

A6. Managing Water: Learning about, and learning for sustainable development

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The effective management of water demands that practitioners understand the concept of sustainability and sustainable development, and that they have the required skills to be able to put the theory into practice. Two modules, one at final level undergraduate, *Managing Water*, and one at Master's level, *Sustainable Water Management*, are taught together in the classroom. Both modules discuss the concept of, and practice of, sustainable management in the water industry nationally and globally, although at postgraduate level the students are required to adopt a strongly vocational approach, supported through additional tutorials. Postgraduates also play a role in the teaching of undergraduates, through presenting a professional standard seminar designed to educate, stimulate and engender debate. Assessment is appropriate to the different levels as well. There is a great deal of student participation, structured and unstructured classroom debate, alongside more traditional lectures and student-led, role-playing seminars. The learning is strongly guided but student-centred, active and participative in style.

Aims

The contested concept of 'sustainability' is explicit in the expected learning outcomes of the modules, as a broad but disputed body of knowledge and understanding, embracing the evolution of the approach from more narrowly defined 'environmental sustainability', into the wider realms of social justice and economic sustainability (Brundtland 1987). By definition, students must engage with sustainability as an object of study (for example, DEFRA and the Water Framework Directive). However, the engagement goes beyond this, into the way in which they learn, and the skills and personal attributes they develop.

Dawe *et al.* (2005) distinguish three groups of characteristics of effective education for sustainable development at an abstract level. First, personal aspects such as the educators acting as role models, the shared experiences of teachers and learners studying together, and lifelong learning are characteristic. Reconnecting learners with 'reality' is a second

characteristic, embracing the inclusion of relationships with the local community, the use of real life problems and experiences such as managing the university's own environmental management system, reconnecting people with nature, and developing a capacity for (non-prescribed) change. Third, Dawe *et al.* propose holistic thinking as crucial, including interdisciplinary and critical thinking, systems approaches and respect for all subject areas.

The tuition in these modules accords with this philosophy, but also fosters a range of high order skills appropriate for practitioners of a discipline where sustainable development practice is so central. Skills for sustainability have been well described by many practitioners (for example, the Environment Agency *et al.* PP4SD Project 1999), and include such things as

- Ability to develop a vision, if necessary by subverting existing paradigms
- Ability to conduct basic research and to use scientific and technical information appropriately
- Ability to construct a logical case, to distinguish fact from opinion, and to make informed and responsible decisions
- Ability to participate in and lead meetings of different types (confrontational/adversarial, disseminating, opinion seeking, consensus-building)
- Ability to work effectively in multidisciplinary teams.

There is a particular focus in the modules on the development of communication skills: written, graphical and oral, and a strong emphasis on the students' abilities to construct an argument which might be tested legally, or at least in a public forum. Partnering this is an expectation of behaviour and attitudinal change amongst the student cohort.

Rationale

For the purposes of initial exploration of the sustainability concept, the Brundtland (WCED 1987) definition of sustainable development is helpful, but there is a wide assortment of other definitions which are used within the sector, and on which national water policies are based. For simplicity, a sustainability mnemonic is used, namely that effective sustainability requires a balanced approach to:

- Engineering
- Economics
- Environment
- Equity

Different case studies, picked up as the module progresses, emphasise the appropriateness of each of the four 'E's' in different contexts. For example, discussion about the changing impacts of human development on the hydrological response of river basins focuses largely on the 'engineering' or technological and scientific issues around identifying such changes, and learning to predict and forecast the impacts of future developments such as urbanisation, or climate change on the water regime. Consideration of the management of droughts and floods starts to include the additional requirement for economic sustainability in the light of uncertainty, the life expectancy of water projects such as dams and the precautionary principle.

Environmental sustainability is a relatively straightforward concept to impart, and pervades many of the areas of management; students normally do not struggle with this, and find little difficulty in identifying the salient points, for example, when environmental impact studies are conducted for the purposes of managing water quality. However, the challenge of ensuring 'equity', fair treatment of individuals, groups, communities, regions and nations in water management practice, is a highly complex issue. This is approached through considering a range of aspects of the management of water supply, in both the developed world (UK and Europe), and the less developed world (Africa, for example). Students also research equity issues at different scales such as water metering, demand management and the possibility of international water wars.

In many parts of the module, case study materials from the tutor's own applied hydrological consultancy work provide original documentation and reports so that students can explore and develop high level skills in a semi-professional context. Over the last two decades, most water resource practitioners will have developed a broader and deeper personal understanding of the concept and practice of sustainability, moving from a relatively straightforward consideration of the underpinning environmental impacts of humanity on the hydrological regime, into a broader consideration of proactive sustainable water management practice. This is also the way the water industry, and indeed almost all areas of professional practice originally with a narrowly defined 'green' focus, have moved.

Effective practitioners grow their own understanding consciously by learning from hydrological practice internationally, and this can be modelled for students. The sustainability challenge of managing an aquifer under a toxic waste site in Birmingham, UK, can be compared with the infinitely more complex challenges of the same scenario in rural Africa, for example. This fascination can be shared with students, showing them that they could make a difference through their own actions.

Implementation

Classes are typically three hours in length, divided into two or three different activities; a typical sequence is illustrated in Appendix 1. Most sessions begin with a presentation on a theme, always illustrated, sometimes with video clips. Observations are solicited, students' views are drawn in through questioning, there are pauses for engagement, interjections of surprising challenges, and strong encouragement for students to speak out. The expectation about every student contributing something to the class, even if only an expression of agreement with another student's view, or a difficulty in understanding a concept, are made entirely clear at the start of the module, together with an acknowledgement that this may be very challenging for some participants, and an exhortation to trust classmates and respect a need for personal support in venturing opinion. This reassurance is repeated often, and the vast majority of students respond. The same emphasis appears in a handout explaining the philosophy.

