

CRITICAL ELEMENTS: DESIGNING FOR ONLINE TEACHING

¹Reushle S., Dorman, M., Evans, P., Kirkwood, J., McDonald, J. and Worden, J.

¹Distance Education Centre
The University of Southern Queensland

Email: reushle@usq.edu.au

Abstract

The University of Southern Queensland (USQ) has offered online units via the Internet since 1997. Experience gained from delivering in an online teaching/learning environment reveals a number of pedagogical issues in this delivery method. The Instructional Design (ID) team at the Distance Education Centre is developing a framework of teaching/learning elements critical for the successful design and delivery of online courses.

Key words

instructional design; online; Internet; pedagogy; critical elements; web design; constructivism

Introduction

Members of the Instructional Design (ID) team at the Distance Education Centre, the University of Southern Queensland, have prepared this paper. USQ, in a move to embrace the principles of flexible delivery, encourages the development of a variety of methods for the delivery of instructional materials. USQ has offered units via the Internet since 1997. Experience gained from delivering in an online teaching/learning environment reveals a number of pedagogical issues. The ID team has developed a framework of teaching/learning elements critical for the successful design of online courses based on literature reviews and practical experience.

What is meant by critical elements?

A number of elements are considered essential for effective web courseware design as it relates to teaching and learning. Gunawardena and Zittle (1995) have identified several themes, which seem to permeate successful online teaching and learning. These are **cognitive strategies, learner-centredness, interactivity, collaborative learning** and **social presence**. It is from these themes that critical elements for online design have emerged.

Cognitive skills

Students (and staff) engaged in online teaching and learning environments are required to master a complex range of skills to achieve their teaching and learning goals. Jonassen et al. (1995) suggest that a constructivist approach to design and evaluation can optimise the learning environment. They recommend using cognitive

tools - computer applications such as computer conferencing, expert systems, databases, spreadsheets, multimedia/hypermedia construction, and other 'mindtools' which require students to interpret and organise personal knowledge.

Thorpe (1995) emphasises that learning is dynamic, and in many ways unpredictable, thus necessitating a design approach which balances appropriate structure for novice learners, with enough flexibility to accommodate self-management. She suggests that students should be encouraged to develop a 'heightened awareness of the self as learner' and strategies for increasing their awareness of their own learning process (p.181). Learning diaries, reflections, or journaling activities are examples of ways in which students might be encouraged to reflect on their learning needs and processes.

Increasingly, in online and other delivery modes, learner independence is a key consideration for designers. There is an expectation that mature age students, or those undertaking postgraduate studies, for example, have developed a skills base of life experience and/or study strategies which will help them to identify and direct their own study activities. Hiemstra (1994, p.81) suggests that many traditional and training situations limit opportunities for such personal involvement, particularly where control over the content or process remains with the 'teacher'. He states that by understanding how to learn, how to locate resources, and how to assess their learning progress, students/learners can develop skills necessary for success in a variety of training or instructional settings.

One of the challenges for designers is accommodating diverse learning styles, allowing appropriate flexibility, yet working within the constraints of time and resources. Given the diverse needs and characteristics of learners, their differing skills, and the likelihood that these will change throughout the course of study, it is essential to incorporate maximum flexibility and interaction within the unit design.

In addition to subject-specific information processing, students must develop a working knowledge of the hardware and software used to deliver their online courses, before they can access the content. As part of the design process, consideration is given to elements which will help students to locate the resources they require for study, to navigate through the unit materials, to manage the tools provided within and to support the unit delivery, and also a range of support facilities.

Content structure

In structuring content for web design, it is necessary to organise the materials into manageable sized 'chunks'. The use of concept maps and graphic organisers helps learners to navigate around materials and see the relationships between the concepts.

Analyses of the differences between the ways novices and levels of experts complete cognitive tasks may be conducted in order to understand the levels of expertise that can be learned and the sequence in which they are to be learned (Taylor 1994). Some research suggests that different experts use different pathways to complete a task and such information may assist the construction of various pathways within online programs.

