

Engaging Learners in Complex, Authentic Contexts: Instructional Design for the Web

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Abstract

The old adage, 'We teach as we have been taught' places a great deal of responsibility on the current generation of online teachers, to teach in a manner that is worth replicating. This paper describes the development of a course in online teaching and learning, available only in online mode, that models the approach to teaching and learning that is advocated in the units. The course is not only an end in itself—it is also a means to an end, providing the necessary skills to enable students to continue to learn and adapt with new technologies and new learning approaches.

The paper describes the instructional design process of developing units for web-delivery that are based on complex and authentic contexts. There is no attempt to simplify instructional sequences, or to structure the learning environment to progress from simple to complex. Instead, the nomination of authentic context, authentic task and integrated assessment guide the development of the learning environment. The paper describes the specific instructional design process adopted, together with the tools and planning resources used for the development of a *Graduate Certificate in Online Teaching and Learning* to be offered by Edith Cowan University.

Designing effective learning environments

There has been a trend in recent years to question the capacity of some of the conventional modes of delivery of tertiary education to bring about meaningful learning. Learning is defined broadly as a change in one's conceptual understanding (e.g., Ramsden, 1992) and it cannot easily be achieved effectively in settings where learners are passive participants in a teacher-centred environment. In recent years, a constructivist view of learning has become popular for describing how learning takes place. Constructivism holds that learners learn through the active construction of knowledge. Learners' prior knowledge and their predisposition to learning are integral parts of the constructivist learning theory.

In response to a heightened understanding of how learners learn, we are now seeing changes made to the nature of the teaching and learning environments across all sectors of education. A number of writers have sought to describe the changes which are now flowing through education systems worldwide in response to a growing awareness and understanding of how learning occurs. Many of the changes are manifested in technology-based learning settings and some of the more characteristic aspects of the changing learning environment include:

- A move away from specified content to learn to specified learning outcomes (e.g., Duchastel, 1996)
- An acceptance of diversity in outcomes among learners rather than the goal of common results (e.g., Duchastel, 1996; Wild & Quinn, 1997)
- A focus on the process of learning as well as the product (e.g., Berge, 1998; Barron, 1998)
- Evaluation of outcomes in practical contexts, and as tasks, as distinct from discrete knowledge (Fisher, 2000)
- An acceptance of the role of social cognition in learning (e.g., Vygotsky, 1978).

The general nature of this evolution involves a movement away from teacher-centred learning to environments where the primacy rests with the learner. The nature of the learning moves from abstracted knowledge based learning to learning that reflects context and usage of the information in appropriate ways. The resulting settings are those which encourage and support deeper levels of learning as distinct from the surface levels that many of today's educators would have been accustomed when they were students in school and university. A feature that is becoming generally accepted as critical to success in contemporary learning settings is that of authenticity.

Authentic context

Authentic context has been widely discussed in the literature, and there is a wealth of research and writing devoted to assessing its value in an educational context. Jonassen (1991) contended that context provides 'episodic memory cues that make the acquired knowledge more memorable' (p. 37). Within learning environments, Rogoff (1984) defined context as 'the problem's physical and conceptual structure as well as the purpose of the activity and the social milieu in which it is embedded' (p. 2). McLellan (1994) has pointed out that context in learning environments can be provided by: the actual work setting, a highly realistic surrogate of the work environment, or an anchoring context such as a video or multimedia program. Many researchers and theorists argue that the natural complexity of many real-life situations is counterproductive to efficient learning. Cunningham (1984), for example, contends that simulations that are too realistic interfere with the underlying educational objectives:

In constructing the role of police officer, it may not be necessary to include the real-life constraints of traffic jams, panic, job dissatisfaction and the size of the police department ... what could be a learning exercise becomes an effort to understand or administer a complex exercise. (p. 225)

Similarly, Sandberg and Wielinga (1992) believe that such an approach can lead to exceptionally high expectations, and ultimately be counterproductive, with students simply 'overwhelmed by the complexities of the field' (p. 136). Reigeluth and Schwartz (1989) recommend that the best instructional design for computer-based simulations is one that begins with low fidelity and progresses in fidelity and complexity as the instruction proceeds. These approaches concur with the systems model of instructional design which specifies that the instructional sequence should progress from simple to complex (Dick, 1991; Dick & Carey, 1990; Gagné, Briggs, & Wager, 1992).

