

On-line delivery: A model for successful implementation

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This paper outlines the methodology and processes employed to develop a mixed mode learning model for the delivery of two postgraduate information technology units to meet the varied needs of a widely dispersed group of students. It outlines how the implementation of instructional design takes account of teaching and learning issues, technological issues and the management of on-line delivery of units of study in the Faculty of Education at Australian Catholic University.

Introduction

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The challenge of IT for on-line delivery

The use of information technologies for on-line delivery in education has allowed diverse learning needs to be met and new methodologies for using information systems are now possible. With this have come greater challenges to ensure that the most appropriate forms of information technology are used to support the diverse learning needs in an on-line environment.

Information technology now provides more than just information. It can be both the medium for communication and the subject of learning itself. It has reshaped learning environments from preschool to university and challenges our approaches to teaching and learning

The Challenge of Learning

Mayer (1999, p143) reports that "Constructivist learning occurs when learners actively create their own knowledge by trying to make sense out of material presented to them." The role of information technology in the constructivist learning environment is as a means of communication and also as a tool for learning. The role of the learner in relation to information technology can be as a user of the technology or as a producer of technology or media for others to use. Within this constructivist model of learning, different roles can be discerned for information technology, depending on the role of the learner.

Constructing a conceptual framework for on-line delivery

Instructional technology and learning are both complex areas of study. In order to examine possible relationships between these two areas it was necessary to construct a conceptual framework. This paper draws heavily on the works of Reigeluth (1983; 1999), who has brought together theoretical instructional design theories and models.

Perkins (1992) requires that instructional-design theory should provide:

- *Clear information* - where descriptions and examples of the goals, knowledge needed, and the performances expected are articulated.
- *Thoughtful practice* - where opportunities are provided for learners to engage actively in the content.
- *Informative feedback* - clear thorough counsel to learners about their performance, helping them to proceed more effectively.
- *Strong intrinsic or extrinsic motivation* - activities that are amply rewarded either because they are very interesting and engaging in themselves or because they feed into other achievements that concerns the learner.

Reigeluth's (1999) model of instructional-design theory has two components for facilitating human learning and development:

- *methods of instruction* which relate to the context in which learning can take place and;
- *situations for learning* which effect the methods of instruction.

Reigeluth's (1999) model is illustrated in Figure 1.

