

SIR06100

Quality eLearning: An instructional design model for online learning in higher education

Dr Lou Siragusa
Curtin University of Technology

Abstract

As online learning (or eLearning) is integrated into ever-growing numbers of university courses, there is a need for practical guidelines and recommendations to facilitate the development and delivery of pedagogically effective eLearning environments. A recent study by Siragusa (2005) examined factors which make for effective instructional design principles and learning strategies for higher education students studying with these environments. Surveys were administered to students and lecturers in Western Australian universities revealing numerous areas of students' eLearning experiences which they had perceived as being successful and those needing improvements.

This paper presents a model that was developed from the study's survey findings, which lecturers and instructional designers may use to design, develop, evaluate and refine their eLearning environments in higher education. The model is accompanied with recommendations that accommodate the varying pedagogical needs of learners as well as varying modes of course delivery. For each recommendation, a pedagogical dimension is presented to illustrate the varying pedagogical needs and instructional requirements. The dimensions are utilised in a similar manner to Reeves and Reeves' (1997) pedagogical dimensions and highlight the decisions which need to be made during the instructional analysis, design, delivery and evaluation phases for the implementation of pedagogically effective eLearning environments.

Introduction

The drive to integrate online learning into higher education courses continues unabated. The Internet provides significantly different and interesting possibilities for computer-mediated communication and learning from other forms of educational technologies (McCormack & Jones, 1998, p. 1; Weller, 2002, p. 34). Online learning environments have appeared in a variety of forms and applications in higher education. In some cases, entire courses are delivered exclusively online to students in remote locations and supplementary materials may also be mailed out including introductory notes containing access information to the class website. Sometimes the entire class website is duplicated onto a CD-ROM for these students with slow and unreliable Internet access. In other cases, the lecturer may use a class website as a supplement to their face-to-face delivered classes. In those cases, the lecturer may be utilising the online communication facilities as well as placing additional information not provided in class on the website for students to access. Some lecturers utilise the class website for the teaching of specific skills and knowledge through automated pre-programmed online activities that can provide specific feedback to students' answers (e.g., Scott & Judd, 2002).

Thus, it can be seen that there are numerous ways in which online learning environments may be utilised based upon the instructional and pedagogical needs. The development of instructionally effective online learning environments that meet these pedagogical needs require the application of appropriate instructional design principles. However, Greening (1998) argued that "... generally, instructional designers either do not always appear to take advantage of the hypermedia technology, or do so without pedagogical foundation" (p. 2). The literature would suggest that there are gaps between the bodies of knowledge relating to learning theories, instructional design principles and research into student learning in higher education, and the application of this body of knowledge to the use of online learning technologies (Siragusa & Dixon, 2005a). A recent PhD study (Siragusa, 2005) developed a theoretical framework and research methodology (Siragusa & Dixon, 2005b) which made ties between these bodies of knowledge together with this study's research findings in order to put

forward instructional design principles that effectively promote the use of online learning to meet the varying pedagogical needs in higher education. These instructional design principles are presented within a model, which is based upon Reeves & Reeves' (1997) model for creating pedagogically effective online learning environments. Reeves and Reeves put forward 10 pedagogical dimensions of interactive learning on the World Wide Web. The new model developed from the PhD study expands upon Reeves and Reeves' (1997) model and presents 24 pedagogical dimensions. The following describes each of the 24 pedagogical dimensions, presents them within a model, and then provides an example of their application.

Underlying pedagogical philosophy

When designing online instruction, the underlying pedagogical philosophy and application of learning theories, including instructivism and constructivism, will influence decisions regarding what instructional strategies may be adopted (Dick, Carey & Carey, 2005, p. 4). Students may be required to learn a set of principles within a discipline area and integrate previously learned knowledge with new knowledge by employing techniques such as advanced organisers, worked-out examples, and elaborative questions. For example, a lecturer teaching how radar works may compare this with a ball bouncing off a wall (advanced organiser) through the use of Flash animations provided on the website. The lecturer may also integrate an instructivist approach by utilising automated online learning activities to assist with teaching specific principles. A lecturer with postgraduate students completing a Masters degree unit may adopt a constructivist approach to teaching, where students are encouraged to construct their own meaning of the content through their own prior experiences.

The varying underlying pedagogical approach may be represented along a dimension as illustrated in Figure 1.

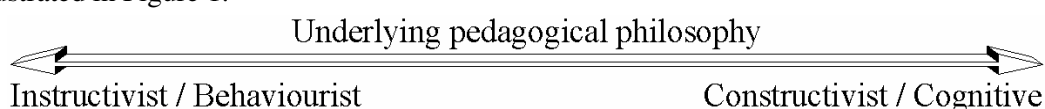


Figure 1 Dimension for underlying pedagogical philosophy

Instructional design analysis for online learning

The development of online learning environments needs to draw upon the vast body of knowledge relating to instructional design models (e.g., Dick et al., 2005; Gagné, Briggs & Wager, 1992) for the analysis of instruction, the learners (background, prior knowledge, motivation, etc.), the learning context, development of an instructional strategy, and evaluation. A lecturer requiring students to learn a particular set of concepts will take into account the online learning environment in which this understanding will be demonstrated, the students' characteristics (e.g., their prior knowledge and motivation to learn). The lecturer will then develop an instructional strategy which will draw upon online learning technologies to assist with achieving this instructional goal. This may include the use of computer-based simulations of the concepts to be taught, automated online interactive activities, the use of the class bulletin board, and links to other websites. The lecturer may aim towards a constructivist learning environment where students combine new learning with existing knowledge and the learning experiences are authentic depictions of existing practices. The lecturer will then develop formative evaluation to identify how to improve the instruction and summative evaluation to determine the overall effectiveness of the instruction.

The level for which instruction incorporates an instructional design process of analysis, strategy development and evaluation may be represented along a dimension as illustrated in Figure 2.

