RESEARCH-ENHANCED TEACHING AT MURDOCH UNIVERSITY
VIA THE RISE WIND ENERGY PROJECTS

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Objectives
Research-enhanced teaching can lead to a more integrated form of student engagement with research and involves the students with academics in inclusive communities of scholarship (Brew, 2006). At Murdoch University in Perth, Western Australia, research-enhanced teaching of students in the discipline of Energy Studies has occurred through involvement of students with research projects associated with The Research Institute of Sustainable Energy (RISE). RISE is based on the campus of Murdoch University and its primary role is in assisting the development of the Australian sustainable energy industry. The on-campus presence of RISE and the involvement of University academic staff in RISE affairs means there are close links between the activities of the Institute and the teaching activities at Murdoch. Wind energy is one of Murdoch’s key areas of research strength and students have either been involved with research work connected with the RISE Small Wind Program at the RISE Outdoor Test Area (Whale & Pryor, 2005) or with the RISE Wind Monitoring Program. In the former case, students have been involved in wind turbine testing at one of the wind test stations at the RISE Outdoor Test Area whereas the latter case involved wind resource assessments of sites in Western Australia. In all cases the projects involved industry partners.

The aim of this study was to assess the impact on the students of involvement in the RISE ‘wind projects’. The specific research objectives were:

1. To examine the impact of the wind projects on constructive learning by studying the effect that working with wind turbine technology and/or wind data had on the students understanding of wind energy concepts taught in their courses,
2. To examine the impact of the wind projects on student employability by studying the effect that the exposure to contacts and procedures from industry had on employability skill sets and career choices, and
3. To examine the relationships between academic and industry partners in the wind projects in the context of scholarships of engagement.

Significance
Renewable energy education has emerged as a new discipline in its own right with its own interdisciplinary curriculum that satisfies the criteria for sustainable development (Jennings, Lund & O’Mara 2000). Murdoch University offers a number of degrees and courses related to Energy Studies including undergraduate degrees in Sustainable Energy Management and postgraduate courses in Energy Studies including Masters degrees in Renewable Energy and Environmental Architecture. The courses aim to produce graduates with a broad-based knowledge of renewable energy systems, who are aware of the environmental, economic and social implications of installing energy systems as well as the technical aspects of the energy technology itself. This broad knowledge content means that the degrees and courses attract students from varied academic backgrounds.
As one of the fastest growing and most cost-competitive renewable energy technologies (Ackermann & Söder, 2002), wind energy is a core subject area in the curriculum. The discipline of wind energy requires knowledge of many branches of science and engineering: meteorology, aerodynamics, mechanical engineering, electrical engineering etc. as well as knowledge of policy issues and economics. During their studies, however, it is very likely that the student will have to explore far from their existing knowledge base in order to cover the required fields of knowledge in wind energy. Use of the RISE wind facilities offers the chance for the student to enhance their reading with experiential learning gained by participation in the wind projects. The significance of this work will give insight into the constructive learning that is occurring through the use of the RISE wind facilities in student projects and may suggest ways to improve teaching methods and increase the quality of learning for future wind projects.

**Theory**

The conventional wisdom that staff discipline-based research benefits teaching and learning is not supported by statistical evidence (Ramsden and Moses, 1992; Astin, 1993). Further, there is evidence of students’ concerns that a teacher’s individual research interests should not dominate at the expense of the aims of the course (Neumann, 1994; Jenkins, Blackman, Lindsay, & Paton-Saltzberg, 1998). More recent studies (Barnett, 2000; Jenkins, 2000) however have questioned the methodologies of these traditional correlation studies, which have treated teaching and research as more or less discrete entities. Educational research has been a starting point for discussion of new ways of thinking about the relationship between research and teaching. Brew (2006) postulates an integrated model of research-enhanced learning with greater involvement of students with academics in scholarly communities. Pascarella and Terinzini (1991) noted that the greater the students’ involvement in academic work, the greater the knowledge acquisition and cognitive development. Brew (2006) argues that not only can research benefit teaching but teaching can stimulate academic learning. Student participation in academic work may help the academic to overcome the isolation of individual research and can generate research ideas through questions posed by students.