Meaningful activities and learner motivation

The concept of 'situated learning' (Reeves 1992) is based on the idea that if knowledge is learned in a meaningful and relevant context of use, it will be used in that and similar contexts. Ideally, online environments give the learner authority to select areas of interest and to follow them up by accessing relevant information. However, active, involved exploration of learning environments presupposes that the learner is motivated to learn. There is still the need to create that motivation through the 'engagement of student interest and passion for learning' (Romiszowski 1992, p.31). There is also a need to expose students to instruction that produces 'feelings of competence and self-efficacy, increases perceptions of personal control, enhances feelings of personal relevance and encourages individual curiosity' (Kinzie & Berdel 1990, p.63). Sustained motivation usually results in an element of success. Students therefore need to be able to access feedback to ascertain how they are going or whether they are 'on the right track'.

Learner control and interactivity

A 'learner-centred' approach requires teachers to be facilitators (Jonassen 1993) rather than lecturers and views the learner as an active participant in the learning process. Because of the high level of learner control in a flexible online environment, it may encourage not only learning of new content but improved personal learning strategies or learning of new ways to learn.

Learner control can be achieved through a variety of methods. Learners can be encouraged to navigate their own paths through the material, or they can use tools such as glossaries, a 'help' facility, and/or concept maps or graphic organisers which illustrate the links between various screens of information. Directly related to the concept of learner control is that of the degree of interactivity of the program. Interactivity refers to the active participation of the learner in the learning process and its essence is learner control. Vazquez-Abad and Winer (1992, p.676) point out that interactivity is 'neither an inherent or exclusive quality' of computer-based programs. Interactivity should not only be measured by the frequency of interactions but by the quality of thinking it demands from the learner (Romiszowski 1992).

Ease of use: navigation and interface design

One of the standard problems with materials presented on the web is the user becoming disorientated. Conklin (1987) identified this 'lost in hyperspace' issue as one of the central problems with the use of large electronic information systems. For these reasons, most web systems contain tools or devices, which inform users:

- where they are within the site;
- what information they can get to; and
- how they can get to the information.

Without such tools, users either become lost, fail to find relevant information or are forced to devote cognitive resources to navigation rather than the content of the site (Heller 1990).

It is also important to think about the structure of the site. A study of disorientation and cognitive overload (McDonald & Stevenson 1996) compared the ability of people

to use information, which was organised in the following ways (each more complex than the previous):

- a **linear sequence** allowing the user to page backwards and forwards;
- a **hierarchy** allowing the user to move between sections and subsections; and
- a **fully connected network** allowing the user to follow links to relevant information.

The fully connected network allowed the author and the user more freedom and expressive power to more fully represent the interconnections in the information. However, as organisation complexity increased, the ability of the user to find the required information decreased. Thus the major issue for designers of web documents is to use the power of hypertext to create large and complex documents containing many links **without** overwhelming the user.

Excellent interface design is directed towards making site navigation a totally 'intuitive' process, while simultaneously hiding the complexity from the user (Krause 1996, in Donnelly 1996). The user must be presented with friendly, self evident and predictable pathways through the site content. Navigation buttons should be placed in logical positions such as either at the top of the displayed screen or at the bottom. Alternate screen positions inevitably clash with the placement of other media components, so constancy of position is essential (Jerram & Gosney 1995). Button design and placement should aid this process and assist the user to cognitively engage with the site content. The provision of 'clickable links or buttons' provides a powerful gateway to related topics that may range from interactive multimedia displays to URLs for associated materials. As such, they provide access to valuable independent learning not present in the printed medium.

Recently, design emphasis has changed from highly coloured displays to the use of more subdued colours that do not distract from the core purpose of knowledge transmission. Likewise the focus has changed from 'technical pyrotechnics' to assisting the learner in a constructive manner. Despite this, there is still major debate on whether users should navigate by means of links, icon groups or by clickable images comprising sections of the screen display. A designer of web materials must always bear in mind the time taken for downloading large images and animations from the Internet and keep these file sizes to a minimum.

