Designing quality e-learning environments in higher education

Lou Siragusa, Kathryn C. Dixon and Robert Dixon
Faculty of Education, Language Studies and Social Work
Curtin University of Technology

With the ever-increasing integration of online learning (or e-learning) into university courses, there is strong need for practical guidelines and recommendations to facilitate the development and delivery of pedagogically effective e-earning environments. An investigation by Siragusa (2005) examined factors which make for effective instructional design principles and learning strategies for higher education students studying within these learning environments. Surveys were administered to students and lecturers in Western Australian universities which revealed numerous areas of students' e-learning experiences which they had perceived as being successful and those needing improvements. This paper presents a model containing 24 sets of recommendations that were developed from the study's survey findings. The 24 recommendations accommodate the varying pedagogical needs of learners as well as modes of course delivery. For each recommendation, a pedagogical dimension is presented to illustrate the pedagogical needs and instructional requirements. These 24 dimensions, which are grouped within nine main sections, highlight the decisions which need to be made during the instructional analysis, design, delivery and evaluation phases of e-learning environments in higher education in order to optimise their pedagogical quality.

Introduction

Higher educational institutions are increasingly moving toward the use of the Internet for delivery of their courses, both on campus and at a distance (Ally, 2004, p. 5; Kim & Bonk, 2006). The Internet provides significantly different and interesting possibilities for computer-meditated communication and learning from other forms of educational technologies (Weller, 2002, p. 34). In some cases, courses are delivered exclusively online to students in remote locations and supplementary materials may also be mailed out. The entire class website can be duplicated onto a CD-ROM for the 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. 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). There are, therefore, ways in which e-learning environments may be utilised based upon pedagogical needs.

The development of instructionally effective online learning environments that meet these pedagogical needs require the application of appropriate instructional design principles. The literature suggests that there are gaps between the bodies of knowledge relating to learning theories, instructional design principles and student learning in higher education, (Siragusa & Dixon, 2005a). A recent PhD study (Siragusa, 2005) developed a theoretical framework and research methodology (Siragusa & Dixon, 2005b) which made links 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. These 24 pedagogical dimensions are described within the following nine main sections. They are then presented within a model, followed by an example of their application.

Pedagogical philosophy and instructional strategy for e-learning

Ally (2004) argued that in order to promote higher-order thinking through technology-based learning environments, instructional strategies which promote learners to make connections with new information to old, acquire meaningful knowledge, and employ metacognitive thinking skills are required within the e-learning environment. This requires an analysis of the learner, the learning context and the learners' specific

learning needs. 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. A lecturer with postgraduate students completing a Masters degree may prefer to adopt a constructivist approach to teaching, where students are encouraged to construct their own meaning of the content through their prior experiences. The varying underlying pedagogical approach is represented along a dimension as illustrated in Figure 1.

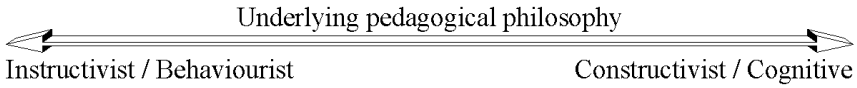

Figure 1: Dimension for underlying pedagogical philosophy

Instructional design processes for e-learning

Caplan (2004) and Davis (2004) described how, in an ideal world, educators, instructional designers, e-learning media developers and graphic designers all work together to create pedagogically effective learning environments that are grounded in sound learning theories. In many cases, however, the lecturer is often left without this team support and resources. There are, however, aspects of the instructional design process that the lecturer needs to consider when creating pedagogically effective e-learning environments regardless of the available resources.

Instructional design analysis

The development of online learning environments needs to draw upon the vast body of knowledge relating to instructional design models (e.g., Dick, Carey & Carey, 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 concepts will take into account the 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 employ online learning technologies to assist with achieving this instructional goal, or he/she may adopt a constructivist learning environment where students combine new learning with existing knowledge and the learning experiences are authentic depictions of existing practices. The lecturer may develop formative and/or summative evaluations to identify how to improve the instruction and 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.