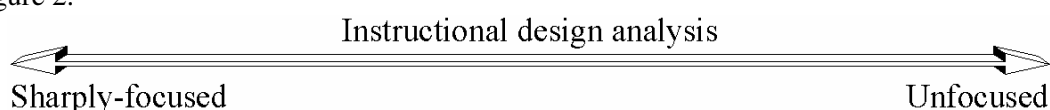


Figure 2 Dimension for instructional design analysis

Content provided

The detail and extent of the content provided to students may vary depending upon the students' pedagogical needs. Students studying entirely online need to have access to all of the content including the learning outcomes, all assignment requirements and relevant resources, while students attending face-to-face classes may receive the content in class and additional content on the supplemental class website. Students studying a first year undergraduate unit in mechanical engineering need to have an understanding of the underlying principles and, therefore, the content needs to be complete, relevant, accurate, culturally sensitive, and appropriately organised so that knowledge is built upon prior knowledge and developed from fundamental principles through to increasing complexity allowing for deeper understanding (Glaser, 1987, pp. ix-xiii; Reigeluth, 1987, p. 248; 1999, p. 438). The purpose of their class website should be made clear as well as unambiguous instructions for access, navigation to relevant information, and use of communication tools and other features of the class website. Students studying at postgraduate level may be required to construct their own knowledge based upon their literature review and research and, therefore, less content is provided.

Figure 3 illustrates the two contrasting pedagogical approaches relating to content on a pedagogical dimension.

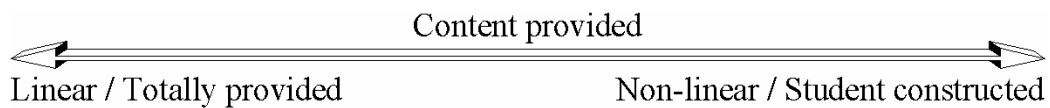


Figure 3 Pedagogical dimension for content provided

Student motivation

Students enrolled in higher education courses come from a variety of backgrounds and have different reasons for studying. A student entering a university course may be extrinsically motivated in only doing what is required in order to pass units without a significantly deep interest for the subject. Therefore, the online learning materials need to be relevant and assist with stimulating student interest and motivation. Principles of good website design should be employed including avoiding the use of slow loading media, provision of printer-friendly materials, appropriate use of font types, colours, etc., and appropriate use of graphics to assist with navigation (Clark, 2003; Lynch & Horton, 2002; W3C, 1994-2006). Students studying in distance mode need to feel that they are part of a group of learners and be made aware of how they may obtain assistance with the unit's requirements and technical difficulties. Lecturers need to make regular contact with students in order to reduce feelings of isolation and attempt to contact those who have not communicated for an extended period of time. Lecturers should immediately acknowledge receipt of submitted assignments and promptly return them with well considered comments indicating the student's progress. For students who are intrinsically motivated to study due to personal interest and desire to develop a deeper understanding of the subject matter (Gibbs, Morgan, & Taylor, 1984) as well as wishing to improve employment opportunities, content which fosters deeper understanding of the subject and relates to real-life and employment situations should also be included.

Figure 4 illustrates the varying pedagogical approaches towards motivation.

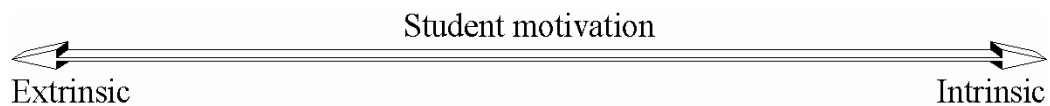


Figure 4 Pedagogical dimension for student motivation

Online unit information and delivery mode

The amount of information to provide on the class website may be determined by the mode of delivery. If the unit is to be delivered entirely online, then the website must include all the information needed for students' successful completion of the unit including appropriately detailed content, learning activities, assignment requirements, and supporting materials (e.g.,

journal articles, past exam papers, links to other websites, etc.). Students in remote locations with unreliable Internet access may need to receive a copy of the entire unit's information in paper-based and possibly CD-ROM format as a backup. If the class website is to be supplemental to face-to-face classes, then the lecturer will need to determine which information will be provided on the website (e.g., supporting information to assist with the completion of assignments), and which information shall be distributed during classes.

The unit information to be provided on the class website, depending upon whether the unit is delivered entirely online or if online learning is supplemental to face-to-face classes, may be represented along a dimension as illustrated in Figure 5.

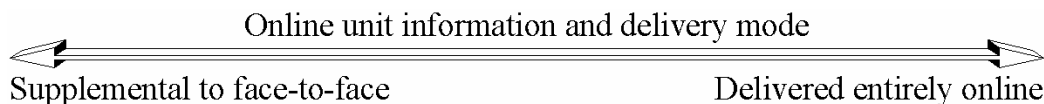


Figure 5 Dimension for online unit information and delivery mode

Lecturer's role and availability

The lecturer's role is an important factor in the design of online learning environments in that various roles can be supported (Reeves & Reeves, 1997). A lecturer with a unit of first year undergraduate students may need to assume a didactic role in order to guide students' learning. This lecturer needs to be available at regularly scheduled times to assist students with the learning activities and for clarifying concepts. For students not required to attend face-to-face delivered classes, lecturers may consider scheduling face-to-face sessions depending upon the students' needs to discuss the content and assignment requirements. A lecturer with postgraduate students studying entirely online may assume a facilitative role and be available to assist students as required either through online communication facilities or via telephone. Lecturers should routinely check the online communication facilities for new postings and provide prompt and adequate replies to student questions.

The varying lecturer's role and expected availability may be represented along a dimension as illustrated in Figure 6.

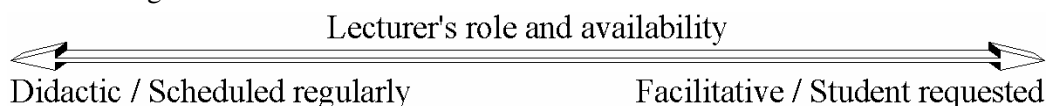


Figure 6 Dimension for lecturer's role and availability

Lecturer's perception of importance

How lecturers perceive the importance of online learning will influence how online learning is utilised and integrated into their teaching practices (Keppell et al., 2004). Lecturers with a low perception of the importance of online learning may not fully consider how to apply online learning to enhance their students' learning and may not support online learning strategies such as encouraging students to utilise the bulletin board for the sharing of ideas. Lecturers with high perceptions of the importance of online learning may explore integrating learning strategies utilising online technologies such as automated interactive activities with automated feedback responses to students' answers. Lecturers also need to consider how students studying online may perceive themselves as being disadvantaged compared to other students completing the same unit with face-to-face classes. Therefore, students studying entirely online need to receive the same detailed information, including the lecturer's verbal elaborations during lectures as received by students attending face-to-face delivered classes. It is important that students attending face-to-face classes receive the same amount of content detail as those studying externally and entirely online. Internal students may also be provided with access to the website provided for externally enrolled students. Lecturers using a class website to supplement their face-to-face delivered classes may consider providing access to additional information including links to relevant websites. Where appropriate, lecturers may provide lecture notes on the website well in advance of scheduled lectures to allow students preparation time for pre-reading them prior to the lecture. Learning strategies may be developed for encouraging students to

utilise online communication facilities such as conducting discussions about specific topics, discuss issues relating to their assignments, and posting draft versions of their assignments for other students to review. Lecturers may encourage students to maintain a reflective learning journal to record what they have learned through collaborative learning.