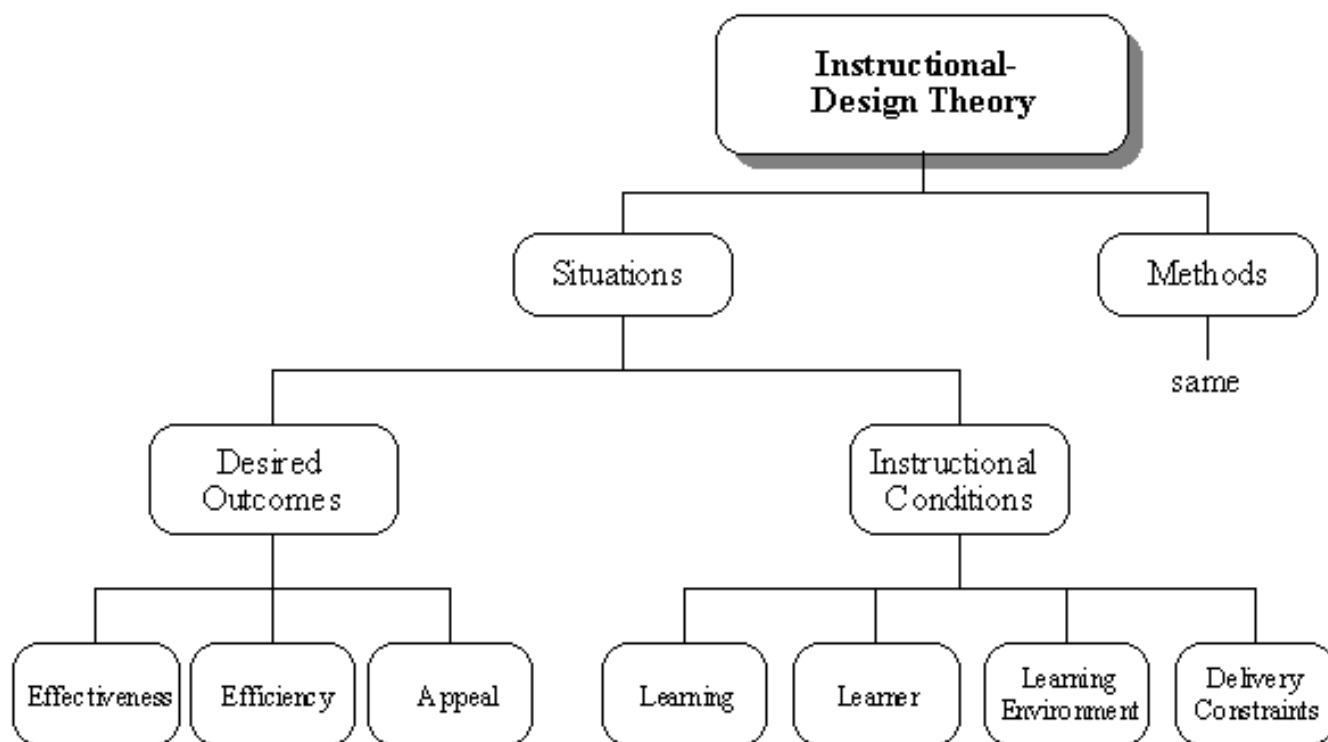


Figure 1 - Reigeluth's components of instructional-design theories

A Model for On-line Delivery at ACU

The framework for implementing on-line units in information technology within the School of Education (NSW) at ACU addresses three broad issues with reference to instructional-design theory.

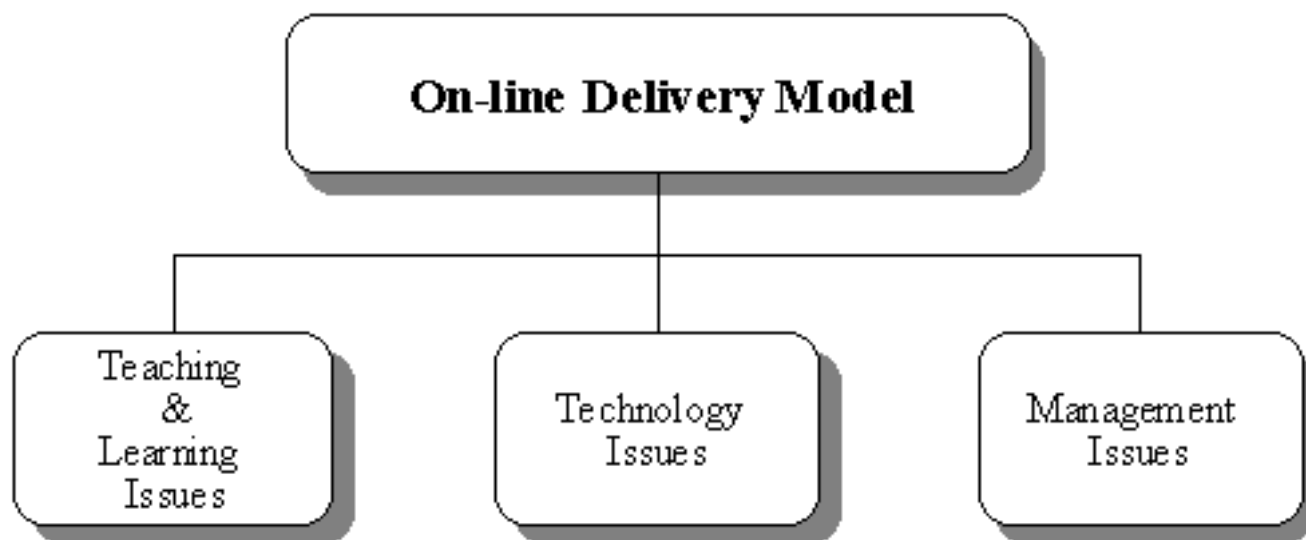


Figure 2 - On-line delivery model for the School of Education (NSW)

