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Water Education for Sustainability in Higher Education

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Dedication to a Dear Friend and Colleague

This special issue on water education is dedicated to our colleague, Peter Oliver, who died on November 20th, 2012. Peter was a leading and passionate water and environmental educator in Australia. His photograph appears on the cover.

We would like to honor Peter by talking about how his life and work embodied and epitomized many of the key themes of this issue. Peter was a highly experienced educator and academic, with an approach to water education developed out of three decades of teaching in secondary schools, universities, community contexts, and professional workshops. Many of Peter's insights grew out of first hand teaching in classrooms, field trips, community meetings, and forums, of listening to and interacting with people from schoolchildren, through commercial fishermen and farmers, to water professionals from around the world. Certainly, Peter reflected critically on his educational practice and related it to academic knowledge and theory, as his papers in this collection discuss, but his approach was born from and centered on practical, thoughtful doing. Peter was continually involved in a process of learning how to be – and aspiring to be – a better educator.

Peter believed in getting students into the field: out into the environment where they could engage with it and the local people who knew it best, see and experience environmental issues first hand, be challenged to analyze those issues and think about responses and solutions. This is the immersive education that Bill Dennison and Peter write about in this issue. Experiential education was his stock in trade: field trips to investigate water resources issues in places like the Brisbane River, Stradbroke Island near Brisbane, the Mary River, the Murray Darling Basin, and the Kalgan River in Western Australia.

For Peter, experiential education in the environment was closely linked with problem-based learning – learning through engagement and analysis of actual problems in real-world contexts rather than classrooms. Getting out into water catchments and river basins enabled students to see and experience development impacts and environmental changes first hand. Learning in the field was one of the best ways to enable students to see and experience the complex relationships between people, water, and development. Field experiences pose real-world problems that require analysis from a range of different disciplines and the integration of those different knowledges. Field experiences require cooperation among students in groups, learning from different stakeholders, and consideration of technical and management solutions in relation to actual contexts.

Peter believed that problem-based learning was one of the best ways to enable students to integrate a range of disciplinary knowledge, social perspectives, and ways of thinking about water management problems into their work. Peter felt strongly that universities and university courses did not "do" integration very well. He was deeply skeptical about formal courses teaching integration or transdisciplinary methods. He would say, "The moment you put integration in a specific subject, you've killed it, it's not integration anymore!" Integration and making

connections across different disciplines was not a subject to be taught, but a process that students and water professionals needed to engage in – attacking a problem, drawing on existing literature, drawing on a range of disciplinary methods, gathering scientific and social science data, and considering the perspectives of different social stakeholders. It is a messy, challenging, and creative process – and ongoing. Mark Pascoe, CEO of the International WaterCentre, called Peter a "walking integrator."

Introduction to the Special Issue

Peter Oliver was the inspiration for a workshop on "Innovative Approaches to Water Education" we hosted at the International WaterCentre in Brisbane in November 2011, bringing together water educators from the International WaterCentre network around Australia, Fiji, China, and the United States. We met, listened to, and learned from each other, openly and positively, and had a little fun – a process which those who knew Peter would recognize as reflecting his generosity and sincere engagement. Several participants in that original workshop have contributed papers here; others have joined us along the way and added a great deal in the process. Those include water educators involved with the Integrative Graduate Education, Research, and Training program (IGERT) funded by the National Science Foundation in the United States, and an international network of universities associated with UNESCO's International Hydrological Program.

Water education for sustainability has emerged as an important field of practice in higher education in recent years, as demonstrated by this journal and recent international networks and workshops coordinated by UNESCO. Nevertheless, some recent commentators have argued that university courses on sustainable development and management of water are very few and far between, and so far are having little impact on the water sector or on improving the sustainability of water resources (Cap-Net 2008; Leendertse and Taylor 2011).

The water educators who contributed to this issue want to change that. We all aspire to education for social change in one form or another; that is, education that will "make a difference" in the professional lives of graduates and in the water sector. In the following papers we address questions such as, how do we educate emerging and practicing professionals to acquire knowledge, skills, and values to enable them to contribute to protecting water resources, and manage them sustainably? How do we educate such professionals to think critically and creatively about current water issues, be able to contribute new knowledge and participate in debates about sustainable development in theory and practice? How do we develop the capabilities and skills in such professionals to enable them to effectively integrate multiple disciplines and interests, and to influence policy development?