However, the tendency to simplify complex cases and situations, particularly in the initial instruction, can impede the later acquisition of more complex understandings (Spiro, Feltovich, Jacobson, & Coulson, 1991b). Spiro, Vispoel, Schmitz, Samarapungavan and Boerger (1987) argue that examples and cases must be studied as they naturally occur 'not as stripped down "textbook examples" that conveniently illustrate some principle' (p. 181). Errors of oversimplification can also compound each other. For example, Feltovich, Spiro and Coulson (1989, cited in Spiro et al., 1991b) have identified more than twelve serious misconceptions held by the majority of medical students they tested, the origins of which they were able to trace to oversimplification of the initial presentation of the concepts.

Honebein, Duffy and Fishman (1993) argue that it is not necessary to simplify learning environments to enhance learning, and that designing realistic levels of complexity in a learning environment can help to make learning easier. They give the example of a study with students who disliked fractions and who found them difficult to learn. These students were asked to design computer software which would teach fractions to students one year younger than themselves. This meant that the students had to learn what was important about fractions before they could teach it to others. Honebein, et al. (1993) note that: 'The students had learned not only about fractions but also about software design and instructional design ... and were so absorbed by the challenges ... they practically 'forgot' that they were also learning about fractions ... It really can be easier to learn more! (p. 95)

Spiro et al. (1987) also criticise the tendency to oversimplify in learning environments. They accuse such practice as motivated by convenience rather than effectiveness of the learning environment:

Simplification of complex subject matter makes it easier for teachers to teach, for students to take notes and prepare for their tests, for test-givers to construct and grade tests, and for authors to write texts. The result is a massive "conspiracy of convenience" (p. 180).

Is it ever appropriate to simplify contexts in education? Spiro et al. (1991a) concede that simplification may be appropriate when two essential conditions are met: the learning is at an introductory level and it is conducted in a well-structured domain. However, Honebein et al. (1993) argue against oversimplification at any level. They recommend that the complexity of the learning environment should reflect the complexity of the environment expected in the final performance. The aim should therefore be to assist the learner in the functioning in the environment rather than to simplify it. Research into cognitive load (c.f. Jih & Reeves, 1992;

Oren, 1990; Stoney & Wild, 1997) is providing guidelines on how this might be achieved. Oren (1990) points out that excessive demands on learners can be reduced by modifying the design of a multimedia program while retaining complexity, for example, by limiting the number of options immediately available for novice users but making them accessible to more advanced users. An example of how this might be achieved in an authentic manner is given by Maor and Phillips (1996) who describe the development of a software package on *Birds of Antarctica*. In order to maintain a complex learning environment, but to avoid an overwhelming inundation of data, students using the program assume a role on board a ship as 'junior researchers'. As their ability in dealing with the instruments and interpretation grows, they move to become 'senior researchers' with access to increasingly more sophisticated variables and data.

Young and McNeese (1993) describe attributes of authentic situations or contexts that include: complex contexts that provide critical perceptual and rich situational affordances; group problem solving which requires the social construction of knowledge; ill-structured content requiring generation of relevant subproblems; and extended time frames for problems which cannot be solved in a few minutes or even a few hours (pp. 825-826). They argue that even contrived situations are 'realistic' if they maintain such properties. Similarly, the Cognition and Technology Group at Vanderbilt (1990) discuss the degree to which 'anchored instruction' is authentic. Their projects are authentic on two levels: authenticity of objects and data in the settings, and authenticity of tasks the students perform (p. 7).

Several implications for practice can be drawn from the research into authentic context. In designing learning environments with authentic contexts, it is not enough to simply provide suitable examples from real-world situations to illustrate the concept or issue being taught. The context must be all-embracing and provide a sustained and complex learning environment that can be explored at length. More specifically, a learning environment that purports to use an authentic context needs to provide elements such as:

- a physical environment which reflects the way the knowledge will ultimately be used (Brown, Collins, & Duguid, 1989; Collins, 1988; Young & McNeese, 1993)
- a design to preserve the complexity of the real-life setting with 'rich situational affordances' (Brown et al., 1989; Collins, 1988; Young & McNeese, 1993)
- complex tasks to be investigated by students over a sustained period of time (Bransford, Vye, Kinzer, & Risko, 1990; Jonassen, 1991; Savery & Duffy, 1996)
- a large number of resources to enable sustained examination from a number of different perspectives (Brown et al., 1989; Collins, 1988; Spiro et al., 1987; Young & McNeese, 1993)
- an editorial policy which makes no attempt to fragment or simplify the environment (Brown et al., 1989; Honebein et al., 1993; Spiro et al., 1987; Young & McNeese, 1993)
- the opportunity to collaborate (Lebow & Wager, 1994; Young & McNeese, 1993)
- activities which are seamlessly integrated with the assessment (Herrington & Herrington, 1998; Reeves & Okey, 1996).

