



UNIVERSITY  
OF WOLLONGONG  
AUSTRALIA

University of Wollongong  
Research Online

---

Faculty of Education - Papers (Archive)

Faculty of Social Sciences

---

2007

# Authentic learning on the web: Guidelines for course design

J. Herrington

*University of Wollongong, janherrington@gmail.com*

R. Oliver

*Edith Cowan University*

A. Herrington

*University of Wollongong, tonyh@uow.edu.au*

---

## Publication Details

This book chapter was originally published as Herrington, J, Oliver, R, & Herrington, A, Authentic learning on the web: Guidelines for course design, in Flexible learning in an information society, Khan, B (ed), Information Science Publishing, Hershey PA, 2007, 26-35.

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library:  
[research-pubs@uow.edu.au](mailto:research-pubs@uow.edu.au)

# Authentic learning on the web: Guidelines for course design

---

**Jan Herrington**

Faculty of Education, University of Wollongong, Australia

**Ron Oliver**

Faculty of Communication and Creative Industries, Edith Cowan University, Australia

**Anthony Herrington**

Faculty of Education, University of Wollongong, Australia

## **Abstract:**

Many teachers, when faced with the task of creating an online course, or adapting an existing course to an online format, are overwhelmed by both the affordances of the technology and by the need to create learning environments that do not simply replicate outmoded pedagogies in a new form. This chapter describes a useful framework for teachers and developers to guide the design of more authentic online learning environments. The chapter describes nine characteristics, derived largely from situated learning theory, and provides a practical and extended example of how the framework might be applied in the design of an online course.

In response to the growing influence of constructivism as a philosophical approach to learning, and a wide range of research studies investigating alternative models of teaching and learning over the last decade, many universities have experimented with the development of 'authentic' learning environments. How successful they have been in this quest is a subject of some debate. For instance, Gayeski (2005) has argued: 'Many of today's programs are no better than those from the early days of interactive video—in fact, they are worse. We still see too many textbooks or PowerPoint slides "ported" over to the web with a few links or silly questions added to make them "interactive"' (p. 98).

The challenge instructors face is to align university teaching and learning more substantially with the way learning is achieved in real-life settings, and to base instructional methods on recent theories of learning which reflect this shift, such as situated learning (Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1989; McLellan, 1996; Choi & Hannafin, 1995). Authentic approaches, as well as requiring students to *apply theory*, also allow students to *create theories* by starting with a realistic problem, and then developing their own knowledge within the practical situations in which the need for learning was created.

This chapter proposes nine critical characteristics of learning as a framework for the design of more authentic learning environments on the web. The elements are based on situated learning theory and other compatible research with particular emphasis on computer and web-based applications.

Design guidelines are presented below for teachers and designers as a framework for their instructional approach to course units on the web (cf. Herrington & Oliver, 2000; Oliver & Herrington, 2000; Herrington & Herrington, 2006). Learning environments would provide:

### **1. Authentic contexts that reflects the way the knowledge will be used in real life**

In designing online learning environments with authentic contexts, it is not sufficient to simply provide suitable examples from real-world situations to illustrate the concept or issue being taught. The context needs to be all-embracing, to provide the purpose and motivation for learning, and to provide a sustained and complex learning environment that can be explored at length. It needs to encompass a physical environment that reflects the way the knowledge will be used, and a large number of resources to sustain examination from different perspectives (Brown et al., 1989; Reeves & Reeves, 1997; Honebein, Duffy, & Fishman, 1993).

### **2. Authentic activities**

The learning environment needs to provide ill-defined activities which have real-world relevance, and which present complex tasks to be completed over a sustained period of time, rather than a series of shorter disconnected examples (Bransford, Vye, Kinzer, & Risko, 1990; Brown et al., 1989; Lebow & Wager, 1994; Reeves & Reeves, 1997). Resources to support these activities should be sufficiently diverse and non-directed to allow students the opportunity to discern relevant from irrelevant material (Young, 1993).

