# Using the World Wide Web to revolutionise technology transfer and training in the water and wastewater industries

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**Abstract** Industry professionals of the near future will be supported by an IT infrastructure that enables them to complete a task by drawing on resources and people with expertise anywhere in the world, and access to knowledge through specific training programs that address the task requirements. The increasing uptake of new technologies enables information to reach a diverse population and to provide flexible learning environments 24 hours a day, 7 days a week. This paper examines one of the key areas where the World Wide Web will impact on the water and wastewater industries, namely technology transfer and training. The authors will present their experiences of developing online training courses for wastewater industry professionals over the last two years. The perspective is that of two people working at the "coalface".
**Keywords** World wide web; internet; professional training; online learning

## Introduction

This paper examines the WWW revolution from the perspective of technology transfer and training in the water/wastewater industry. Firstly, we must acknowledge that the term "WWW revolution" is often quoted and frequently over-stated. However, in terms of technology transfer and training, the term revolution is most appropriate.

Ehrmann (1999) has identified a three-phase revolution in higher education:
1. The reading-writing revolution
2. The campus revolution
3. The WWW revolution

Each revolution has used technology to help more teachers teach and more students to learn, to improve scholarship and increase specialisation, to change teacher – community relationships and to increase the diversity and uniformity of teaching resources. Today, educational innovations must be designed to alter who learns, how they learn and what they learn.

The international online training market is enormous. In a very short period it has had the effect of turning the whole concept of learning on its head. Universities and learning institutions around the world are all changing in an attempt to exploit the online learning phenomenon. In this paper we attempt to look at the specific issue of information exchange and training in our industry.

*How will the WWW impact on how professionals in our industry access and manage information?* The authors come from two very diverse backgrounds. Paul Lant is an industry professional who does research and consulting work in the wastewater industry. Paul has also been involved in continuing professional education for a number of years. David Emmett is an educational consultant who specialises in online training. David has an extensive background in training and multimedia design. We came together in an attempt to solve a problem that Paul Lant encountered in terms of addressing the changing needs of professional training in the wastewater industry.

P.A. Lant and D. Emmett

*What role will the WWW play in continuing professional development in the water and wastewater industries?* The main message of this paper is that the WWW will revolutionise the way that water industry professionals access and use information. It will happen sooner rather than later. Consequently, industry employers and professionals need to start preparing to best exploit the opportunities that will arise. We will use our experiences over the last two years, working together to develop training courses for water industry professionals, as a case study.

## Drivers for change

We contend that online learning and technology transfer via the WWW will become part of the daily routine of water industry professionals. This argument is based on two key drivers, namely the burgeoning online training industry and the current trends in the water industry, which mean that professionals must now learn more and manage more at the same time. These issues are discussed in the following two sections.

### Online training industry

The online training industry is developing rapidly as access to communication and information is improved using the network of optical fibres and satellites that are the Internet. International Data Corporation (IDC) predicts the corporate online learning market will surpass $7.1 billion by 2002. This is quite impressive, considering that online learning only came into being in the late-1990s.

The main forces driving the development of the online training market are:

- technological innovation
- decreasing costs of technology
- demand for more quality
- equitable access and service; and
- growth of knowledge and lifelong learning.

Harasim *et al*. (1995:271) refers to online teaching "as a new form of education, creating a paradigm shift, a change to a new model and set of expectations and rules for how to function successfully within a new learning environment". Increasingly the WWW is viewed as the technological panacea to solve the problem of delivering training efficiently when and where required.

As the historian and social commentator, Spender (1995), comments:

We are the last generation to be reared within a culture in which print is the primary information medium. Because we have grown up and become skilled in a print-based community, we have developed certain ways of making sense of the world. We are to some extent, what print has made us. And now we have to change.

### Industry drivers

In order to examine how the WWW will impact on industry professionals, it is important to establish what the current working environment is like. There are several pertinent aspects

- The water industry is at a stage where its rate of technology uptake has never been greater.
- The water industry, like all others, is constantly seeking greater efficiencies.
- The water industry is global.
- The industry is under increased scrutiny from government bodies, environmental and health bodies.
- Water is growing in value as a commodity.

128

- Industry professionals have increasing mobility, and thus a need to have access to information from different sites.

