- The assessment tasks are structured in a way that encourages students to develop professionally-relevant generic skills and technical competencies – for assessment, the programme adopts an approach advocated by Ramsden: assessment tasks should focus first on learning, then on encouraging effort, and lastly on grading [9];
- A collaborative environment is established and supported where students, community groups and staff engage together in scholarly activities.

The students from the Faculty of Design, Architecture and Building are primarily drawn from Visual Communications, whereas the Faculty of Engineering students are primarily final year research-project students. Early in the process, expectations are negotiated with students, a time-plan is discussed, and engineering students are required to produce a detailed proposal of what is to be achieved and how. Members of each community group act as the liaison for student contact, provide ongoing feedback and direction, attend presentations and evaluate the outcomes relating to each project.

## MECHANISM FOR EVALUATION

There exist many approaches for evaluating programmes such as this. Previous research that was concerned with the impact of service-learning on critical thinking, personal and interpersonal development, engagement, curiosity and reflective practice includes that of Astin and Sax, and Eyler and Giles [10][11].

One approach is to longitudinally track how people's perceptions of their abilities change with time. This approach can be relatively resource intensive, as it requires students to be re-tested at different stages of their education. Notwithstanding, assuming that the testing instrument has an acceptable level of test-retest reliability, the approach allows changes in perceptions to be tracked. However, educational programmes employing this approach are relatively rare, partly

because it is often considerably more difficult to locate the same respondents on two or more occasions than it is to administer a test to respondents on a single occasion. A promising cross-sectional approach to studying students' perceptions about the importance of various graduate attributes at different stages of their course has been attempted within the Faculty of Engineering, but the method is yet to be validated [12].

The authors' review of the literature suggests that it might be best to evaluate such programmes using information from multiple sources; in this case, data was included from face-to-face sessions with students that occurred before, during and at the conclusion of each project. Part of the evaluation of the programme relies on information obtained through written self-reporting. The authors do, however, take into account previously documented limitations of this approach. For example, scores on self reporting when using measuring instruments, such as the Approaches to Studying Inventory, vary with age [13]. Older respondents tend to score more highly on items that relate to deep learning, whereas younger respondents tend to score more highly on items that relate to surface learning [14]. Others have also raised questions concerning the validity of self-reporting – Ross and Conway describe a study where students reported that a course that they had attended was beneficial to them, even after it was demonstrated in a debriefing that their academic performance was no better than students who had not taken the course [15].

In evaluating the programme, the authors engaged in activities informed by:

- Each of the authors' respective roles, experiences, values and beliefs;
- The philosophy of the programme;
- Research in the field of education;
- Professional practice in each of their respective disciplines.

In seeking to discover whether the methods are appropriate to the goals, the authors looked at the programme as a whole, and then each sub-task to assess the extent to which each appears to be aligned with one or both of the two broad aims.

The authors also sought to discover whether the programme facilitates deep learning, as opposed to surface learning. Surface learning is where students learn isolated facts, and treat items independently of each other and what the task is about. Deep learning *requires a sound foundation of relevant prior knowledge, so students needing to know will naturally try to learn the details, as well as making sure they understand* [8].

Some of the considerations for evaluating the programme included the following:

- Feedback surveys are completed by students;
- *Discussion board* communications are reviewed by staff and issues relevant to the programme are noted;
- Most students provide group presentations that describe the development stages of their thought processes and how the design decisions were made, and students show that they have searched for examples of current best practice for the community group's sector; engineering students write a literature review – examples of work that appear to indicate objectives being achieved or missed (eg surface learning as opposed to deep learning) are noted by staff during assessment;

- The students' design is to reflect their awareness of multicultural, gender, indigenous and other diverse perspectives, and the extent to which this appears to have been achieved is noted by staff during the presentations; engineering students' awareness of these perspectives is discussed during face-to-face sessions with staff and noted;
- Staff and students speak about the learning outcomes with an emphasis on the context of professional development; students provide feedback about the workings of their groups during these face-to-face sessions with staff and issues that relate to the evaluation of the programme are noted;
- UTS Shopfront staff maintain regular communication with community groups throughout the life of the project; e-mails and other aspects of the communication are reviewed and issues relevant to the evaluation of the programme are noted;
- Members of the community groups attend the design presentations and provide feedback, which is noted; some members of community groups also (voluntarily) provide feedback by e-mail, which is then collated.