### **3. Access to expert performances and the modelling of processes**

Access to expert performances and the modelling of processes has its origins in the apprenticeship system of learning, where students and craftspeople learned new skills under the guidance of an expert (Collins et al., 1989). Important elements of expert performances are found in modern applications of the apprenticeship model such as internships (Jonassen, Mayes, & McAleese, 1993), and case-based learning (Riesbeck, 1996). An important aspect of expert performances is that it enables the learner to compare his or her performance or understanding to an expert in the field (Candy, Harri-Augstein, & Thomas, 1985; Collins, Brown, & Holum, 1991) and with others at various levels of expertise (Collins et al., 1989).

### **4. Multiple roles and perspectives**

In order for students to be able to investigate issues from more than a single perspective, it is important to enable and encourage students to explore different perspectives, and to 'criss cross' the learning environment repeatedly (Collins et al., 1989; Honebein et al., 1993).

### **5. Collaborative construction of knowledge**

The opportunity for users to collaborate in a 'community of learners' is an important design element, particularly for students who may be learning at a distance (Brown et al., 1989; Collins et al., 1989; Reeves & Reeves, 1997; Hooper, 1992). Collaboration has been defined as 'the mutual engagement of participants in a coordinated effort to solve a problem together' (Roschelle & Behrend, 1995). Forman and Cazden (1985) have suggested that true collaboration is not simply working together but also 'solving a problem or creating a product which could not have been completed independently' (p. 329).

## **6. Opportunities for reflection**

In order to provide opportunities for students to reflect on their learning, the online learning environment needs to provide an authentic context and task, as described earlier, to enable meaningful reflection. It also needs to provide non-linear organisation to enable students to readily return to any element of the site if desired (Boud, Keogh, & Walker, 1985; Collins & Brown, 1988; Kemmis, 1985).

## **7. Opportunities for articulation**

In order to produce a learning environment capable of providing opportunities for articulation, the tasks need to incorporate inherent—as opposed to constructed—opportunities for collaborative groups to engage in dialogue, and the public presentation of arguments to enable defence of a position (Collins et al., 1989; Edelson, Pea, & Gomez, 1996; Lave & Wenger, 1991). Bakhtin (1986) contends that ‘any true understanding is dialogic in nature’ (cited in Brown & Campione, 1994, p. 267). The implication is that the very process of articulating enables formation, awareness, development, and refinement of thought.

## **8. Coaching and scaffolding**

In order to accommodate a coaching and scaffolding role principally by the teacher (but also provided by other students), the online learning environments needs to provide collaborative learning, where more able partners can assist with scaffolding and coaching, as well as the means for the teacher to support learning via appropriate communication technologies (Collins et al., 1989; Greenfield, 1984).

## **9. Authentic assessment**

In order to provide integrated and authentic assessment of student learning, the online learning environment needs to provide the opportunity for students to be effective performers with acquired knowledge, and to craft products or performances in collaboration with others. It also requires the assessment to be seamlessly integrated with the activity, and to provide appropriate criteria for scoring varied products (Duchastel, 1997; Reeves & Okey, 1996; Herrington & Herrington, 1998; Wiggins, 1993).

### **Applying the model**

How might a teacher designing an online course apply such principles?

Imagine you are an instructor at a college or university and as part of your teaching duties, you have been asked to design and teach an introductory online course on the Internet and the World Wide Web. The principal aim of the course is to introduce students to a wide range of online technologies and to promote understanding of how they are used.

One way to approach this challenge would be to list 12-15 different web-based technologies (to correspond to the number of weeks in the semester), and create weekly online lectures, tasks and readings on each. Topics and tasks would become progressively more complex as the course progressed, and three major assignments would be required at evenly spaced intervals throughout the semester. Such a course would fulfil your obligations as a teacher, and no doubt you would have a lot of fun, and learn much while creating the course.

An alternative approach, based on the situated learning principles described above, would be more student centred, and designed around more authentic contexts and tasks.

The first crucial consideration is to create an *authentic context* that reflects the way the knowledge would be used in real life. This might involve the development of a story or scenario that is capable of carrying or instantiating all the concepts and skills associated with the course curriculum. Suppose you decide to focus your course on the creation of a web-page, how could you incorporate a range of web technologies in a realistic and pedagogically appropriate way? You decide to create a scenario around a family reunion, due to take place in the near future. Capturing the 'scene' will enable you to introduce students to web technologies in a realistic and meaningful way. Suppose that the family is large, and a special website is required, to mark the occasion and to focus all family members on the upcoming celebrations.