All of this means that we all work in an industry which is increasingly competitive, more complex to manage and operate, and yet which must perform much better. In order to perform well, it will be imperative to get rapid access to up-to-date information on technology. It will also be equally important to update skills ahead of the changes in technology. The future will require all of us to skill and train at a faster rate than at present. Of course, we must manage to do this in a more competitive and technically complex industry! We contend that the solution to this paradox lies in the WWW, and more specifically online training and technology transfer.

Organisational prosperity has become increasingly dependent upon the intellectual capacity of workers, and their ability to change in the current dynamic business environment (Nonaka & Takeuchi, 1995). As Ray Stata of Analog Devices commented:

> "The rate at which organisations learn may become the only sustainable source of competitive advantage" (Stata, 1989:63).

No longer will learning be confined to front-end school learning, but continuous across the life cycle to facilitate flexible career paths and to enhance personal development. The learner of the near future will be supported by an IT infrastructure that enables them to complete a task by drawing on resources and people with expertise anywhere in the world, and access to knowledge through specific training programs that address the task requirements.

## Case study

The case study outlines the experiences of the two authors in addressing some problems that Paul Lant had identified with conventional training courses for water industry professionals. The work presented was performed between September 1998 and November 1999.

Paul Lant had been involved in continuing professional education for a number of years prior to this case. In the main, these had been traditional classroom sessions with small groups of industry professionals, and they ran for 2–3 days. It became evident that there were several problems with this model of training.

- Only a very small percentage of people who would be interested in the course material could participate. A good example of this is the course "Prefermentation for BNR". Paul was part of a group of researchers at The University of Queensland who had done some pioneering work in modelling and simulating prefermentation. Prefermentation is a new technology with international appeal, and thus potentially a good candidate for professional training. It is, of course, also very specialised, and therefore aimed at a niche market. Conventional classroom sessions meant that it was impossible to disseminate information internationally, apart from publishing in international journals, which are mostly not accessible to practitioners.
- Conventional intensive (2–3 days) classroom courses made it very difficult to skill people in the use of new technologies, such as software packages. In the main, people need time to reflect and "play" with new technology. This was not possible in the traditional setting.
- Recent experience indicates a drop in the number of people who attend intensive classroom sessions. Anecdotal evidence suggests that this is a global phenomenon. There are a number of possible reasons for this, but the most likely are cost and time away from the office.

*Consequently, the problem statement was to provide quality training to water industry professionals who are at different international locations, which was cost effective,*

P.A. Lant and D. Emmett

*provided time for reflective thinking and learning, yet did not require people to be away from the office.*

The solution was to utilise the online learning capabilities of the World Wide Web as both delivery medium and communication tool.

With this in mind the project team chose WebCT as its preferred delivery medium. Figure 1 illustrates the functions that WebCT offers. WebCT is an online learning development and delivery tool, which provides teachers and learners with many capabilities, including:

- content delivery
- internal email function
- chat and bulletin board functions
- quizzes and self tests
- ability to work collaboratively on online presentations
- calendar

[More detailed information on WebCT, including sample courses can be found at http://www.webct.com]

It was also acknowledged by the team from the outset that while web technologies offer many advantages, the technology by itself does not change or improve learning. It does, however, change the conditions under which learning can take place. The technology is simply another delivery mode. The important element for the team was Instructional Design. The key to any learning process is the interactions between student and teacher and between student and student, and the collaboration in learning that results from these interactions.

The main strength of web based delivery, in terms of content delivery, is the ability to present material non-sequentially. That is, rather than learning by reading page after page like in text book based learning, it is possible to structure information so that "students" learn by enquiring. This was seen as a very important attribute for professional training, where participants will be motivated, self-directed, and enter the course with a diverse range of skills and interests.

Another key attribute of web based delivery is that it is easily amenable to multi-media presentations. As such, we could incorporate video clips, where appropriate. Video was found to be very useful for adding powerful visual experiences to courses, such as plant visits, laboratory visits, and analytical methods.

In the period August 1998–November 1999, we developed two courses. We are currently developing another three. Figure 2 illustrates the design of one of the courses, and shows how the material and activities are structured. The courses developed were based on available content material (either text book or course notes). The educational design process to reconfigure the material to best exploit the attributes of the WWW was a very creative exercise. This is also the most fun step ! The major considerations were:

- present material in manageable "chunks";
- make navigation through the course simple; Students must always know where they are;
- students must learn by discovery; as such, problem based learning was employed so that students were encouraged to learn in order to solve real life problems;
- focus on the development of practical skills that people can use in their workplace;
- DO NOT dump lecture material onto the web!