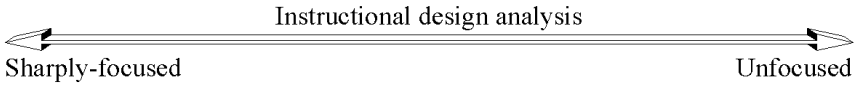

Figure 2: Dimension for instructional design analysis

Content

The detail and extent of the content provided to students may vary depending upon the students' pedagogical needs. Students studying entirely online must have access to all of the unit content including the learning outcomes, assignment requirements and relevant resources. 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 and accurate, (Glaser, 1987, pp. ix-xiii). The purpose of the class website should be made clear and unambiguous instructions for access, navigation to relevant information, and use of communication tools and other features of the website. Students studying at postgraduate level may need to construct their own knowledge based upon their literature review and research and, therefore, less content is provided. Figure 3 illustrates two contrasting pedagogical approaches relating to content on a pedagogical dimension.

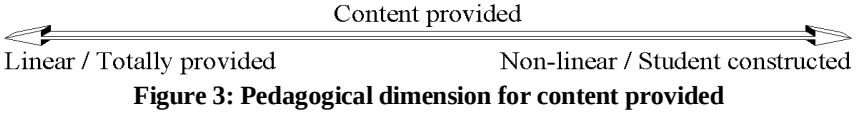

Figure 3: Pedagogical dimension for content provided

Online information and delivery mode

The amount of information to provide on a class website may be determined by the delivery mode. If a 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. 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 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 4.

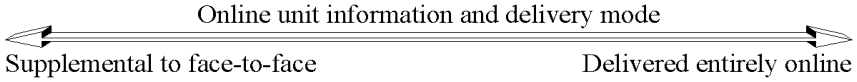

Figure 4: Dimension for online unit information and delivery mode

Student motivation in e-learning

Students enrolled in higher education courses come from a variety of backgrounds and have different reasons for studying. While it is generally accepted that online learning designers should use intrinsic motivation strategies, extrinsic motivation may also be used. A university student may be extrinsically motivated in only doing what is required in order to pass units without a significantly deep interest for the subject. Students studying in distance mode need to feel that they are part of a group of learners and are able to obtain assistance with the unit's requirements and technical difficulties. For students who are intrinsically motivated to study due to a desire to develop a deeper understanding of the subject matter content which fosters deeper understanding of the subject and relates to real-life and employment situations should also be included. Figure 5 illustrates the varying pedagogical approaches towards motivation.

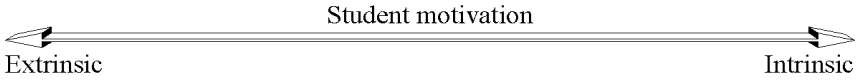

Figure 5: Pedagogical dimension for student motivation

Lecturer's role in e-learning

The lecturer's role is an important factor in the design of technology-based environments in that various roles can be supported. While there is much written about how e-learning technologies can facilitate greater interaction and collaboration for students and their lecturer in the teaching and learning process (e.g., Maor, 2003), there are several facets of the role of the lecturer that can impact upon how e-learning environments are developed and delivered. The following discusses the considerations that developers and lecturers need to take into account for each of these facets when designing e-learning environments.

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.

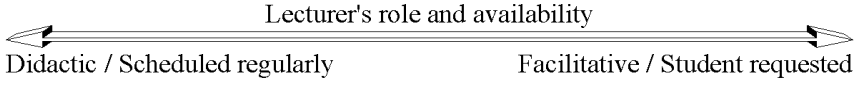

Figure 6: Dimension for lecturer's role and availability

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. Lecturers with a low perception of the importance of online learning may not fully consider how to apply online strategies to enhance their students' learning. Lecturers with high perceptions of the importance of online learning may explore integrating learning strategies utilising online technologies such as automated interactive activities. Educators 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. Learning strategies may be developed for encouraging students to utilise online communication facilities such as conducting discussions about specific topics and discussion based on issues relating to their assignments. Lecturers may also encourage students to maintain a reflective 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.