Figure 7 illustrates levels of significance of the lecturers' perceptions of the importance of online learning represented along a dimension.

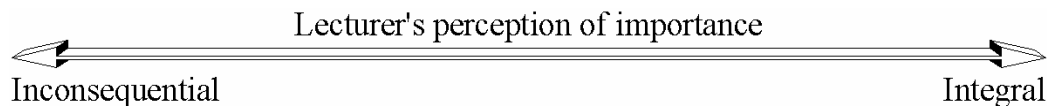


Figure 7 Dimension for perceived importance towards online learning

Lecturer's online abilities

Lecturers' knowledge and abilities of online learning technologies may influence how they utilise the class website to enhance their students' learning (Keppell et al., 2004). A lecturer with a low understanding of online learning technologies may simply use the website as a repository of content for students to access, print out and read elsewhere without active online engagement with the learning materials. However, a lecturer with sound knowledge of online learning technologies, as well as basic HTML editing skills, may use these technologies for creating effective learning strategies such as interactive online learning activities including online quizzes and encouraging students to present their assignments on the online LMS.

Lecturers' varying abilities to use the Internet to enhance their teaching may be represented along a dimension as illustrated in Figure 8.

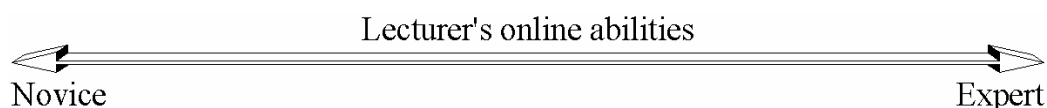


Figure 8 Dimension for lecturer's online learning abilities

Lecturer's online support and training

Lecturers involved in developing further knowledge of online learning through professional development may put into practice what they learn into their own online learning environments. Lecturers not interested in further developing their knowledge of online learning may only be interested in getting the learning materials onto their class website in the quickest way possible without knowledge of whether there are better ways of presenting these materials to the students to assist with their learning. Lecturers with advanced knowledge of online learning development practices may apply more efficient practices of presenting the same learning materials. Online learning development staff also needs to be made available to assist with technical issues and coordinating conformity of the structure and appearance of class websites within the learning area. Lecturers need to be aware of the labour intensive nature of online learning development (McMurray & Dunlop, 1999) and the resources (e.g., funding opportunities, professional development, experienced colleagues, etc.) available to assist with the development of effective online instruction. The university's reward and promotional system should acknowledge lecturers' activities with developing successful online learning, mentoring other staff members in their online delivery of units, and any commercial successes of their online learning development.

Figure 9 illustrates, along a dimension, lecturers' availability of support and training and their willingness to avail themselves of further online learning support and training.

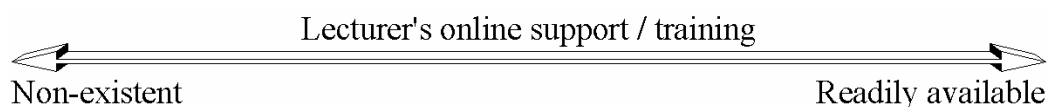


Figure 9 Dimension for lecturers' online support and training

Lecturer's decision making input

Lecturers showing interest in the development and decision making aspects of online learning are often involved in innovative solutions for online learning within their teaching area (McMurray & Dunlop, 1999). A lecturer with a specific need for online learning to assist with the teaching of specific concepts may explore the use of automated interactive activities. Therefore, lecturers need to be aware of their university's policies, processes and the decision making groups regarding online learning and be encouraged to put forward their input regarding the direction of online learning development. A collegial atmosphere of sharing resources, innovative ideas, exemplary examples and experiences relating to online learning within the university should be encouraged.

Varying involvements with the decision making process regarding online learning may be represented along a dimension as illustrated in Figure 10.

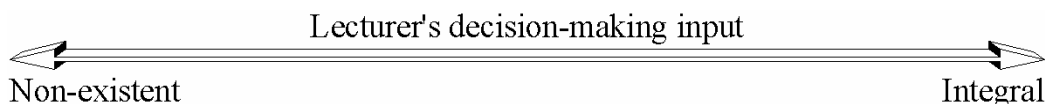


Figure 10 Dimension for lecturer's decision making input

Lecturer's development activities

The existing body of knowledge relating to instructional design should be made aware to all lecturers involved in the development of online learning (Siragusa & Dixon, 2005a). Lecturers involved in online learning design and development are more likely to employ some form of instructional design process in order to analyse and accommodate the specific learning needs of their students. The class website may be utilised to assist with students' learning through carefully planned activities. For example, a lecturer may require a group of students to understand a particular concept through exploration of specific information on the Internet, completing online collaborative activities, sharing ideas, and using the class website for presenting their collated information and completed assignment for other students to review. Lecturers may consider undertaking professional development in order to further developing effective teaching and learning strategies for enhancing student online learning.

Figure 11 illustrates the level of online learning development activity along a dimension.



Figure 11 Dimension for development activities for online learning

Structure and organisation

The structure of the class website, including navigation, information provided, and use of the online LMS features (e.g., electronic submission of assignment, automated online activities, help facilities, etc.) may vary depending on the targeted students and pedagogical need for online learning (Greening, 1998). The website's structure may be rigidly structured so that students may only follow a linear learning path, such as a first year undergraduate unit where specific knowledge needs to be taught. Suitable learning materials represented in appropriate learning steps when it is most needed with additional materials to develop deeper understanding of the content needs to be provided. The structure should be self-intuitive, including the use of "breadcrumbs" to assist with navigation. Flexibility may be provided to develop the structure as needed, such as a postgraduate student developing a thesis.