These elements, and others derived from the extensive literature base on constructivist learning environments (described in Herrington & Oliver, in press; Oliver & Herrington, 2000) were used in the instructional design of four units comprising a Graduate Certificate in On-Line Teaching and Learning.

Graduate Certificate in On-Line Teaching and Learning

The purpose of developing this course was to provide an avenue for teachers of adult learners wishing to develop skills and understanding in the design and use of on-line learning technologies. The aim of the course is to develop teachers who are able to design and plan effective learning environments using on-line technologies, and focuses on developing teachers' abilities to design effective learning environments using contemporary communications technologies.

The course enables them to learn about: the technologies that can be used to support and deliver on-line learning; the strategies by which these technologies can be made to motivate and enhance student learning; contemporary instructional design guidelines for on-line environments; and the measures by which the quality of on-line learning can be measured and assessed.

The design of the units is characterised by strongly student-centred environments, with authentic and contextualised learning tasks in collaborative settings, using integrated assessment strategies and learning scaffolded by strong teacher support. The course consists of four units: *On-Line Teaching and Learning*, *Resources for Teaching and Learning On-Line*, *Designing Effective On-Line Learning Environments*, and an *On-Line Learning Project Unit*. The units are designed to be delivered on-line and to showcase a variety of effective on-line teaching and learning strategies.

Designing the first unit: On-Line Teaching and Learning

The design of the first unit of the course involved a process quite remote from the task analysis and systematic approach required by the systems approach to instructional design (e.g., Dick & Carey, 1990; Gagné, Briggs and Wager, 1992). The first unit entitled *Online teaching and learning* was designed to explore issues associated with the creation of effective learning environments for open and flexible delivery. Theories of adult learning and cognition, constructivism as a learning philosophy, learning styles, and self-regulated learning would all be investigated in completing the unit. Students would also explore the broader issues of flexible and open learning, and current trends and practices in developing and delivering courses for on-line delivery.

Rather than analysing unit objectives and breaking subject areas into tasks and sub-tasks to simplify the content, the context was designed to be complex and authentic. Instead of focusing on the content to be covered in the unit, the activity itself became the main organising structure for the entire unit, and the content became resources to be used to solve the problem presented in the activity.

The unit is based upon a task where the student takes on a role in a fictitious scenario set in a university. The context is one where the student is required to evaluate a website that has been set up as an exemplar for a consortium of universities planning to develop a joint online course. The student will then, in collaboration with other students ('representatives from the other universities') recommend a set of guidelines for website development, and then redesign the original website according to those guidelines. While comprising a single sustained task, the activity can be evaluated at three points.

In order to complete the activity, students need to draw upon a wide variety of resources which can be accessed from the website. The interface design, rather than text-based hyperlinks, provides a metaphor for the context, in this case a well-equipped office. Students are able to access resources by clicking on appropriate object in the interface, such as books, files, computers, and so on. An example of such an ‘ecological’ interface, based on metaphors rather than hyperlinks or buttons is given in Figure 1.

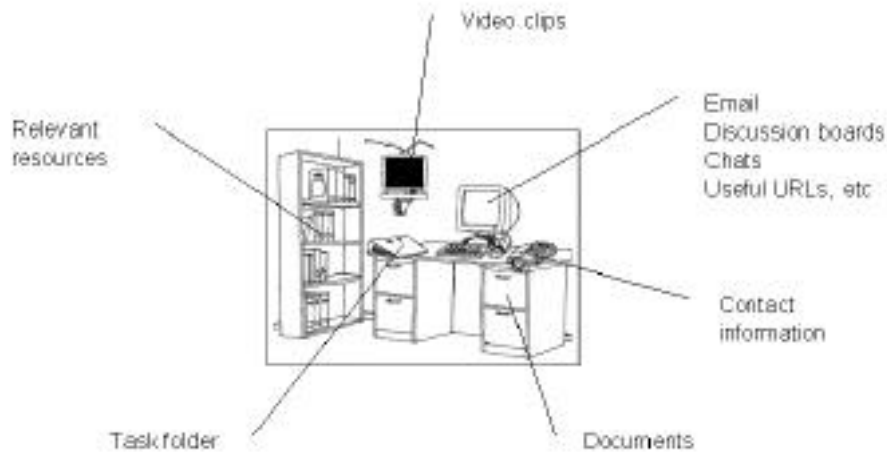


Figure 1: Metaphors for resources to be accessed within online units (example design)