The next, and possibly most important decision for the design of your learning environment is to create *authentic activities* or tasks for students to complete as they study the course. Because you have established a meaningful and authentic context, design of authentic tasks is usually readily achieved. Because of real life university constraints that require you to set three assignments (rather than the one complex task that you are planning), you need to divide the creation of the family website into three stages, but you can incorporate this quite creatively into the scenario.

The three tasks you set are:

- Task 1:** A distant cousin has written to you, telling you about a planned family reunion, and asking if you would be able to develop a family website. The first stage of the site is required for a family reunion to be held in 5 weeks time. At the reunion, you need to show a fully functioning website which includes an appropriate interface, 6-10 main menu items with pages, links to outside sites and several family photographs. (Task due Week 5)
- Task 2:** The family reunion was a huge success and you and your cousin managed to acquire many useful resources to put onto the site. For example, people have sent old home movies on videotapes, audio recordings, recipes handed down from great-grandmother, war histories, information about famous and infamous ancestors, newspaper clippings, family trees, old letters, telegrams, slide transparencies and many more relevant existing internet links. Your next task is to include some of these items into your webpage. As a further consideration, the copyright of many of the items you receive is owned by outside parties (professional photographs, newspaper articles, television interviews, etc.), you need to include a page on your website explaining copyright regulations and how you have satisfied them. (Task due Week 10)
- Task 3:** The family is delighted at the progress of the web site and you are receiving many emails, phonecalls and letters almost on a daily basis. The family reunion has put many people in touch with each other after many years and they are keen to keep contact. You decide to add some communication elements to the site. First, you decide to survey the family to find out how they would like to communicate (create an online feedback form), then based on that feedback, you establish discussion and chat boards, and other communicative elements as required. (Task due final week of semester)

To create a product such as the one that is required through fulfilment of these tasks, students need *access to expert performances and the modelling of processes*. Who are the experts in this situation? Because of the nature of the tasks, experts can be thought of as those people who have successfully completed this kind of task before. In creating the learning environment, you could give students access to other family websites and the methods that have been used to create such

sites. As instructor, you can model the process of developing a website yourself in an online tutorial. Students have the capacity to compare themselves to others in varying stages of expertise.

In any complex learning environment, a single perspective such as that offered through a text book or the instructor's online 'lectures' is insufficient to reflect the authentic nature of the task. It is important to provide the kinds of *multiple roles and perspectives* that are available in real life challenges. While a single textbook on creating webpages would be useful and informative, it is insufficient. As noted by Spiro, Feltovich, Jacobson and Coulson (1991), instruction that puts forward a single, 'correct' interpretation or method, is not false, but inadequate. The affordances of the web enable alternative perspectives to be readily accessed through directed resources or search engines, and online readings or specific databases can be targeted for particular tasks.

The authentic tasks in the learning environment lend themselves to individual endeavour, where students could use their own family histories to resource the site. The nature of university assessment also means that there is often a limiting of collaboration to a percentage of assessable tasks. Nevertheless, this learning environment allows *collaborative construction of knowledge* through construction of tools that could be used jointly, or through collaboration on the entire course through the creation of a fictitious or historical family site.

By allowing students to choose their own pathways through the tasks and resources, rather than providing a single step-by-step approach, the learning environment provides many *opportunities for reflection*. The social nature of the learning environment could be supported by discussion forums, web conferences and chats (e.g., on different aspects of the task, such as uploading, interface design, authoring tools etc.,) which not only allow active reflection, but also provide *opportunities for articulation* of students' growing understanding of their work. Lave and Wenger (1991) have argued that being able to speak the vocabulary and tell the stories of a culture of practice is fundamental to learning, but many web-based learning environments allow the knowledge to remain tacit. Formulating arguments or questions, and using the vocabulary of the discipline area strengthen students' professional role in their learning.