The notion of research-enhanced teaching forms the main theoretical context for this paper but the very nature of the research makes connections with a number of teaching and learning concepts. The research gives the academic the experience of the process of constructive learning (Biggs, 2003) which can then be communicated to the students in the classroom. In addition, the sort of two way exchanges between academia and industry as related in this paper falls under the idea of a scholarship of engagement (Holland, 2005; Ramaley, 2005) and has the ability to raise the research profile of the university and build the opportunity for students to better prepare for the workforce. In addition the multidisciplinary nature of the research is allied with student learning outcomes, in particular developing employability through the formation of the types of skill sets valued by employers and identified by Kubler and Forbes (2005).

**Design and procedure**

Since Energy Studies students are from different disciplinary backgrounds and have a wide difference in their learning needs and knowledge base, diagnostic testing of all undergraduate and postgraduate students on wind energy concepts is planned for the start of their respective courses. During their course an undergraduate student’s contact with the RISE wind projects may occur through honours projects and independent study contracts while a postgraduate student’s contact with the RISE wind projects may occur through small research projects in elective units, Masters
by coursework dissertation projects and higher degree research. In addition, postgraduate students from other universities may have contact with the wind projects through undertaking a practical traineeship with RISE.

To test the impact that involvement with wind energy technology and wind data has on a student’s understanding of wind energy concepts, further diagnostic testing is planned for undergraduates and postgraduates at the end of their respective courses. The test results from those students involved in the RISE wind projects will be compared to the results of their cohorts who were not involved in the RISE wind projects. To test for the impact of the wind projects on deep learning and employability, students involved in the RISE wind projects will be surveyed during their project and then surveyed again a number of years later as part of a focus group of former students. The survey questions aim to uncover the student’s experience of the effect that the RISE wind projects have had on their education, employability skill sets and career choices.

Findings

Preliminary findings have involved informal feedback from a focus group of eleven former postgraduate students who were involved with the RISE wind projects during their studies at Murdoch University over a period from 2003 to 2006. The focus group were asked for their general comments about their experience with the wind project and its contribution to their education and future careers. The feedback from the group was extremely positive with two members identifying the wind project as the “… most interesting unit of the entire course” and the “… high point of my university study…”

Some comments made by the focus group suggested that involvement in the wind projects resulted in a process of constructive learning by the student. Examples of these comments are that “… the work on the turbine deepened my knowledge …”, that the work was “… beyond the coverage of the topic in the coursework …” and that the project “… took me well beyond the limits of any previous studies …” Other members of the focus group pointed out the context of the environment in which this constructive learning occurred in that it “… gave me the opportunity to apply some of the skills and techniques I had learned … in a real-world, industrial context” and it “… allowed me to gain some practical experience within a commercial framework”.

One member gives insight that supports the notion of the industry-academia exchange on the wind projects as an example of scholarship of engagement. They state “Another new and absolutely positive experience for me was to actively participate in the meetings (with industry). It was very instructive to be responsible for the preparation and presentation of results (at the meeting) as well as give further details and to answer questions”.

Finally a number of the focus group address the impact of the wind projects on their employability. Some statements refer to the potential impact such as “I’ve talked it up in all interviews and I’m sure its well regarded” and “…will be regarded favourably by potential employers” while others recognise a direct impact in that the project “… was very helpful in getting my current position …” and “has directly contributed to my current employment in a wind engineering capacity…” Interestingly, members of the focus group not working in wind energy still recognised the contribution that the wind projects had made to their careers in terms of the ability to think analytically, to communicate, write reports and give presentations.
The preliminary findings support the idea that the RISE wind projects promote the teaching and learning concepts of constructive learning, scholarship of engagement and student employability. A more formal study is planned involving diagnostic testing of students as outlined in the Design and Procedure. In addition a new unit is planned which will promote undergraduate involvement in the RISE wind projects and increase the exposure of undergraduate students to research-enhanced teaching at Murdoch University.

References