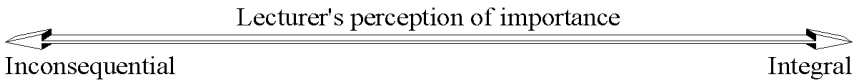

Figure 7: Dimension for perceived importance towards online learning

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. 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, 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.

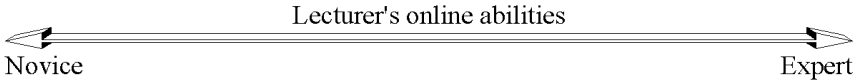

Figure 8: Dimension for lecturer's online learning abilities

Lecturer's online support and training

Lecturers involved in developing further knowledge of online learning through professional development may integrate 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. Lecturers with advanced knowledge of online learning development practices may apply more efficient ways of presenting the same learning materials. Educators need to be aware of the labour intensive nature of online learning and the resources 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 and mentoring other staff members in their online delivery of units. Figure 9 illustrates the dimension, lecturers' availability of support and training.

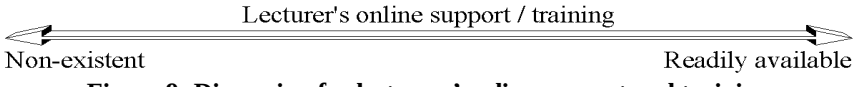

Figure 9: Dimension for lecturers' online support and training

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 and decision making process and be encouraged to put forward their input regarding the direction of online learning development. A collegial atmosphere of sharing, 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.

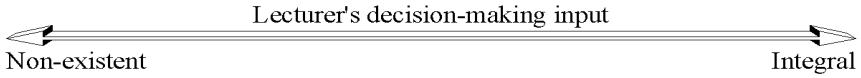

Figure 10: Dimension for lecturer's decision making input

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 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 develop effective teaching and learning strategies for enhancing student online learning. Figure 11 illustrates the level of online learning development activity along a dimension.

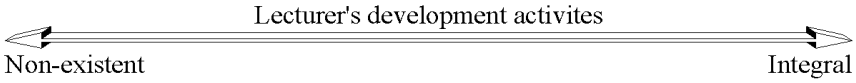

Figure 11: Dimension for development activities for online learning

Infrastructure for e-learning

Davis (2004) described the infrastructure for online learning including student support. Parker (2004) described 24 benchmarks for quality Internet-based distance education including institutional support, student support and course structure. The following discusses how student support may be provided within the structure of e-learning.

Structure and organisation

The structure of the class website, including navigation, information provided, and use of the online LMS features may vary depending on the targeted students and pedagogical need for online learning. The website's structure may be rigid so that students can 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, including navigation, must be self-intuitive. 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.

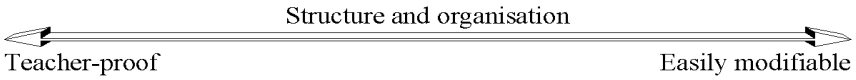

Figure 12: Pedagogical dimension for structure and organisation

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 13.

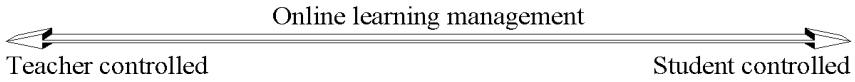

Figure 13: Dimension for online learning management

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

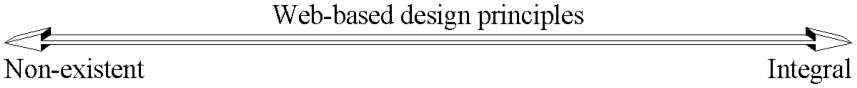

Figure 14: Dimension for web-based design principles

Subject content and instructional strategies for e-learning

Ally, (2004) argued that e-learning designers should select learning strategies that motivate learners, facilitate deep processing, build the whole person, cater for individual differences, promote meaningful learning, encourage interaction, provide feedback, facilitate contextual learning, and provide support during the learning process. Pedagogical issues relating to content and learning strategies to be considered during the design of e-learning are discussed in the following.

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 for 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 a particular problem, and to encourage them to maintain a reflective journal to record their successes and barriers to their learning. The lecturer may 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 15 illustrates the variation between teacher developed and student developed learning strategies represented along a dimension.