Another central question is the extent to which the programme contributes to students' professional formation, especially with respect to the ability to relate theory and methodology to professional practice. Even though it seems likely that grounding the programme in the principles of learning through experience and the scholarship of engagement is *a good thing to do*, the authors genuinely question the programme's alignment with these principles, and try to understand the impact of the programme on all who are involved. Attempting to evaluate the learning outcomes of non-classroom activities is an important issue for professions where competence is developed through both classroom activities and internships – professions such as architecture, design, education, engineering, law, nursing, psychology and social work.

The authors are mindful of recent research aimed at furthering knowledge about non-classroom learning, such as Rowley, Smith, Falconer and Pettigrew, and Powell, Mayson and de Lange [16-19]. The authors are also informed by their own previous efforts directed towards evaluating educational issues relating to non-classroom remote laboratories and methods for evaluating educational outcomes relating to online blended groups [20-22].

A noteworthy aspect arising from prior research is the proportion of learning that professionals attribute to sources other than the classroom. For example, an analysis by Baker of a study by Garth and Martin indicated that law graduates reported law school as being the primary source of only 25% of their total learning [23][24]. Canale, Cates and Duwart described a study of Northeastern University students who attributed about 44% of their development to the classroom,

46% to internships and 11% to other sources [25]. The findings for UTS engineering students are similar (see Table 1). Such results suggest that the classroom is not as significant a source of learning as might be expected.

Another consideration is the possibility that international students are less (or more) prone to response bias than other groups. However, prior research suggests that this is not likely to be a significant factor. For example, Grim and Church indicated that response bias was stable across cultures [26]. A related issue concerns whether the participants interpret written statements as intended – face-to-face meetings are thus a primary source of the information that have been used to evaluate the programme.

One of the challenges for educators who seek to evaluate the impact of non-classroom activities on learning is to develop methods that are sensitive to the wide and varied outcomes, yet sufficiently specific to demonstrate whether such outcomes are directly attributable to the programme, as opposed to other extraneous factors. Specially-developed methods for computerised confidential peer assessment used within the Faculties of Design, Architecture and Building, and the Faculties of Engineering have been used for those students involved in community projects [27][28]. Information about student learning outcomes, which is yielded from the processes by which the students involved are assessed, is a key input for evaluating the programme.

#### CONCLUDING REMARKS

Programmes such as this require relatively high levels of staffing resources. However, it seems that the authors' experiences are not unique in that they feel that such programmes can effectively enable activities that develop understanding and capacity while building on the strengths and expertise of the community groups, the University and students.

Firstly, the capacity of the community groups seems to be strengthened by the scholarly interaction and sharing of knowledge and skills, and a greater awareness of sources of expertise within, and external to, each organisation. The framework seems to be suitable for enabling the community organisations involved to benefit from the sharing of knowledge and know-how, and the value of the deliverable outputs of the projects.

The capacity of the University is developed through engaging in multidisciplinary work situated within the local community, and the University benefits from providing a stimulating learning environment for staff and students. Members of staff benefit from the multidisciplinary aspects of the programme, and it has been found that being involved with the programme is a rewarding and enjoyable experience.

Table 1: Findings for UTS engineering students.

Issue	Workplace	Classroom	Other
The ability to design and conduct experiments, as well as to analyse and interpret data	36	56	8
The ability to function on multidisciplinary teams	46	48	6
An understanding of professional and ethical responsibilities	51	42	7
The ability to design a system, component or process to meet desired needs	51	43	7
The ability to communicate effectively	53	35	12

The framework appears to be suitable for enabling a form of practice-based learning that facilitates reflective practice, professional development, contributes to personal growth and has socially relevant outcomes. Students develop cultural sensitivity through respectful, responsible and professional interactions with community groups.

Students also benefit as indicated by the results of student feedback surveys, and comments such as those of an engineering student who, after working in a group with Visual Communication students, said *I'd like to learn more about design theory*. Regarding learning outcomes, the student said *a lot that I can't describe – liaising, organising, planning ... other project things*. Such comments illustrate that curiosity and motivation is aroused by the experience, and that they value the generic competences that the framework enables them to develop.