Embedded activities — interactive learning objects

Interactivity has long been seen as 'a necessary and fundamental mechanism for knowledge acquisition' (Sims 1997). Generally, a student may interact with either objects or information (e.g. a book) or other people (e.g. students or teachers). Highly interactive educational objects called COOL (Creative Opportunities for Online Learning) Tools can be embedded in static web pages. The following two examples have been developed at USQ.

Interactive labels

The interactive labels tool presents the student with a 'control panel' which allows the user to interact with a labelled diagram or photo in the following ways:

- show or hide all the labels;

- show or hide the labelled regions;
- hide the labels and show each label as the mouse is moved over it; and
- do a 'self test' in which the labels must be dragged from the bottom of the screen to the correct location (if the location is not correct, the label will fall back to the bottom of the screen).

The educational power of this tool is that it allows the students to interact with labelled diagrams e.g. parts of the brain, in ways not possible with paper.

Interactive numeric exercises

The Interactive Numeric Exercises tool allows the creation of interactive exercises in any subject domain which requires the user to follow a set algorithm to solve a numeric problem e.g. an Accounting problem. The primary strength of this tool is that it allows a student to progress at his or her own pace through complex and often long procedures. Instead of being overwhelmed by the process of doing the exercise and only getting feedback at the end, the student gets immediate feedback guiding them to successful completion of the activity.

Collaborative learning

Collaborative learning is currently an educational 'buzz word', with authors using it to describe a variety of different learning situations. Roschelle and Teasley (1995, p. 70) define collaboration as 'a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem'. In an online teaching/learning context, this generally means a group of students using technology-enabled participation in collaborative activity for a semester.

In *Transforming Learning: Individual and Global Change*, Askew & Carnell (1998, p. 2) argue for a 'transformatory' approach to education, 'with the approach to learning involving reflecting, learning and actions for change'. In a chapter entitled 'Evolving through collaboration: the group context', they argue that learning is more effective when undertaken in groups. Conversation and collaborative tools (such as online discussion groups) enable communities of learners to negotiate and co-construct meaning for problem solving and knowledge construction (Jonassen 1998). Dillenbourg (1999, p.7) suggests that the words 'collaborative learning' describe a situation in which particular forms of interaction among people are expected to occur, which would trigger learning.

At USQ, the online learning environment encourages synchronous and asynchronous computer-mediated communications to support collaboration among learners. Online discussion groups enable learners to share information and collaboratively construct socially shared knowledge. Learners indicate that participation in collaborative online discussion groups is both stimulating and satisfying academically and professionally.

Assessment

Regardless of the delivery mode of the learning materials, the first step in assessment design and selection is clarification of the purpose of the assessment. The online environment offers new possibilities in the matching of suitable assessment tasks to desired student learning. The advantages and opportunities for both learning and

assessment activities offered in this delivery mode are possible through the communication pathways that are integral to online delivery.

With opportunities for assessment which have relevance and purpose, it is possible for students to 'own' the set assessment tasks. Brown, Collins and Duguid (1989) emphasise the importance of task ownership in 'situated cognition', where learning is linked closely to the environments where the learning will be used. By emphasising authentic assessment tasks, e.g. forming a simulated company and carrying out specific tasks such as designing a product or producing a marketing campaign, knowledge and skill transfer can be enhanced.

Electronic discussion group activities can also be used as assessment instruments, with students participating in set discussion tasks. These tasks may involve adding constructive comments to a discussion on a set topic, critiquing other students' work, or participating in reflection activities which focus on the facilitating role of the teacher in engendering collaborative reflection on practice. Experience with the use of online discussion groups has demonstrated that when contributions to online discussion are assessable, learners will tend to contribute meaningfully to group discussions.