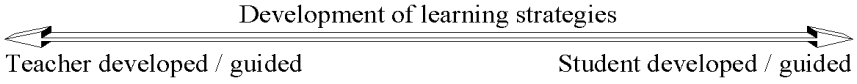

Figure 15: Dimension for the development of learning strategies

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 strategies, the content may include up-to-date real-life examples (e.g., employment situations that students may encounter), enrichment materials and links to relevant websites. The level which the unit is suitable for supporting such learning strategies may be represented along a dimension as illustrated in Figure 16.

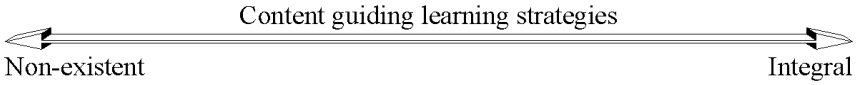

Figure 16: Dimension for the content guiding learning strategies

Learning styles and study flexibility for e-learning

Ally (2004) argued that learning strategies within e-learning environments should accommodate various learning styles and allow learners to select appropriate activities suited to their own learning style. Ally (2004) also argued that, while online learning allows for flexibility of access from anywhere and anytime, the learning materials must be designed properly to engage the learner and promote learning. The following discusses how adequate support can be provided to learners to accommodate flexibility and individual learning styles.

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 17 illustrates varying support for individual learning styles along a dimension.

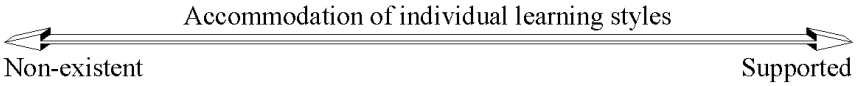

Figure 17: Dimension for accommodation of individual learning styles

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 18.

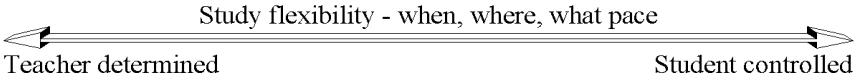

Figure 18: Dimension for online study flexibility

Student learning strategies

When designing online instructional materials, consideration towards the different approaches to learning based upon contemporary learning theories is needed in order to select the most appropriate instructional strategies (Ally, 2004). As discussed earlier, the adopted online learning strategies should motivate student learning and facilitate deep approaches to learning. Ally (2004) suggested that learning strategies should promote meaningful learning, encourage interaction, provide feedback, facilitate contextual learning, and provide support during the learning process. The following describes instructional strategies which can be utilised for technology-based environments to promote effective student learning.

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 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 may be schedule for the 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 19.

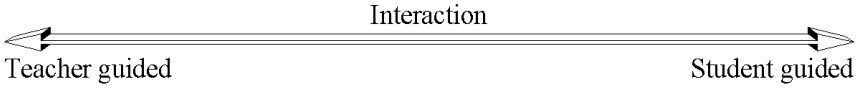

Figure 19: Pedagogical dimension for interaction

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 bulletin board and email at various stages of the collaborative effort as well as maintaining a reflective journal to record their contributions. Postgraduate students studying in 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 share ideas about the assignment tasks and to post draft versions to each other for checking. Figure 20 illustrates the varying use of collaborative learning activities represented along a dimension.

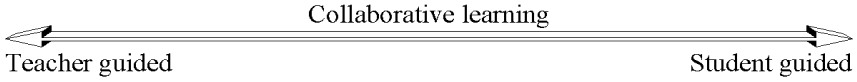

Figure 20: Dimension for collaborative learning

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, 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 reinforce 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 21.

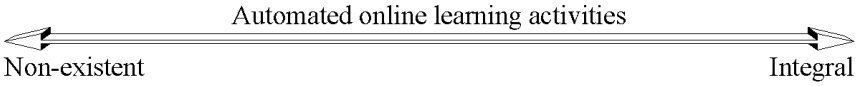

Figure 21: Dimension for automated online learning activities

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 employ effective online search strategies (e.g., Harris, 1997). In this case, students are provided with specific links and are guided with finding specific information, as well as providing access to online resources which are useful for their future employment. A postgraduate student involved in research may search for information through a variety of online resources including online journals and 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 22 illustrates the varying amount of teacher guidance provided with finding specific information on the Internet as represented along a dimension.