The papers presented here almost all come from reflecting on educational practice, rather than research as such. They have been developed out of reflection on the educational practice of university academics and out of professional desires to improve learning outcomes for our students, many of whom are practicing water professionals. That has meant that many of us have not contextualized our stories and analysis in educational theory or concepts, but rather ideas and educational strategies developed in practice with colleagues and students in the spirit of "learning by doing."

The first paper by McIntosh and Taylor gives an important context for the whole issue, and starts by outlining some of the challenges facing water sector professionals in the future, and in doing so, sets forth a persuasive justification for new and better ways of educating professionals in the water sector. They argue that water professionals will need to have strong leadership skills, and lead change within teams, organizations and institutions towards goals set by sustainability and Integrated Water Resource Management. Water professionals also need to be skilful integrators – able to draw upon and apply a range of technical and disciplinary knowledge to water management issues, and join technical, scientific perspectives up with social science and social perspectives in the analysis, development, and implementation of water management strategies. To achieve such expertise and skills, McIntosh and Taylor draw upon leadership, organizational management, and learning theory to propose the idea of the "T-Shaped Water Professional" as a way of developing and

teaching postgraduate courses in Integrated Water Resource Management and water sustainability. The T-Shaped Professional has a deep but narrow educational training and experience in a particular professional discipline (the trunk of the T), but capped off with a broad transdisciplinary education in aspects of science, social science, economics, and management needed to be a critical thinker, leader, and integrator in the water sector (the hat of the T). They conclude with some ideas about how we can educate such T-Shaped graduates.

The next two papers come from a very interesting project of collaboration, dialogue, and reflection between two highly experienced educators, Peter Oliver and Bill Dennison. Peter and Bill had regularly worked together across the previous two decades, but four years ago they began a collaborative writing project together that involved them sharing, reflecting on, analyzing, and writing about environmental and water education. The outcomes of that process include a book, *Dancing with Dugongs*, and the two jointly authored papers here. Sadly, Peter died before he saw this work published.

In "Popular Education for Water Sustainability: Three Lessons from Reflective Practice," Peter and Bill tell the story of commercial fishers affected by exclusion and a cyanobacterial bloom. As they show, their work with the fishers can be characterized as popular education, that is nonformal education aimed at collective action and social change. Peter and Bill draw out three lessons from the case. First, popular water educators need to know the people they work with, their knowledge, experience, and aspirations. Second, they should learn from their participants and enable the participants to learn from each other. Lastly, effective popular education has a strong emotional dimension that is just as important as thinking and doing – the heart should be integrated with the head and the hands, in Peter and Bill's words.

In the second of their joint papers, Bill and Peter reflect upon Bill's teaching of marine studies and coastal zone management at the university level to develop principles for a form of experiential education they call "immersive education." For Bill and Peter, "immersive education places students directly in the water environment that is home to their interests and uses the experiences they gain as a way to learn about, reflect on, and advocate for the better understanding and management of this water environment." They give examples from their own teaching when immersive education provoked in students strong emotional connections to the environment, that was process-driven and transdiciplinary, collaborative and democratic, and fostered critical thinking and new insights and perspectives.

In the following paper, Missingham continues exploring the usefulness of popular education principles and approaches, but in this case, within the university classroom. He briefly discusses the origins of popular education and participatory learning approaches and their growing influence in the field of environmental education, but quickly turns to an exposition of what has worked well in his own pedagogy of water and sustainability. Missingham highlights strategies of asset-based teaching and learning in which students' knowledge, experience, and heart-felt aspirations are turned into learning resources equally – or even more – important as the lecturer's expert knowledge. He also discusses problem-posing education, participatory learning underpinned by effective group facilitation techniques, and student construction of knowledge and theory (rather than uncritical consumption).