These contrasting pedagogical approaches relating to structure can be illustrated on a pedagogical dimension as shown in Figure 12.

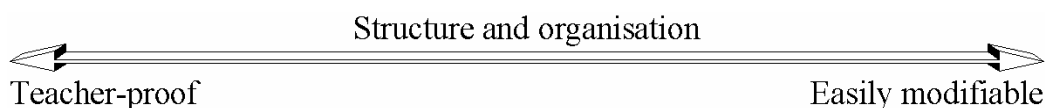


Figure 12 Pedagogical dimension for structure and organisation

Development of learning strategies

Instructional design decisions can influence and encourage different learning strategies that can be used by students (Bull, Kimball, & Stansberry, 1998; Smith & Ragan, 2005). The development of content for online learning may include specific learning strategies that facilitate building new knowledge upon previously learned knowledge. A lecturer with a first year undergraduate group of students may encourage students to work collaboratively in finding specific information on the Internet and report their findings to the rest of the class via the bulletin board. Students may also be encouraged to share their thoughts regarding the content and assignments via communication facilities. If students are working in an on-campus computer laboratory, they may be encouraged to interact with each other through online chat while solving particular problems. A lecturer with postgraduate students may encourage them to develop their own learning strategies for working on a particular problem, and to encourage the students to maintain a reflective learning journal to record their successes and barriers to their learning. The lecturer needs to develop discrete strategies for observing successful online learning strategies developed by students. Observational strategies may include observing students as they study in the on-campus computing laboratories and monitoring the bulletin board messages. The lecturer should consider how future classes utilising a class website may adopt similar successful learning strategies.

Figure 13 illustrates the variation between teacher developed and student developed learning strategies represented along a dimension.

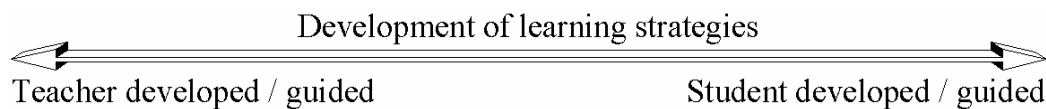


Figure 13 Dimension for the development of learning strategies

Content guiding learning strategies

The content placed on the class website may assist with guiding particular learning strategies to foster deep understanding of the subject matter (Miller & Miller, 2000). A lecturer may provide discussions regarding a particular concept within the content. To reinforce those concepts, students may be required to contact associated industries or associations to either observe a particular situation or to assist with solving a particular problem through applying the concepts learned. After the students have completed the task, they may share their experiences through online facilities such as the bulletin board or the student presentation area of their online LMS. To facilitate these learning strategies, the content should include up-to-date real-life examples (e.g., employment situations that students may encounter), enrichment materials and links to relevant websites.

At what level is the unit suitable for supporting such learning strategies may be represented along a dimension as illustrated in Figure 14.

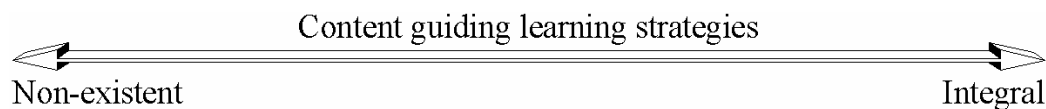
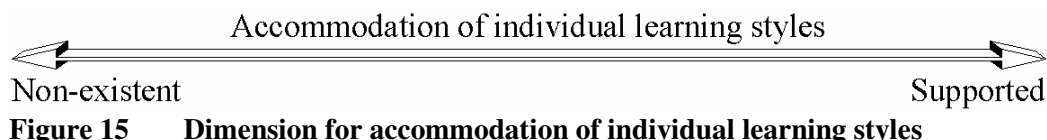


Figure 14 Dimension for the content guiding learning strategies

Accommodation of individual learning styles

Lecturers involved in the development of online learning needs to consider how the design of online materials may accommodate students' learning styles and facilitate deep approaches to learning through active engagement with the online materials (Weigel, 2002). Students may be required to think about the learning tasks rather than just learning enough facts to pass an examination. The lecturer may wish to develop learning-focused activities for facilitating deep approaches to learning and accommodating individual learning styles. The lecturer may draw upon existing instructional design models for computer-based instruction for the development of learning-focused activities (e.g., Hsu, Chen & Hung, 2000; Soulier, 1988).

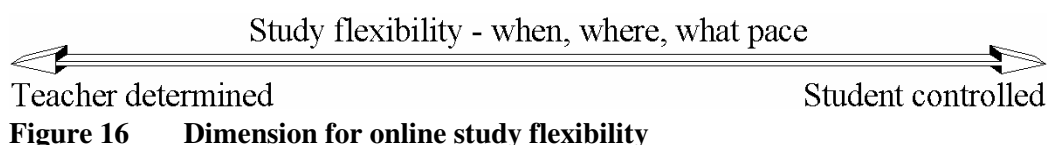
Figure 15 illustrates varying support for individual learning styles along a dimension.



Study flexibility – when, where, at what pace

Students in higher education are demanding greater flexibility in the delivery of their courses (Ryan, Scott, Freeman, & Patel, 2000, p. 12). The design of an online learning environment may facilitate whether students are able to study when, where, in what sequence and at what pace they choose. A lecturer with face-to-face delivered classes may not require students to attend every scheduled class and may provide self-directed learning materials on the class website during the weeks attendance is not required. A lecturer may require students to attend every scheduled class and the website is provided only as a supplement to face-to-face classes.

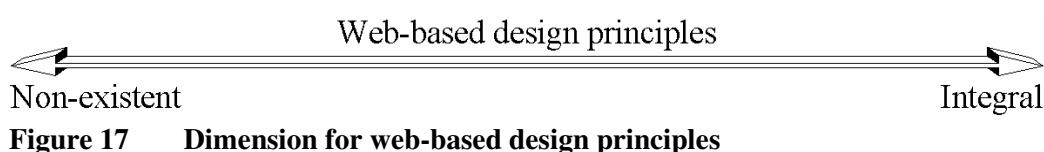
The amount of flexibility allowed for student to study when, where and at what pace required may be represented along a dimension as illustrated in Figure 16.