The content design for this project acknowledged the importance of flexibility and quality and that participation and interaction (Kruh, & Murphy, 1990) were essential elements of the teaching – learning process. Moore (1989) distinguishes three types of interaction: learner ⇔ content, learner ⇔ instructor and learner ⇔ learner. He noted that while learner
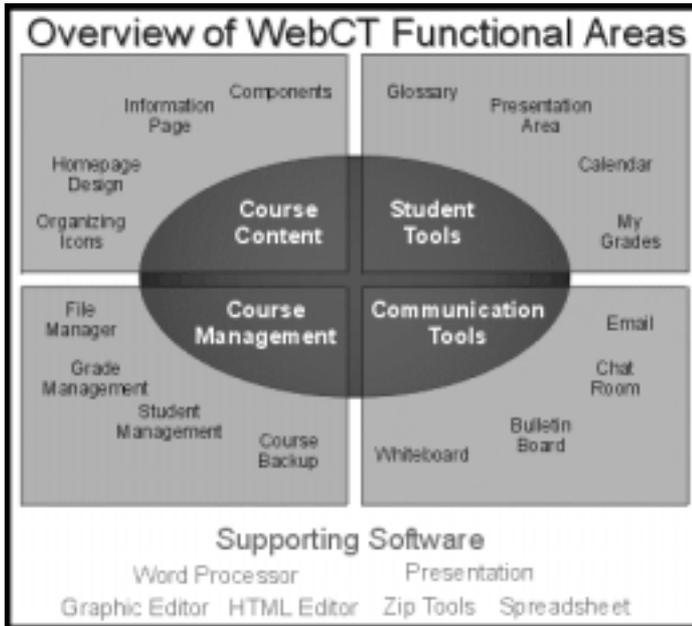
**Figure 1** WebCT Functional Areas (modified from Steve Leask, New Mexico State University)

⇔ instructor interaction is deemed traditional and desirable it will be learner⇔ learner interaction that will challenge our thinking and practice in the 1990s.

### Findings

The major findings from this case study are as follows

- The nature of the medium means that the courses must be developed by a team of developers, comprising the content expert, instructional designer and graphic artist.
- The up-front development cost of online courses is much greater than for conventional courses. However, it could be argued that as the market for the online course is much larger, this is a good investment. Of course, this remains to be seen.
- The courses must be developed around content that has international appeal.
- Unlike conventional training, the online courses have significant on-going cost in terms of providing technical and learning support (tutoring).
- Because the development is team based, and the instructional design quite complex, it is critical to use rigid quality assurance procedures and testing throughout the development process.
- Initial feedback indicates that online learning is an appropriate medium for water industry professionals:

   *"I thought the course was excellent and would definitely consider undertaking more courses offered in the same way."*
   *" exciting online training initiative."*

- The discussion fora, which are available in all courses, have been unsuccessful to date. Interestingly, whilst most "students" indicate a desire to participate, only a small minority post items for discussion.

   *"I was disappointed that the discussion forums were not used more, although I can't complain too much as I was one of the people who didn't make any contribution to the forum."*