## REFERENCES

1. Mezirow, J., *Transformative Dimensions of Adult Learning*. San Francisco: Jossey-Bass (1991).
2. Rogers, C., *On Becoming a Person*. Boston: Houghton Mifflin (1961).
3. Kolb, D., *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs: Prentice-Hall (1984).
4. Dewey, J., *Experience and Education*. New York: Touchstone (1938).
5. Boyer, E.L., *Scholarship Reconsidered: Priorities of the Professoriate*. Princeton: Carnegie Foundation for the Advancement of Teaching (1990).
6. Kendall, J.C., *Combining Service and Learning: an Introduction*. In: Kendall, J.C. (Ed.), *Combining Service and Learning: a Resource Book for Community and Public Service*, Vol. 1. Raleigh: National Society for Experiential Education (1990).
7. Jacoby, B., *Service Learning in Higher Education: Concepts and Practices*. San Francisco: Jossey-Bass (1996).
8. Biggs, J.B., *Teaching for Quality Learning at University*. Buckingham: Society for Research into Higher Education and Open University Press (1999).
9. Ramsden, P., *Learning to Teach in Higher Education*. London: Routledge (1992).
10. Astin, A.W. and Sax, L.J., How undergraduates are affected by service participation. *J. of College Student Development*, 39, 3, 251-263 (1998).
11. Eyler, J. and Giles, D.E., Jr, *Where's the Service in Service Learning?* San Francisco: Jossey-Bass (1999).
12. Moulton, B.D. and Lowe, D.B., Engineering students' perceptions of the importance of personal abilities in relation to career performance, and their perceptions of the extent to which their courses focus on personal abilities. *Proc. 4<sup>th</sup> ASEE/AaeE Global Colloquium on Engng. Educ.*, Sydney, Australia (2005).
13. Ramsden, P. and Entwistle, N., Effects of academic departments on students' approaches to studying. *British J. of Educ. Psychology.*, 51, 368-383 (1981).
14. Richardson, J., Mature students in higher education: 1. A literature survey on approaches to studying. *Stud. in Higher Educ.*, 19, 309-325 (1994).
15. Ross, M. and Conway, M., *Remembering One's Own Past: the Construction of Personal Histories*. In: Sorrentino, R.M. and Higgins, E.T. (Eds), *Handbook of Motivation and Cognition: Foundations of Social Behavior*. New York: Guilford Press, 122-144 (1986).
16. Rowley, J., Action research: an approach to student work based learning. *Educ. and Training*, 45, 3, 131-138 (2003).
17. Smith, V., Raising retention and achievement in work-based learning. *Educ. and Training*, 45, 5, 273-279 (2003).
18. Falconer, S. and Pettigrew, M., Developing added value skills within an academic programme through work-based learning. *Inter. J. of Manpower*, 24, 1, 48-59 (2003).
19. Powell, L., Mayson, S. and De Lange, P., Experiential learning: evaluating the experiences of accounting students. *Proc. Accounting & Finance Assoc. of Australia and New Zealand Conf.*, Alice Springs, Australia (2004).
20. Moulton, B.D., Lasky, V.L. and Murray, S.J., The development of an environment for remote embedded systems: feedback from students and subsequent enhancements. *World Trans. on Engng. and Technology Educ.*, 2, 1, 65-68 (2003).
21. Moulton, B.D., Lasky, V.L. and Murray, S.J., The development of a remote laboratory: educational issues. *World Trans. on Engng. and Technology Educ.*, 3, 1, 19-22 (2004).
22. Thompson, D., Online-on campus - the best of both worlds in a blended learning project. *Proc. ATN Evaluation and Assessment Conf.*, Adelaide, Australia, 1-12 (2003), <http://www.unisa.edu.au/evaluations/program.htm>
23. Baker, B., *Dissemination of Research to Reform Practice: Fishing (and Lawering) to Learn*. In: Linn, P., Howard, A. and Miller, E. (Eds), *Handbook for Research in Cooperative Education and Internships*. Mahwah: Lawrence Erlbaum, 279-300 (2004).
24. Garth, B. and Martin, P., Law schools and the construction of competence. *J. of Legal Educ.*, 43, 469-510 (1993).
25. Canale, R., Cates, C. and Duwart, E., Co-op and ABET 2000: the added learning dimension! *Proc. ASEE Annual Conf.*, St Louis, USA (2000).
26. Grim, S. and Church, A., A cross-cultural study of response biases in personality measures. *J. of Research in Personality*, 33, 415-441 (1999).
27. Thompson, D., *Online Learning Environments for Group-Based Assessment*. In: Davies, A. (Ed.), *Enhancing Curricula: Exploring Effective Curriculum Practices in Art, Design and Communication in Higher Education*. London: Centre for Learning and Teaching in Art and Design (2002).
28. Thompson, D., Assessing group projects in design education. *The Design J.*, 5, 41-56 (2002).