Web-based design principles

While developing an online learning environment, sound web design principles (e.g., Lynch & Horton, 2002) suited to the targeted audience need to be employed including self-intuitive navigation, page layouts, text usage, background colours and textures, compatibility with various computer configurations, and allowances for human disabilities. A lecturer may require students to read particular passages of text from web pages before completing an online interactive activity. The design characteristics of web pages need to conform to appropriate design guidelines for suitable viewing on the web. The employment of graphics, animations and Flash-programmed activities need to be considered in order to reduce the amount of unnecessary text needed to describe a particular concept, while accommodating varying conditions including slow connection speeds.

Figure 17 illustrates the varying employment of web design principles and web-based technologies along a dimension.



Interaction

Social constructivism suggests that learning is derived through a collaborative negotiation of meaning through multiple perspectives. A student interacting with other students and their lecturer, in conjunction with engagement with the content, will build his or her understanding of the unit's principles (Miller & Miller, 2000; Savin-Baden, 2000, p. 34). Undergraduate students may build an understanding of the principles through structured online collaborative activities with class peers. Postgraduate students may initiate communicate with their peers as needed to discuss particular concepts or issues. Therefore, asynchronous communication facilities including a bulletin board and email need to be provided. Students and lecturers need to be familiar with the features associated with these facilities such as creating "threaded discussions." Lecturers should post an introductory message on the bulletin board at the commencement of the unit and then encourage students to post a short message introducing themselves to the group. Students may also be encouraged to post their thoughts regarding the content and assignment requirements on the bulletin board. Lecturers may encourage students

to make regular postings to the bulletin board throughout the duration of the unit and the lecturer may post additional materials to assist with assignments. Discourteous and irrelevant comments should be discouraged. Synchronous online communication facilities such as online chat and online whiteboard may also be utilised. Online chat sessions could be schedule throughout the duration of the unit for sharing of ideas and addressing concerns. Lecturers should prepare discussion topics prior to the scheduled chat sessions.

Contrasting pedagogical needs for interaction is illustrated in Figure 18

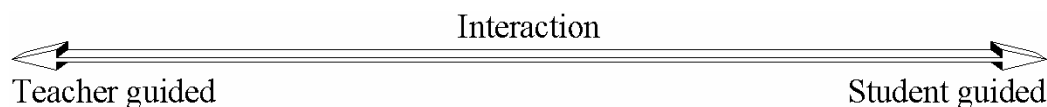


Figure 18 Pedagogical dimension for interaction

Collaborative learning

Ralph (1998) argued that student-centred learning should be encouraged through strategies such as cooperative learning. Student collaboration activities may be designed with varying levels of predefined structure. A lecturer with a first year undergraduate class may structure collaborative activities by defining the tasks for each group of students, defining tasks for individuals within the groups, devising procedures for reporting their progress and prescribing methods of presenting the completed assignments to the whole class. This lecturer may encourage students to utilise the class bulletin board and email at various stages of the collaborative effort as well as maintaining a reflective learning journal to record their contributions. Postgraduate students studying from remote locations may be encouraged to communicate with each other via the bulletin board and email as needed to assist each other with the assignments. They may be encouraged to share ideas about the assignment tasks and to post draft versions to each other for checking.

Figure 19 illustrates the varying use of collaborative learning activities represented along a dimension.

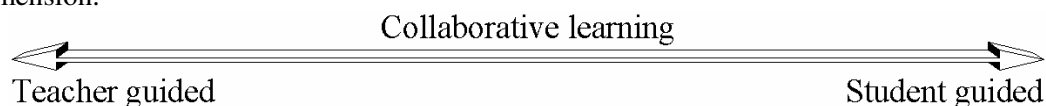


Figure 19 Dimension for collaborative learning

Automated online interactive activities

Automated online learning activities may be provided for student learning to support repeated practice and feedback (behaviourist) type learning providing optimal conditions for the learner to receive and process information (cognitivist). Activities may include multiple choice questions, open-ended questions and matching activities (e.g., labels to pictures). A lecturer teaching specific discipline related concepts to first year undergraduate students may require them to complete a series of online activities (e.g., Scott & Judd, 2002). The activities may start with an introduction supported with graphics and other media of the concept or problem to be examined, a demonstration of how the problem may be solved, followed by an activity which allows the student to attempt a similar problem. After entering an answer, either correct or incorrect, the student is automatically provided with appropriate feedback as well as adding or deducting marks for correct or incorrect answers respectively. The sequence of completing each online activity may be predetermined, not allowing students to move on to the next questions until the current problem has been solved. Automated online learning activities may also be provided as a non-assessable, non-compulsory and non-linear supplement to the students' learning experience. Online quizzes may be provided for students to reflect upon their learning to determine whether they have understood key concepts, which may also assist with examination preparations. Automated online activities should operate efficiently with off-campus computers and slow Internet connections. Slow loading pages should be minimised and timed logout functions be used appropriately to allow students time to consider their answers.

The varying application of automated online learning activities may be represented along a dimension as illustrated in Figure 20.

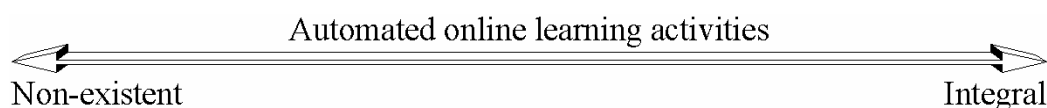


Figure 20 Dimension for automated online learning activities

Internet-based information

Purposes for encouraging students to search for specific Internet-based information to foster deeper understanding of the subject matter may vary. A lecturer teaching law may require students to find specific information about a particular case study obtained from a government website in order to complete an activity. Students may also be required to find similar case studies on the Internet and may need to employ effective online search strategies (e.g., Harris, 1997). In this case, students are provided with specific web links and are guided towards finding specific information, as well as providing access to online resources which are useful for their future employment. A postgraduate student involved in a research assignment may choose to search for information through a variety of online resources including online journals and online scholarly databases. Students and lecturers may post useful URLs to relevant websites which they have encountered on the class bulletin board for other students to access.

Figure 21 illustrates the varying amount of teacher guidance provided with finding specific information on the Internet as represented along a dimension.