131
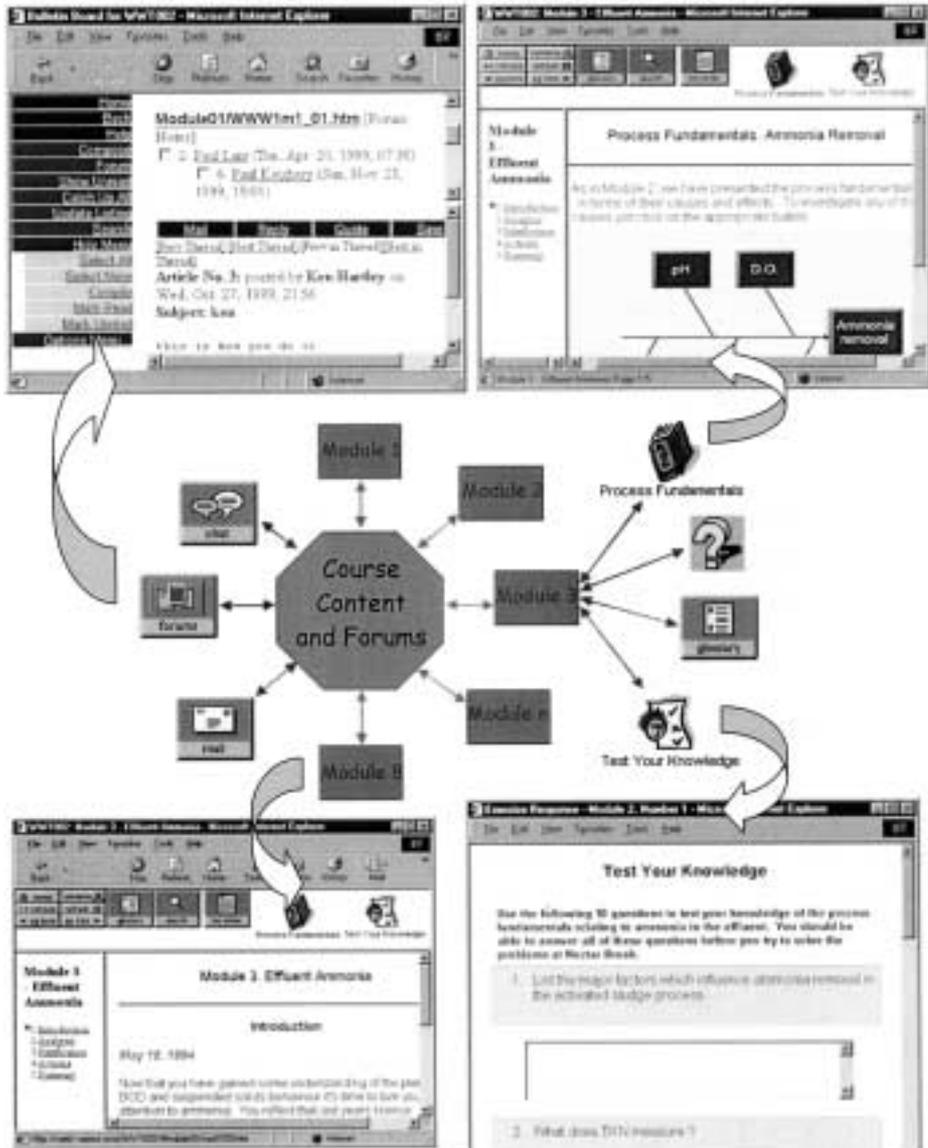
**Figure 2** Example course design. The courses are designed around a central hub, the "Course Content and Forums" page, through which the course notes, case study, problems and interactions can be accessed. The figure below shows how the material is connected. A few selected pages are shown to illustrate the page layouts and the student interface

As Palloff and Pratt (1999:6) assert, *"learning in the distance education environment cannot be passive. If students do not enter into the online classroom – do not post a contribution to the discussion – the instructor has no way of knowing if they have been there… Learning is an active process in which both the instructor and the learners must participate if it is to be successful"*. Participation in the discussion fora is something that will require further work in the course design, so that "students" must feel the need to participate. We are currently focussing on this issue.

• Problem based learning enables learning to be put into context. This has been evident in the course "Operating the Activated Sludge Process" which revolves around 2 years of

operation of a real plant. This is extremely powerful for providing skills that people can then directly use in their workplace.

*"… the use of a case study was excellent, particularly the way in which the concepts were developed and built upon."*

## Conclusions and vision for the future

Education institutions worldwide are confronting pedagogical revolution as they move from a print based institution to one that is part of the technological age. As Drucker (Tinkler *et al*., 1996:92) states:

"Technology itself matters less than the changes that it triggers in substance, content and focus of schooling and school. The technology will be very important; but primarily because it should force us to do new things rather than because it will enable us to do old things better."

The real question then is not what the software and hardware platforms will be in 2010 but what will education be like.

*What is the future for technology transfer and professional training in the water industry?* We will exist and work within an international community of professionals with daily sharing of information, and where learning is an integral component of the job. What will online training mean for the professionals in the water industry? Very simply, it will mean that more people will have access to a greater number of quality courses. For the employer, it will mean that staff training will be better, at no extra cost. Consider the benefits of online training:

- attendance without having to take time off work;
- no travel and accommodation costs – which are often significant;
- quick and easy access to courses at any time of day, as long as there is computer access;
- control of the learning situation – which means that the individual is able to progress at their own pace;
- networking with international colleagues, rather than local counterparts;
- interacting with world leaders.

The fact that distance is now not a barrier will also significantly impact on technology transfer in the water industry. It is no longer necessary to learn from the local expert, or benchmark against your local "rivals". The WWW will mean that we all learn from world leaders in specific fields, and that we all benchmark against world best practice.

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134