Video or taped material from the media focuses either on the change in practice over the years (materials from a decade ago make for interesting comparisons) or the contemporary (Boscastle flooding; Hurricane Katrina; drought in southern England), where politics and high levels of feeling are apparent. Discussions around this in the early sessions are often structured, with a worksheet to prompt the collection of relevant materials prior to exchange of views. BBC Radio 'phone ins', television programmes and film extracts are all productive stimulus material. Later sessions are more exploratory, less structured. In the last couple of years a friendly barrister and immigration judge has been brought in to discuss the issues around constructing an argument for legal purposes. He has been warmly welcomed, and enjoyed the experience himself. Most recently, he excelled himself by illustrating his seminar with extracts from Handel's music, artwork and poetry.

The third part of the session involves student-led activities such as short presentations (for example, develop two PowerPoint screens of views on flood management, supported by material gleaned in a twenty minute internet search either in the classroom in small groups, or before the class), role-playing seminars, exploration of a piece of literature or similar devices. In the early classes, students experiment with addressing or co-ordinating a group – how to stand, how to gesture, how to speak, how to collaborate – and how to listen, draw together ideas and summarise, utilise graphics effectively, and give and take critique. In the later classes, these interactions become more student-led, culminating in a role-playing seminar series.

Active learning

This activity works well with the advanced undergraduate and postgraduate group, and capitalises on the diversity of their experiences, and backgrounds. In addition to the use of the tutor's own consultancy materials, the groups have frequently been privileged to include students who are also 'practitioners', typically employees of the Environment Agency, consultancies or engineering companies, who can contribute current issues and their management into the debate. On several occasions major issues around sustainable water management have unfolded during the semester. The 2001 Foot and Mouth crisis, the disposal of BSE-infected animal corpses, and major droughts and floods, are examples in which some students were actively professionally involved.

Feedback

The most recent cohort commented very positively on their experiences, not only of the interest of the subject matter and the focus on sustainability, but on the participatory style of delivery which is linked to the skills they would need into the future as managers in this domain. Typical comments included:

I have always welcomed active lectures and learning. This module again demonstrated what a success they can be. Group work skills have developed. Good research skills.

(I valued) how to construct an argument and show that I can do a presentation/seminar in front of a group. My skills have developed, especially in relevance to explaining the aspects involved.

The talk from the barrister was interesting and informative. He gave some ideas that would help me so that I can talk and discuss in front of a group. I enjoyed the seminars a great deal, and the debates/discussions about the subject.

There were many opportunities to participate in the module. I feel that I have always something to say/add to the conversations, and always had the opportunity to participate.

Lots of participation, nice to have different aspects of delivery and the choice to debate. Style very good, split into sections, often with active discussions within the group, sharing thoughts and further exploring topic.

Very good and interesting, gives an insight of what is expected of water managers, useful to know.

Very good, broad range of water issues, very enjoyable sessions.

Newman (q.v.) writes about her undergraduate experience in the module. It is also apparent that students work very hard, have been very pleased with the grades they achieved, and that a disproportionate number have moved into careers in the water industry and related areas.

Strengths and weaknesses

Whilst the activities outlined are effective with students whose first language is English, there are challenges for students working in a language other than their mother tongue. Moreover, international students who have begun or completed degree programmes in regions with a stronger didactic, lecturer-led tradition have found the module unusual in its approach. It has always therefore been important explicitly to explain at the start of the module that this will be a very supportive learning environment, but that everyone is expected to participate, even initially if it is only by articulating an occasional agreement. Murmurs of assent from classmates, for example, are particularly reassuring to students who are starting to voice their opinions for the first time. Normally their confidence grows, and after three or four sessions they feel able to start explaining more complex views, and by the sixth or seventh session it has sometimes been necessary to reconsider the 'etiquette' of group participation to prevent verbal overload. The configuration of the teaching room is also

important; 'Board room' or round table format with good visibility between participants, and high standard AV facilities (including in recent years WiFi) have been important elements of the success.

Programmes

The undergraduate module is 15 CATS at Level 3 module for BA or BSc (Hons) programmes in Human and Physical Geography, Environmental Science, Environmental Management, Water Resource Management and Environmental Policy. The Master's level module is 20 CATS and is used in the MSc Environmental Policy and Management, and MSc Water and Environmental Management.

Keywords:

Water resource management; hydrological consultancy; sustainability skills; active learning; communication; role-play

References

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Appendix 1

The broad subject sequence used over the course of the module in 2006-7 was:

1. Water management systems and objectives
Changing perspectives- AV material and discussion on New Orleans
Flooding and other examples
2. Catchment Management: Methods and purpose
Exploring effective presentation - Kielder Water role play
3. Hydrological impacts of climate and land use changes
Discussion of case studies based on consultancy work; on line
materials
4. Management of hydrological extremes: Drought
Video and audiotapes, discussion
5. Management of hydrological extremes: Floods
Video material and preliminary role-play
6. Water quality and its management
Video material on coastal waters and discussion; online activity and
presentation
7. Flooding in the Lower Severn: case study from visiting specialist
Case studies based on consultancy work, and research activity

8. Groundwater quality management: theory and practice case studies
On line activity and students present findings; Postgraduate seminar
9. Water supply management: needs and demands
How to construct an argument – visiting Barrister/Judge and discussion
10. Water supply: meeting the needs
Student-led role-playing seminar; Postgraduate seminar
11. Integrated water management: Companies, Agencies and stakeholders in the UK
Student-led role-playing seminar
12. Integrated water management: International comparisons
International Case study; Student-led role-playing seminar
13. Overview case study and revision guidance