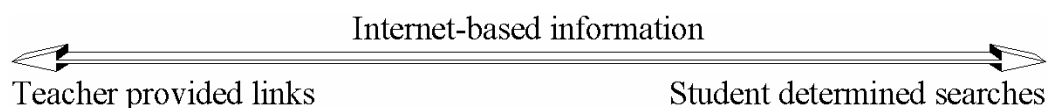


Figure 21 Dimension for Internet-based information

Online learning management

The features contained within proprietary online LMS applications may be utilised by students in various ways for enhancing their online learning experience (Ryan et al., 2000, pp. 141-3). A lecturer with first year undergraduate students may wish to utilise the student progress tracking feature allowing students to have access to their progressive assignment and test scores throughout the duration of the unit. This lecturer may also encourage students to post bulletin board messages to particular discussion topics and to follow particular discussion threads. Students may be encouraged to present their assignments on the class website for other students to review. Students may also be required to complete automated quizzes within the LMS. The lecturer may also post significant dates, such as assignment due dates, on the online class calendar. A lecturer with postgraduate students may simply provide some of the features on the online LMS for students to utilise as they choose without incorporating specific teacher controlled learning strategies.

The level of teacher control over how students use the online LMS application's features may be represented along a dimension as illustrated in Figure 22.

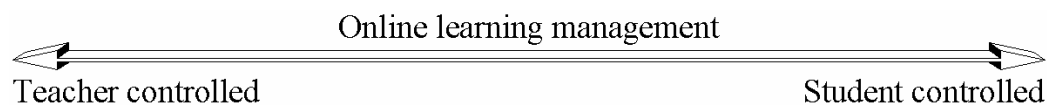


Figure 22 Dimension for online learning management

Feedback

Students are increasingly expecting more reliable and valid assessment with prompt feedback on their performance (Steven & Zakrzewski, 2002, p. 124). Lecturers need to demonstrate to students that they are genuinely concerned with their progress through the feedback they provide. The amount and type of feedback students require will vary depending upon the students' perceived need for support, whether they are studying entirely online or attending face-to-face delivered classes, and whether they are at the commencement of an undergraduate course or working on a

doctoral thesis. A postgraduate student working on a doctoral thesis will usually ask for feedback as required and may initiate online contact with other postgraduate students or people working within the field of study for their comments and feedback about issues relating to their enquiry. A first year student studying an undergraduate unit in a pre-service teaching course will require feedback to questions relating to the subject matter, the assignment requirements, and feedback on their teaching practice performance from peers and their lecturer. They may also be encouraged to work collaboratively on group assignments and obtain feedback from their peers via online communication facilities. Students need to be aware of all the assignment requirements, how they relate to the learning outcomes of their study, and be provided with supporting materials to allow them to complete the assignments. The lecturer, through the encouragement of specific learning strategies, may control the feedback provided to these students. Students may be provided with the flexibility to submit their assignments either by the Internet or by other means such as post (for distance students) with prompt notification of receipt of their assignments. Assessed assignments should be promptly returned with well considered feedback.

Figure 23 illustrates the varying pedagogical approaches towards feedback.

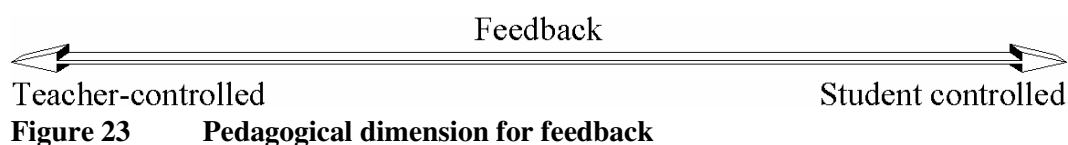


Figure 23 Pedagogical dimension for feedback

Online learning evaluation

Information collected about the learning environment through a formative evaluation process can be used to revise this environment for efficiency and effectiveness (Dick et al., 2005, p. 278). The continuing development of online learning environments can benefit from students' evaluation comments regarding their experience with online learning, which may be collected either formally or informally. A lecturer with a first year undergraduate class may ask students to complete a unit evaluation form which may contain questions regarding the strengths and weaknesses of their website. The comments collected from the evaluation form, in conjunction with comments from other sources such as the bulletin board, may contribute towards improvements of the online learning environment for future cohorts of students. A lecturer with postgraduate students studying entirely online may email each student once or twice throughout the duration of the unit asking them to provide comments regarding their progress and the effectiveness of the online learning environment.

The amount of formal and informal online learning evaluation sought from students regarding the effectiveness of their online learning experiences may be represented along a dimension as illustrated in Figure 24.

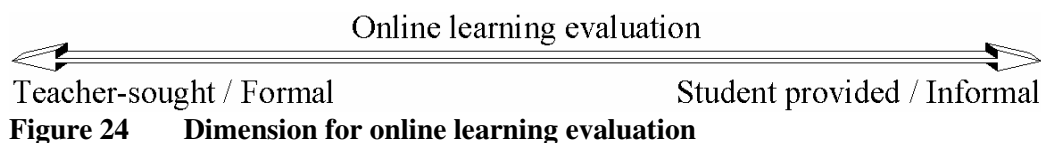


Figure 24 Dimension for online learning evaluation

Instructional design for online learning model

The above presented the 24 recommendations derived from the PhD's survey findings (Siragusa, 2005) which contribute towards effective online learning environments for students studying in higher education. These recommendations need to be considered at the design phase of the unit to consider what role the online learning environment will have with the delivery of the unit. The role will vary depending upon a number of factors including the skills and knowledge students will be taught, the pedagogical approaches to be adopted, the learning context and mode of delivery, the instructional strategy to be adopted, the role of the educator, and the method of evaluation.

The instructional design for online learning (IDOL) model presented in Figure 25 is an adaptation of Reeves and Reeves (1997) model of ten pedagogical dimensions for web-based instruction. The pedagogical dimensions provided a means of accommodating the wide range

of pedagogical needs of online learning which exists in higher education. Reeves and Reeves (1997) acknowledged that their "... set of ten dimensions is by no means exhaustive, and enhancements to strengthen its utility are expected" (p. 59). The IDOL model enhances and extends Reeves and Reeves ten pedagogical dimensions to 24 dimensions. The IDOL model presents these 24 recommendations (and dimensions) as elements within a typical systematic instructional design framework (Dick et al., 2005) to assist with the instructional design analysis of an online unit. Each of the 24 elements in the IDOL model has been numbered to correlate with the 24 figures presented in the previous section. To demonstrate the application of the IDOL model's 24 elements, the design and analysis of two sample units are presented here. The two units differ in their pedagogical approaches, lecturer requirements, and lecturer roles.