The tasks set for students are usually collaborative, and students use communication technologies, principally email and discussion boards, to plan and complete joint products. The teacher’s role is a supporting one, assisting students through the discussion boards, email and by responding to issues and problems in reflective journals completed individually by students. Documents and other material designed to support students as they complete the task prepared by the lecturer and other support personnel will be available in one of the filing cabinet drawers.

Table 1 shows the planning document used to plan and monitor the development of the online unit. The elements that comprise the unit are generally accessible from the main unit interface, and each is planned to ensure that students have sufficient resources and support to be able to complete the activity without feeling overwhelmed by the complexity of the task. Planning for each of the elements is given in Table 1 and described below:

Unit plan

A Unit Plan document advises students on the unit aims and scope, and the resources and supports available to them. The Unit Plan exists outside the boundaries of the scenario to describe to students the way the unit will be conducted. Students are given advice on the nature of the task, their role in the unit and how to collaborate at a distance. They are also provided with all the administrative and general information they need to complete the unit.

Relevant course aims

Course aims and objectives exist for the unit and these are incorporated into the planning document to check that each aim can be met by the activities proposed.

Authentic context

An appropriate and authentic context needs to be designed for each unit, which is in keeping with the subject matter and resembles the kind of workplace or setting where the knowledge would be applied in real life. For example, if the unit was one on marine biology an appropriate context could be a coastal environment, if the unit comprised pre-primary teaching strategies the context could be a classroom, business management could be a shop, and so on. In this case, the unit requires access to online resources and communication, so an appropriate setting contains suitable equipment and technology to teach a unit online.

Authentic problem description (activity)

The problem needs to be sustained and realistic, with sufficient complexity to require the student to research a wide literature base and other resources. In this case, a scenario is developed involving a request from a head of department for the student to evaluate a website. The memo is provided in a realistic way, together with another more abrupt memo to give another perspective. No other description or listing of tasks is provided for students to simplify the process, ensuring that their first task is to plan the response and divide the task into subtasks. The students complete the first part of the assignment individually (but with support provided by the lecturer and other students through the discussion board), and the remaining parts of the activity are completed collaboratively.

Collaboration, coaching and communication tools

The manner in which students collaborate as they complete the unit tasks needs to be planned to ensure that contact is not confined to casual or ad hoc arrangements. The requirement to collaborate on activities ensures that students work purposely towards the completion of a polished product. However, discussion boards and other communication technologies ensure that students can support each other in their efforts to use the technology productively and well. Experience has shown that students are more than willing to provide assistance and to help each other in these circumstances.

Support provided by tutor

As many online units are taught by teachers other than those involved in the design, the instructional design plan provides specific advice on the tutor's role throughout the unit. This includes procedures required to introduce students to the unit, such as instructions on how to connect to the unit, how to use email and other methods to communicate, and advice on studying an activity-based unit online.


Assessment



Assessment of the unit is fully integrated with the activity, and decisions need to be made on issues such as whether the finished product will be completed collaboratively or individually (with support), whether it will be published publicly (or sent privately to the tutor), whether it will be peer reviewed, and the criteria that will be used for assessment.

Instructional design plan

In order to ensure that each of these elements could be used to guide the design and development of the online learning environment, a matrix was drawn up as a functional working document for the instructional design of each activity. Each of the elements was listed in the first column, followed in the second column with ideas on how that element might be implemented. Finally in the last column, a list of actions or resources that needed to be developed was prepared, effectively setting out all the tasks that need to be done to successfully complete the design and development of the unit, and offer it online.