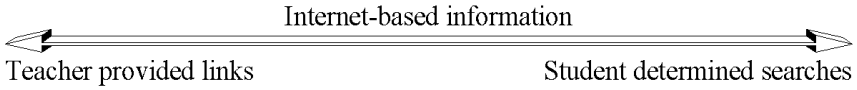

Figure 22: Dimension for Internet-based information

Feedback and evaluation of e-learning

The ongoing development cycle of an e-learning environment, as with all other learning environments, needs to include an evaluation process to determine and maintain the effectiveness of the system. Davis (2004) suggested that this should be based on the achievement of the learning outcomes and on students' feedback. In turn, lecturers can assist students with their learning through providing appropriate support and feedback to students during their online studies for enhancing their learning. The following discusses how feedback can enrich students' online learning experiences, as well as how students' evaluation of their online learning experiences can feed back into the ongoing development of the online learning system.

Feedback

Students are increasingly expecting more reliable and valid assessment with prompt feedback on their performance. The amount and type of feedback students require will vary depending upon student need and level of engagement with the learning materials. A postgraduate student working on a doctoral thesis will usually ask for feedback as required and may initiate online contact with other postgraduate students regarding issues relating to their enquiry. A first year student studying an undergraduate unit will require feedback relating to the subject matter and more likely, assignment requirements. 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 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.

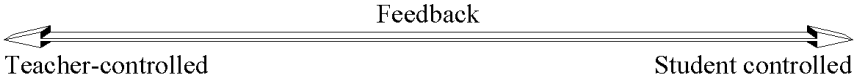

Figure 23: Pedagogical dimension for feedback

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 experiences. 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.

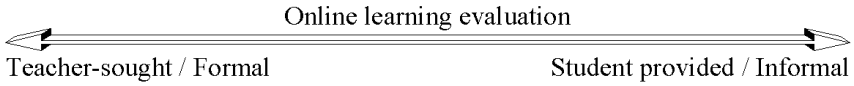

Figure 24: Dimension for online learning evaluation

Instructional design for online learning model

The 24 recommendations above need to be considered at the design phase of teaching materials to consider what role online learning will have with the delivery of the unit. This will vary depending upon a number of factors including the skills and knowledge of students, the selection of pedagogical approaches the learning context and mode of delivery, instructional strategies, 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. 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 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 in the Bachelor of Arts (Training & Development) 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. They are illustrated on the same figure to show 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 the author's involvement with other instructional designers in the online development of these units, as well as several discussions with the units' lecturers. The rating method is not unlike the method used by Reeves and Reeves (1997).

Conclusion

The IDOL model presented above incorporates findings from a PhD study (Siragusa, 2005) in the form of 24 pedagogical dimensions. This model accommodates the various students' pedagogical and delivery needs which occur in higher education. While the IDOL model is presented within a typical instructional design format including the analysis, strategy development and evaluation phases, it is not designed to replace any particular instructional design model. It is designed to work alongside other instructional design models (e.g., Dick, Carey & Carey, 2005) in order to ensure that decisions made at the instructional design phase take into account decisions which are specific to the development of pedagogically effective e-learning environments. As with Reeves and Reeves' (1997) model, the IDOL model should not be considered comprehensive and complete. While the development and utilisation of online learning technologies continues to grow to include more sophisticated virtual environments for learning (e.g., Yellowlees & Cook, 2006), the pedagogical dimensions presented here will undoubtedly need ongoing revision that is informed by ongoing research into quality e-learning.