The role of the instructor changes in authentic learning environments *to coaching and scaffolding*—less the 'sage on the stage' and more 'guide on the side' (Laurel, 1993), or 'expert learner' along with novice learners in a community of learners (Carroll, 2000, cited in Sherry & Gibson, 2002). Rather than simplifying topics by breaking them down into their component parts, Perkins (1991) suggested temptation to over should be resisted, and instead instructors should search for new ways to provide appropriate scaffolding and support. There is no longer a need to focus on content and information, or on direct instruction about how to build a webpage, as these are available through rich resources and searching capacity within the learning environment, but the instructor is now able to focus on support for students at the metacognitive level.

Instead of essays, quizzes or examinations, the tasks would be assessed using integrated and *authentic assessment*. The activities, and the website they produce, form the entire focus of the course, and it is on those activities and product that students would be assessed. Students working in this example learning environment would have a goal, and emerge with a real and tangible product. They would become, as noted by Wiggins (1993) effective performers with acquired knowledge, and able to craft polished performances or products.

## Conclusion

The alternative model described in this paper draws widely upon the philosophy of constructivism, and on the extensive literature base on situated learning and other theory, and

comprises a practical framework for teachers and designers to implement as they begin to work on their online courses. It reflects the growing trends in higher education towards pedagogy and curriculum that reflects vocational needs and develops students' lifelong learning skills (Tynjälä, Välimaa, & Sarja, 2003).

Many teachers, when faced with the task of creating an online course or adapting an existing course to an online format, are overwhelmed by both the affordances of the technology and by the need to create learning environments that do not simply replicate outmoded pedagogies in a new form. There are now growing numbers of online materials being developed based around the notions of authenticity and relevance to the workplace and real world settings, such as in literature (Fitzsimmons, 2006), in business writing (Pennell, Durham, Orzog & Spark, 1997), in physical activity fitness and health (Rice, Owies, Campbell, Snow, Owen, & Holt, 1999), in evaluation (Agostinho, 2006), in literacy education (Ferry et al., 2006), in mechanical engineering (Bullen & Karri, 2002), in transition from school to university (Hunt, Kershaw & Seddon, 2002), in Indigenous education (Marshall, Northcote & Lenoy, 2001), in multimedia design (Bennett, Harper & Hedberg, 2001), and in architecture (Challis, 2002). The model described here provides a useful framework for teachers and developers to guide the design of online courses in a way that may promote meaningful and transferable learning.

## References

- Agostinho, S. (2006). Using characters in online simulated environments to guide authentic tasks. In A. Herrington & J. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 88-95). Hershey, PA: Information Science Publishing.
- Bennett, S., Harper, B., & Hedberg, J. (2001). Designing real-life cases to support authentic design activities. In G. Kennedy, M. Keppell, C. McNaught, & T. Petrovic (Eds.), *Meeting at the Crossroads. Proceedings of the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 73-81). Melbourne: Biomedical Multimedia Unit, University of Melbourne.
- Bullen, F., & Karri, V. (2002). Design and construction of a Formula SAE racecar in a teaching and research framework. In A. Goody, J. Herrington, & M. Northcote (Eds.), *Quality conversations: Research and Development in Higher Education, Volume 25* (pp. 74-82). Jamison, ACT: HERDSA.
- Challis, D. (2002). Integrating the conceptual and practice worlds: A case study from architecture. In A. Goody, J. Herrington, & M. Northcote (Eds.), *Quality conversations: Research and Development in Higher Education, Volume 25* (pp. 106-113). Jamison, ACT: HERDSA.
- Boud, D., Keogh, R., & Walker, D. (1985). Promoting reflection in learning: A model. In D. Boud & R. Keogh & D. Walker (Eds.), *Reflection: Turning experience into learning* (pp. 18-40). London: Kogan Page.
- Bransford, J.D., Vye, N., Kinzer, C., & Risko, V. (1990). Teaching thinking and content knowledge: Toward an integrated approach. In B.F. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 381-413). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Brown, A.L., & Campione, J.C. (1994). Guided discovery in a community of learners. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 229-270). Cambridge, MA: MIT Press.
- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Candy, P., Harri-Augstein, S., & Thomas, L. (1985). Reflection and the self-organized learner: A model for learning conversations. In D. Boud & R. Keogh & D. Walker (Eds.), *Reflection: Turning experience into learning* (pp. 100-116). London: Kogan Page.
- Choi, J., & Hannafin, M. (1995). Situated cognition and learning environments: Roles, structures and implications for design. *Educational Technology Research and Development*, 43(2), 53-69.
- Collins, A., & Brown, J.S. (1988). The computer as a tool for learning through reflection. In H. Mandl & A. Lesgold (Eds.), *Learning issues for intelligent tutoring systems* (pp. 1-18). New York: Springer-Verlag.
- Collins, A., Brown, J.S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, 15(3), 6-11, 38-46.