Next, we turn back to field-based education, which is a central theme of the following three papers. In "Cross-boundary Peer Learning in the Mekong: A Case of Field-based Education in Natural Resources Management," Xing Lyu, Phil Hirsch, and their colleagues present and analyze their experience in running the Mekong Learning Initiative research exchange program, which set out to create educational linkages and collaborative learning between postgraduate students at Yunnan University in China, Ubon Ratchathani University in Thailand and the Royal University of Phnom Penh in Cambodia. An important aspect of the program is that it grew out of collaborations between academic researchers at the three universities and the University of Sydney, and aspirations on their part to try something new in terms of cross-boundary student exchange for research and learning in a region that has experienced increasing interconnections in other dimensions (such as trade, economic

infrastructure, population movements, and political). Xing Lyu, Hirsch, and their colleagues characterize the program as cross-cultural, peer-based learning, and experiential learning. They describe in detail how they managed and facilitated the process, and the main learning outcomes. They draw out many useful lessons for transboundary and cross-cultural water pedagogy.

The next two papers come to us from academics involved in the IGERT program, funded by the U.S. National Science Foundation (NSF). The IGERT program has aimed to encourage and fund inter-departmental and inter-institutional initiatives that develop interdisciplinary and integrative experiences and skills in postgraduate research students.

As Pinter and his colleagues argue in their paper, "An 'IGERT' Model for Interdisciplinary Doctoral Education in Water-Related Science and Policy," the need to foster interdisciplinary and integrative approaches and skills is particularly relevant in water and watershed science. Their paper describes how the IGERT Watershed science program at Southern Illinois University has set out to facilitate the interdisciplinary processes and integrative skills being sought by the NSF. Their approach has been based on three key premises. First, they believe that "student training in multidisciplinary watershed science cannot be meaningfully multidisciplinary without meaningful collaboration between students and advisors from different disciplines." Therefore they adopted the organizing principle of the "cadre," consisting of 5 to 6 new Ph.D. candidates, each from a different disciplinary background, each year. Their second premise was to set the cadres the task of developing a research-driven assessment and management plan for a specific river basin. Thus the students had to work collaboratively on field-based and real-world problems. Finally, academic researchers from a range of disciplines collaborated in developing a suite of new interdisciplinary courses for postgraduate research students. Their account and examples show that the program was particularly effective in achieving transdisciplinary and collaborative group work by the IGERT fellows. Interestingly, they conclude with a discussion of the resourcing issues and institutional resistance they continue to face in running the program.

The penultimate paper is also about an NSF-funded IGERT initiative, this time in a collaboration between Kent State and Miami University to teach doctoral students about advanced sensors for freshwater science in a transdisciplinary and integrative way. Laura Leff and her colleagues present a range of effective education strategies developed in the program. Once again, taking students into the field was important, as was assigning them to work in small teams on applied research questions requiring research design, application of sensor technology, and the analysis and interpretation of sensor data. Their program also reveals the importance and effectiveness of being responsive to the career development needs of students. Leff and her co-writers designed and presented courses such as proposal writing, academic writing, and career opportunities and planning. Through internships, visits to industry, and other means, they also exposed students to the business side of remote sensing. Leff and her colleagues conclude with a succinct statement that will resonate with many of us: "The key to achieving inter-disciplinary training, in our view, is to give students a common problem to tackle and the tools to do so."

Finally, Camkin and Neto's paper makes a thoughtful conclusion to our special issue. They remind us of some of the big issues facing water resources development and management. They also remind us that multidisciplinary, interdisciplinary, and transdisciplinary all mean different things. What we are all probably aiming towards is transdisciplinary approaches to underlie truly integrative research and teaching. Camkin and Neto describe some of their approaches to achieving such transdisciplinary teaching in the Erasmus Mundus Master Course in Ecohydrology. They draw methodological inspiration from Frierian ideas of dialogue and praxis (also associated with popular education and critical pedagogy mentioned in some earlier papers). Drawing on the previous professional experience of participants and challenging them to consider how water decisions and actions could be improved by Integrated Water Resource Management concepts proved fruitful. Learning in their courses became collaborative, as students' professional experience and knowledge was valued and shared with lecturers knowledge.

At the same time, they analyzed, discussed, and learned through practical water problems in real world contexts.

Conclusion

In his article here with Bill Denison, Peter Oliver argues that you should know your students, build effective relationships with them, and be prepared to learn from them. We hope you enjoy engaging with and learning from the experiences of the authors as presented here in this Special Issue. If any of the ideas, experiences, or reflections presented resonate with you, then please contact the authors involved. Learning is not a one-way process and we all genuinely look forward to engaging with others to transform university learning into a force for positive and effective change across the water sector.

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