The first sample unit is called *Reflective Practitioner*. This unit is delivered within the Bachelor of Arts (Training & Development), Graduate Certificate (Training & Development, Tertiary Teaching) and Graduate Diploma (Training & Development) courses within the Department of Education at Curtin University of Technology. This unit is delivered in distance education mode and is provided entirely online. After students have completed some preliminary activities, principles of action research are applied as the learning strategy and students are encouraged to be self-directed through inquiring areas of interest. The targeted students are adult learners employed as lecturers, trainers, community program developers or facilitators.

The second sample unit is called *Introduction to Microbiology* from the School of Biomedical Science at Curtin University of Technology. It is part of the undergraduate human life sciences program which is delivered via the Open Learning Australia (OLA) portal (<http://www.ola.edu.au>). This unit is delivered entirely in external online mode for off-campus students and is supported with additional materials, including a biomedical practical kit and a CD-ROM. These materials are posted to students to allow them to complete the required practical assignments for each of the modules from home.

Figure 25 illustrates the design analysis for both units using the IDOL model. Both units have been illustrated on the same figure to demonstrate how the IDOL model can accommodate online units with varying instructional and pedagogical needs. The positions (ratings) along each pedagogical dimension shown in Figure 25 have been determined by the author. They have been influenced by this author's involvement with other instructional designers in the online development of these units, as well as several discussions with the units' lecturers. This method of rating each pedagogical dimension is not unlike the method used by Reeves and Reeves (1997).

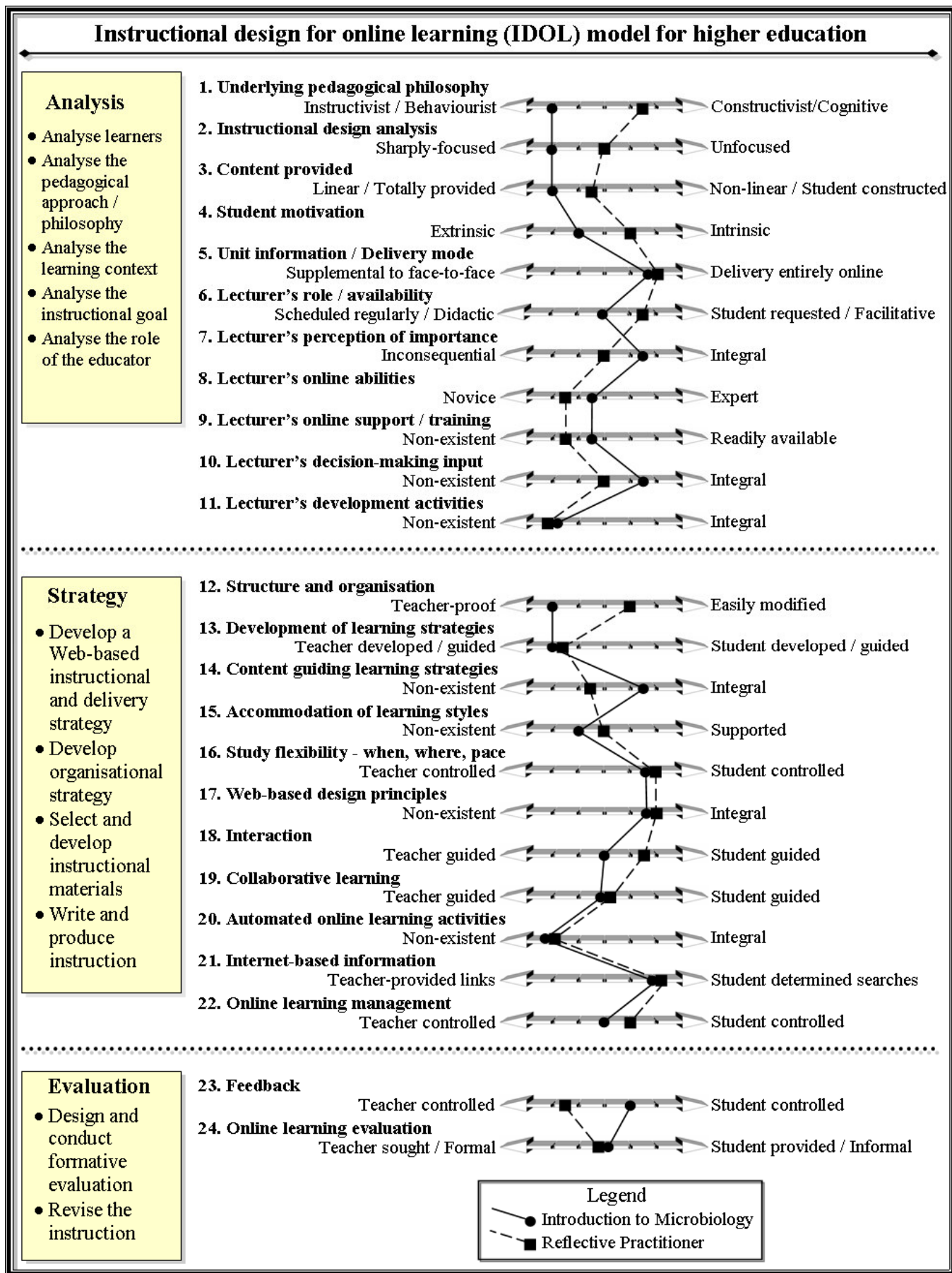


Figure 25 Instructional design analysis for two sample units using the online learning (IDOL) model for higher education

Conclusion

An instructional design for online learning (IDOL) model for higher education has been put forward that incorporates the findings from a recent PhD study (Siragusa, 2005) in the form of 24 pedagogical dimensions. This model was designed to accommodate various students' pedagogical and delivery needs including the delivery of learning entirely online through to online learning provided as a supplement to face-to-face learning. The IDOL model is presented in a format that resembles a typical instructional design model including the analysis, strategy development and evaluation phases. However, it is not designed to replace the use of any particular instructional design model. Instead, the IDOL model is designed to ensure that decisions made at the instructional design phase take into account decisions which are specific to the development of pedagogically effective online learning environments. The IDOL model can work alongside other instructional design models, such as Dick, Carey and Carey's (2005) systematic instructional design model.