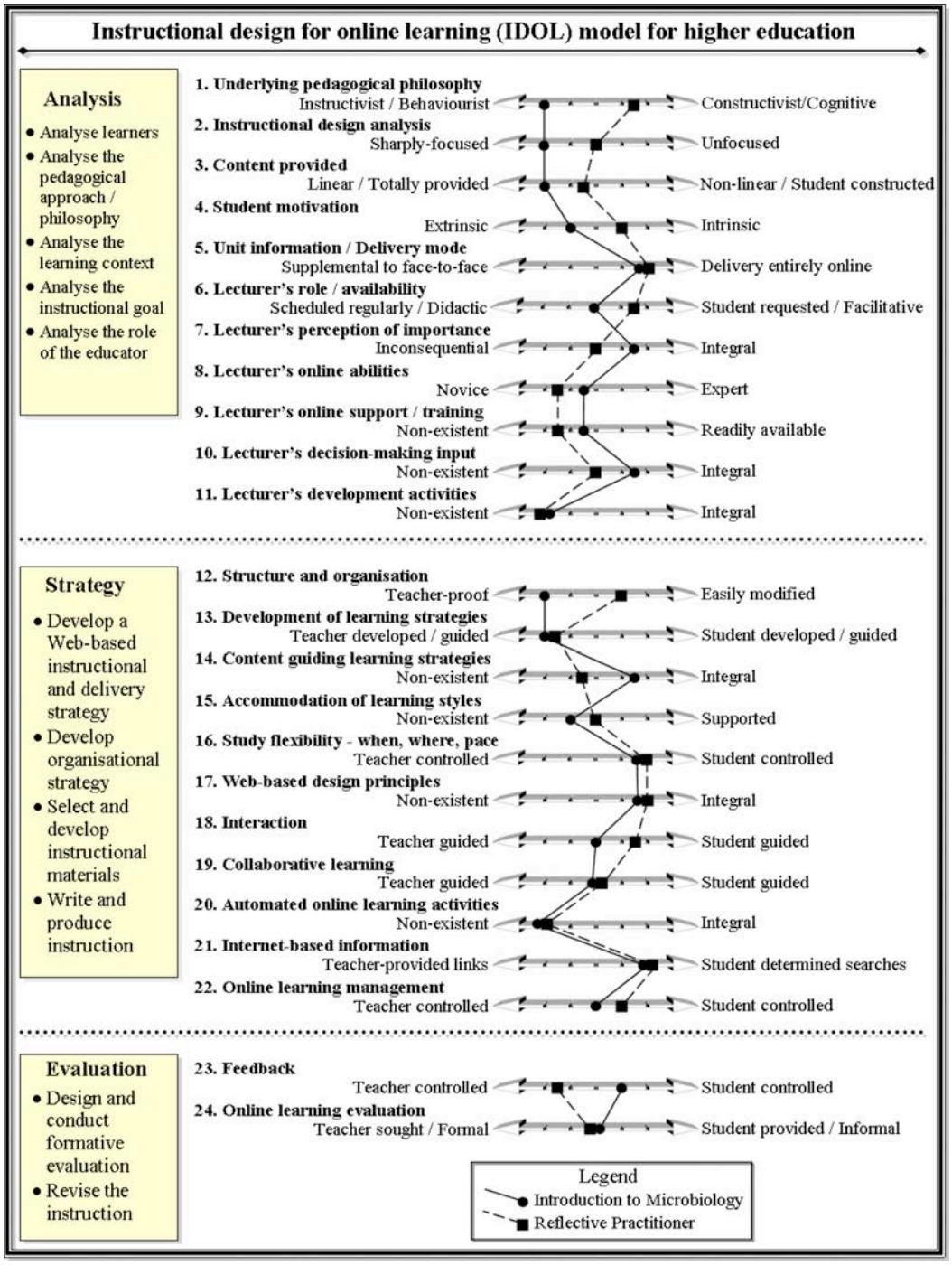

Figure 25: Instructional design analysis for two units using the online learning (IDOL) model for higher education

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Dr Lou Siragusa, Faculty of Education, Language Studies and Social Work, Curtin University of Technology,
Email: L.Siragusa@curtin.edu.au
Dr Kathryn C. Dixon, Faculty of Education, Language Studies and Social Work Curtin University of Technology,
Email: K.Dixon@curtin.edu.au
Mr Robert Dixon, Faculty of Education, Language Studies and Social Work, Curtin University of Technology,
Email: R.Dixon@curtin.edu.au

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