- Collins, A., Brown, J.S., & Newman, S.E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L.B. Resnick (Ed.), *Knowing, learning and instruction: Essays in honour of Robert Glaser* (pp. 453-494). Hillsdale, NJ: LEA.
- Duchastel, P.C. (1997). A Web-based model for for university instruction. *Journal of Educational Technology Systems*, 25(3), 221-228.
- Edelson, D.C., Pea, R.D., & Gomez, L. (1996). Constructivism in the collaboratory. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 151-164). Englewood Cliffs, NJ: Educational Technology Publications.
- Ferry, B., Kervin, L., Puglisi, S., Cambourne, B., Turbill, J., Jonassen, D., & Hedberg, J. (2006). Online classroom simulation: Using a virtual classroom to support pre-service teacher thinking. In A. Herrington & J. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 135-161). Hershey, PA: Information Science Publishing.
- Fitzsimmons, J. (2006). Speaking snake: Authentic learning and the study of literature. In A. Herrington & J. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 162-171). Hershey, PA: Information Science Publishing.
- Forman, E.A., & Cazden, C.B. (1985). Exploring Vygotskian perspectives in education: The cognitive value of peer interaction. In J.V. Wertsch (Ed.), *Culture, communication and cognition: Vygotskian perspectives* (pp. 323-347). Cambridge: Cambridge University Press.
- Gayeski, D. (2005). From stir fried circuit boards to streaming video: Perspectives from an interactive media pioneer. In G. Kearsley (Ed.), *Online learning: Personal reflections on the transformation of education* (pp. 92-100). Englewood Cliffs, NJ: Educational Technology Publications.
- Greenfield, P.M. (1984). A theory of the teacher in the learning activities of everyday life. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: Its development in social context* (pp. 117-138). Cambridge, MA: Harvard University Press.
- Herrington, A. & Herrington, J., (2006). What is an authentic learning environment? In A. Herrington, & J. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 1-13). Hershey, PA: Information Science Publishing.
- Herrington, J., & Herrington, A. (1998). Authentic assessment and multimedia: How university students respond to a model of authentic assessment. *Higher Education Research and Development*, 17(3), 305-322.
- Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, 48(3), 23-48.
- Honebein, P.C., Duffy, T.M., & Fishman, B.J. (1993). Constructivism and the design of learning environments: Context and authentic activities for learning. In T.M. Duffy & J. Lowyck & D.H. Jonassen (Eds.), *Designing environments for constructive learning* (pp. 87-108). Heidelberg: Springer-Verlag.
- Hooper, S. (1992). Cooperative learning and computer-based design. *Educational Technology Research and Development*, 40(3), 21-38.
- Jonassen, D., Mayes, T., & McAleese, R. (1993). A manifesto for a constructivist approach to uses of technology in higher education. In T.M. Duffy & J. Lowyck & D.H. Jonassen (Eds.), *Designing environments for constructive learning* (pp. 231-247). Heidelberg: Springer-Verlag.
- Kemmis, S. (1985). Action research and the politics of reflection. In D. Boud & R. Keogh & D. Walker (Eds.), *Reflection: Turning experience into learning* (pp. 139-163). London: Kogan Page.
- Laurel, B. (1993). *Computers as theatre*. Reading, MA: Addison-Wesley.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Lebow, D., & Wager, W.W. (1994). Authentic activity as a model for appropriate learning activity: Implications for emerging instructional technologies. *Canadian Journal of Educational Communication*, 23(3), 231-144.
- Marshall, L., Northcote, M., & Lenoy, M. (2001). Design influences in the creation of an online mathematics unit for indigenous adults. In G. Kennedy, M. Keppell, C. McNaught , & T. Petrovic (Eds.), *Meeting at the Crossroads. Proceedings of the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 113-116). Melbourne: University of Melbourne.
- McLellan, H. (Ed.). (1996). *Situated learning perspectives*. Englewood Cliffs, NJ: Educational Technology Publications.