Traditional assessment items such as essays, multiple choice tests and examinations can be included as items in a range of assessment items. Electronic quizzes, which can include multiple choice questions, are automatically marked with immediate feedback to the student. Such tests are useful in providing formative assessment throughout the course and have particular value in classes with large numbers of students.

Feedback

Feedback is a vital part of the learning process during which misconceptions are corrected. It is most effective when the feedback is both immediate and in sufficient detail for the student to initiate corrective action (Waldrop, Justen & Adams 1986). Ference and Vockell (1994) note that feedback should be given frequently during instruction for small steps rather than large chunks of learning. Spitzer (1996) expresses very similar views with his statement that feedback can be dramatically improved by providing it continuously, reinforcing the positives and focusing feedback on how performance can be improved in the future.

Two categories of feedback have been recognised by Laurillard (1996), namely intrinsic and extrinsic. Intrinsic feedback takes place when the consequences of performing a particular act are indicated as an outcome to the student, while they are completing a task. Extrinsic feedback is not 'situated' within the learner's immediate action and may take the form of right-wrong, attention-focusing or the correct answer (Merrill, Li & Jones 1992). Right-wrong feedback does not convey any basis for correcting a wrong answer, much like supplying the correct answer. Attention-focusing feedback directs the learner's attention to key aspects of the designated task with the goal of inducing correction of their misconceptions.

In the online environment, feedback can be strongly intrinsic and situated within the learning process. No longer does the learner have to wait for delayed feedback on

submitted assignments, which his or her instructor may return up to two weeks in the future. Extrinsic feedback to the learner on final assessments or examinations is very often nonexistent. With animations and computer models, the learner can obtain immediate feedback on his/her responses and incorrect answers can be changed as part of the acquisition of new knowledge. This also greatly facilitates problem-based learning and learner independence.

Social relations and social presence

An interesting concept in terms of social relations and the online environment is that of social presence. Do the online social relations between student and student and student and teacher affect the quality of the learning experience? Does using this technology tend to dehumanise the teaching/learning process? Our experience has found that, as with face-to-face teaching, relationships online can be established with others based on common interests, beliefs, senses of humour, and so on. This in turn does appear to influence the quality and quantity of interaction, enthusiasm and participation. Some students respond extremely well to working and discussing with others online. However, collaborative learning may not work for everyone in every setting. Research conducted by Eastmond (1995) discovered that students in the same course could have opposite learning experiences based on their social acceptance of the collaborative ventures set up in the course design. For some students, the prospect of posting comments to a group of strangers can be very intimidating. It is important to be aware of this possibility and provide opportunity for students to contact lecturers individually by electronic mail.

However, many of the key social skills needed for nurturing online collaboration are not specific to online communication. They are the skills needed by any tutor or facilitator involved in a peer learning situation - the ability to make group members aware that their own experiences are important and worth contributing and that other peers can be as valuable a source of knowledge as the course materials.

Study skills for online learning

Entering a new learning environment can be intimidating at the best of times - perhaps even more so when entering the relatively new online environment. It is apparent to the team that support for students to help ease them into this new environment is a primary consideration. Development of online study aids in terms of tips, shortcuts, examples and opportunities for interactive practice are integral parts of the design of an online learning environment.

Online evaluation

Evaluation should be an essential design consideration and an integral part of all aspects and levels of any educational design and development process. From the student perspective, the ability to complete and submit an evaluation online is an essential element of any web design. A reliable, validated instrument will ensure that feedback received from students on the successes, concerns and problems encountered will enable continuous improvement.

Conclusion

Exploration of the critical elements of online teaching and learning has evolved from the belief that what is needed at USQ is a number of exemplars that academics can embrace to guide the way they teach in the online environment. If these exemplars are not provided, academics may use the new technology, but continue teaching in the traditional manner. In 1996, Hall noted that:

most universities are using the technology simply to complement their conventional teaching. Most recognise the promise of learning technologies, but what is missing is an overarching sense of purpose along with any practical sense of what the shape and consequences of successful innovations might look like.

(p. 29)

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