Table 1: Instructional design planning sheet for Activity 1 *On-Line Teaching and Learning*

Unit element	Description/ideas	Resources to be developed/action
Unit plan	A Unit Plan to advise students on the unit aims and scope, the resources and supports available, the administrative and general information they need to complete the unit.	<ul style="list-style-type: none"> • Prepare Plan as print-based document
Relevant course objectives	<ul style="list-style-type: none"> • Employ contemporary learning theories in the design of flexible and open on-line courses; • Assess the learning potential of on-line activities and exercises; • Understand the limitations and opportunities of on-line technologies for teaching and learning; 	<ul style="list-style-type: none"> • Ensure objectives enabled by task and resources
Authentic context (interface and environment)	<p>University setting, well-equipped office. Student's role is to assume the identity of a university academic asked to evaluate a website. Interface needs to provide access to: the task (folder on desk), communication technologies (the computer on desk), databases of resources (books and journals), reflective journal (journal on bookcase), websites and online resources (computer on shelves), supporting documents and guidelines (desk drawers) etc.</p> <p>Preliminary sketch of interface:</p>  <p>Metaphors will extend to one more level beyond the main interface, for example, if you click on the folder on the desk the next screen will be the inside of the folder with the tasks tabbed with index tabs.</p>	<ul style="list-style-type: none"> • Prepare primary interface, and second level designs

Unit element	Description/ideas	Resources to be developed/action
<p>Authentic problem description (activity)</p>	<p>Memo or letter to student from Head of Department describing the development of an online learning unit. The unit is the first of a complete course to be developed with a substantial grant from the government, in collaboration with several other universities. The first unit has been developed, and the task is to evaluate the site (with guidelines provided in the memo).</p> <p>Another memo or letter outlines the concerns expressed about the site by the Dean of a Faculty where the main criticism is that the site merely transposes an existing print-based unit onto the web without taking into account the strengths of the medium. A comment is included that new learning theory has provided us with principles that could be used to guide the development of online units, and that these principles should be employed to evaluate the site.</p> <div style="display: flex; justify-content: space-around;">   </div> <p>Resources to be defined and located to provide examples of expert performance together with multiple perspectives and ideas. Other resources, particularly supporting material needs to be specifically developed.</p>	<ul style="list-style-type: none"> • Write memo to student • Write memo from Dean • Prepare 'inadequate' online unit • Find, and establish links to, web resources relevant theory • Prepare supporting documents and resources to guide students as they complete the activity • Research appropriate texts, e.g. Bates (2000). <i>Managing technological change</i>. Merriam & Cafarella, (1998). <i>Learning in Adulthood</i>. • Locate appropriate journal resources, e.g., AJET, BJET, ETR&D, Journal of Interactive Learning Research, Journal of Educational Multimedia/Hypermedia • Locate appropriate listserves and other online resources.
<p>Collaboration, coaching and communication tools</p>	<ul style="list-style-type: none"> • Email (for communicating in small groups) • Discussion boards • Bulletin board • Online reflective journal (student to tutor) <p>(As this is an individual task, support will be provided through online discussion about the challenges, resources available and processes of evaluating such a website,)</p>	<ul style="list-style-type: none"> • Establish discussion boards, bulletin board, online reflective journal and other communication elements
<p>Support provided by tutor</p>	<ul style="list-style-type: none"> • Introductory email welcoming students to unit. • Email all students in first week introducing unit, advising how to group, etc advise students of discussion boards and how to contribute • Monitoring of discussion boards and timely contributions • Regular contributions to bulletin board • Provide comment on students' reflective journal entries if appropriate 	<ul style="list-style-type: none"> • Prepare introductory email message • Prepare example letters for tutors
<p>Assessment</p>	<ul style="list-style-type: none"> • Students assessed on evaluation of online unit. • Evaluation criteria established in memo. • 30%, due Week 5 	

Another two matrices have been developed to guide the design of the remaining parts of the activity. These parts of the activity are completed collaboratively by students. The second part, requires the students to communicate with other members of the consortium (two other students) to produce a list of guidelines for the development of an online unit based upon a relevant theory. The guidelines need to be well-researched and attributed to appropriate literature. Students post a polished final product on the discussion board, and they are assessed by the tutor and other students acting as the 'grant holders'. In the final part, the students collaboratively redesign the website according to their own guidelines. Students need to design the learning elements of the site, not the graphic elements or programming. They need to produce activities, collaborative and coaching/scaffolding support, assessment, and relevant recommended resources for learning.

Conclusion

The design requirements for the unit described here presented a challenge for the authors and developers, which was not readily solved by applying a systems model of instructional design. Determining a fixed sequence of instruction was suited to neither the online learning environment nor the diversity of outcomes enabled by the activity-based approach. Instead, an attempt has been made to base decisions on recent learning theory and research, with a particular emphasis on authenticity of context, complexity and a sustained, problem-based activity. The implementation of the units in 2001 will enable us, not only to monitor and evaluate the success of the approach, but also to model the type of learning environment we envisage these teachers designing for their own students in the future.

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