- Oliver, R., & Herrington, J. (2000). Using situated learning as a design strategy for Web-based learning. In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education* (pp. 178-191). Hershey, PA: Idea Group Publishing.
- Pennell, R., Durham, M., Ozog, M., & Spark, A. (1997). Writing in context: Situated learning on the web. In R. Kevill & R. Oliver & R. Phillips (Eds.), *What works and why: Proceedings of the 14th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 463-469). Perth, WA: Curtin University.
- Perkins, D.N. (1991). What constructivism demands of the learner. *Educational Technology*, 31(8), 19-21.
- Reeves, T.C., & Okey, J.R. (1996). Alternative assessment for constructivist learning environments. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 191-202). Englewood Cliffs, NJ: Educational Technology Publications.
- Reeves, T.C., & Reeves, P.M. (1997). Effective dimensions of interactive learning on the World Wide Web. In B.H. Khan (Ed.), *Web-based instruction* (pp. 59-66). Englewood Cliffs, New Jersey: Educational Technology Publications.
- Rice, M., Owies, D., Campbell, A., Snow, R., Owen, N., & Holt, D. (1999). V-Lab: A virtual laboratory for teaching introductory concepts and methods of physical fitness and function. *Australian Journal of Educational Technology*, 15(2), 188-206.
- Riesbeck, C.K. (1996). Case-based teaching and constructivism: Carpenters and tools. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 49-61). Englewood Cliffs, NJ: Educational Technology Publications.
- Roschelle, J., & Behrend, S.D. (1995). The construction of shared knowledge in collaborative problem solving. In C. O'Malley (Ed.), *Computer supported collaborative learning*. New York: Springer-Verlag.
- Sherry, L., & Gibson, D. (2002). The path to teacher leadership in educational technology. *Contemporary Issues in Technology and Teacher Education* [Online serial], 2(2), 178-203.
- Spiro, R.J., Feltovich, P.J., Jacobson, M.J., & Coulson, R.L. (1991b). Knowledge representation, content specification, and the development of skill in situation-specific knowledge assembly: Some constructivist issues as they relate to cognitive flexibility theory and hypertext. *Educational Technology*, 31(9), 22-25.
- Tynjälä, P., Välimaa, J. & Sarja, A. (2003). Pedagogical perspectives on the relationships between higher education and working life. *Higher Education*, 46(2), 147-166.
- Wiggins, G. (1993). Assessing student performance: *Exploring the purpose and limits of testing*. San Francisco: Jossey-Bass.

### Author information

Dr Jan Herrington  
 Faculty of Education  
 University of Wollongong  
 Northfields Avenue, Wollongong, New South Wales, Australia  
 Phone: +618 4221 4277 Fax: +618 4221 3892 Email: [Jan.Herrington@uow.edu.au](mailto:Jan.Herrington@uow.edu.au)  
 Web: <http://www.uow.edu.au/educ/>

Dr Ron Oliver  
 Professor of Interactive Multimedia  
 School of Communications and Multimedia  
 Edith Cowan University  
 Bradford Street, Mt Lawley, Western Australia, 6050  
 Phone: +618 9370 6372 Fax: +618 9370 6668 Email: [r.oliver@ecu.edu.au](mailto:r.oliver@ecu.edu.au)  
 Web: <http://elrond.scam.ecu.edu.au/oliver>

Dr Anthony Herrington  
 Faculty of Education  
 University of Wollongong  
 Northfields Avenue, Wollongong, New South Wales, Australia

Phone: +618 4221 4643 Fax: +618 4221 3892 Email: [Tony\\_Herrington@uow.edu.au](mailto:Tony_Herrington@uow.edu.au)  
Web: <http://www.uow.edu.au/educ/>