The 24 pedagogical dimensions presented in the IDOL model is an extension of Reeves and Reeves (1997) ten pedagogical dimensions. As with Reeves and Reeves' model, the IDOL model should not be considered comprehensive and complete. While the development and utilisation of online learning technologies continues to grow, the pedagogical dimensions presented here will undoubtedly need ongoing revision and modification that is informed by ongoing research into online learning in higher education.

References

- Bull, K. S., Kimball, S. L., & Stansberry, S. (1998). *Instructional Design in Computer Mediated Learning*. Paper presented at the Coming Together: Preparing for Rural Special Education in the 21st Century. Conference Proceedings of the American Council on Rural Special Education (18th, Charleston, SC, March 25-28, 1998), U.S., Oklahoma.
- Clark, J. (2003). *Building accessible Websites*. Indiana: New Riders Publishing.
- Dick, W., Carey, L., & Carey, J. O. (2005). *The Systematic Design of Instruction* (6th ed.). Boston: Pearson, Allyn and Bacon.
- Gagné, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of Instructional Design* (4th ed.). Fort Worth: Holt, Rinehart & Winston, Inc. Harcourt Brace College Publishers.
- Gibbs, G., Morgan, A., & Taylor, E. (1984). The world of the learner. In F. Marton, D. J. Hounsell & N. J. Entwistle (Eds.), *The experience of learning*. Edinburgh: Scottish Academic Press.
- Glaser, R. (1987). *Advances in instructional psychology* (Vol. 3). Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Greening, T. (1998). WWW support of student learning: A case study. *Australian Journal of Educational Technology*, 14(1), 49-59.
- Harris, R. (1997). *Evaluating Internet research sources*. Retrieved 26th May, 2006, from <http://www.virtualsalt.com/evalu8it.htm>
- Hsu, J. J. F., Chen, D., & Hung, D. (2000). Learning theories and IT: The computer as a tutor. In M. D. Williams (Ed.), *Integrating technology into teaching and learning: Conceptions and application - An Asia-Pacific perspective*. Singapore: Prentice Hall.
- Keppell, M., Cote, P., Chen, S., Leung, P., Jones, J., & Richards, C. (2004). Staff perceptions of online learning: Five cases from a teacher education setting in Hong Kong. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* (pp. 503-511). Perth, 5-8 December.
<http://www.ascilite.org.au/conferences/perth04/procs/keppell.html>.
- Lynch, P. J., & Horton, S. (2002). *Web style guide: Basic design principles for creating Web sites* (2nd ed.). New Haven: Yale University Center for Advanced Instructional Media.
- McCormack, C., & Jones, D. (1998). *Building a Web-based education system*. New York: Wiley Computer Publisher.

- McMurray, D. W., & Dunlop, M. E. (1999). The collaborative aspects of online learning: A pilot study. In *UtiBASE*. Peer Reviewed. Paper originally presented at the '6th International Literacy & Education Research Network Conference on Learning' Bayview Beach Resort, Penang, Malaysia on the 27-30 September 1999. <http://ultibase.rmit.edu.au/Articles/online/mcmurry1.htm>.
- Miller, S. M., & Miller, K. L. (2000). Theoretical and practical considerations in the design of web-based instruction. In B. Abbey (Ed.), *Instructional and cognitive impacts of Web-based education* (pp. 156-177). Hershey, USA: Idea Group Publishing.
- Ralph, E. G. (1998). *Motivating teaching in higher education: A manual for faculty development*. Still water, Oklahoma: New Forums Press Inc.
- Reeves, T., & Reeves, P. (1997). Effective dimensions of interactive learning on the World Wide Web. In B. H. Khan (Ed.), *Web-based instruction* (pp. 59-66). Englewood Cliffs, N.J.: Educational Technologies Publications.
- Reigeluth, C. M. (1987). Lesson blueprints based on the elaboration theory of instruction. In C. M. Reigeluth (Ed.), *Instructional theories in action: Lessons illustrating selected theories and models* (pp. 245-288). Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.
- Reigeluth, C. M. (1999). The elaboration theory: Guidance for scope and sequence decisions. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instruction theory* (Vol. II, pp. 425-453). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Ryan, S., Scott, B., Freeman, H., & Patel, D. (2000). *The virtual university: The Internet and resource-based learning*. London: Kogan Page.
- Savin-Baden, M. (2000). *Problem-based learning in higher education: Untold stories*. Buckingham: The Society for Research into Higher Education & Open University Press.
- Scott, N., & Judd, K. (2002). *Efficient continuous online assessment of large classes: Continuous diagnostic assessment in engineering & mathematics subjects*. Retrieved 3rd August, 2004, from <http://www.cshe.unimelb.edu.au/assessinglearning/04/case13.html>
- Siragusa, L. (2005). *Identification of effective instructional design principles and learning strategies for students studying in Web-based learning environments in higher education*. Unpublished PhD thesis, Curtin University of Technology, Perth.
- Siragusa, L., & Dixon, K. C. (2005a). Closing the gap between pedagogical theory and online instructional design: a bridge too far? In G. Chiazzese, M. Allegra, A. Chifari & S. Ottaviano (Eds.), *Methods and Technologies for Learning*. Southampton: WIT Press.
- Siragusa, L., & Dixon, K. C. (2005b). *A theoretical framework for research and development into sound online learning in higher education*. Peer reviewed paper presented at the AARE 2005 International Education Research Conference. Creative Dissent: Constructive Solutions, New South Wales: Parramatta.
- Smith, P. L., & Ragan, T. J. (2005). *Instructional Design* (3rd ed.). NJ: John Wiley & Sons, Inc.
- Soulier, S. (1988). *The design and development of computer based instruction*. Boston: Allyn and Bacon, Inc.
- Steven, C., & Zakrzewski, S. (2002). Student assessment in ICT. In S. Fallows & R. Bhanot (Eds.), *Staff and educational development series: Educational development through information and communications technology* (pp. 123-132). London: Kogan Page.
- W3C. (1994-2006). *World Wide Web Consortium*. Retrieved 26th May, 2006, from <http://www.w3.org/>
- Weigel, V. B. (2002). *Deep learning for a digital age: Technology's untapped potential to enrich higher education*. San Francisco, CA: Jossey-Bass, A Wiley Company.
- Weller, M. (2002). *Delivering learning on the Net: The why, what & how of online education*. London: Kogan Page.