The first focuses on **teaching and learning** and addresses some of the issues that are commonly discussed when educational technology is used. These are essentially the **methods** referred to in figure 1. The second is a listing of some **technology issues** or **instructional conditions** associated with the different forms of technology that

have been used within different educational contexts. The third raises the important **management issues** that are the recurring themes in the literature of instructional technology and education. The **management issues** have a significant relationship to the **desired outcomes** in figure 1. Figure 3 shows the relationship of the School of Education (NSW) conceptual framework developed in this paper to Reigeluth's components of instructional-design theories.

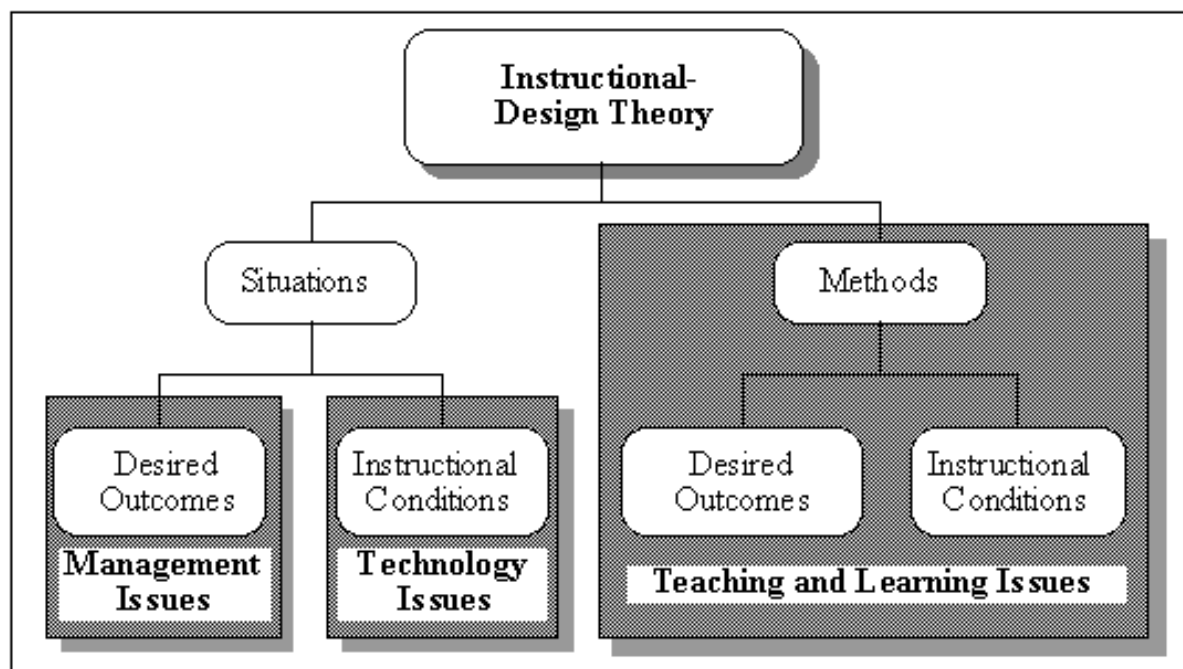


Figure 3 - On-line delivery issues relating to instructional-design theories.

Teaching and Learning Issues

When presenting on-line study using information technology, there are a number of issues in the achievement of students' learning outcomes. Three major components will be discussed here:

- students' prior knowledge and skill with using information technology;
- the curriculum model used in the delivery of on-line study;
- interactions with staff and other participants during on-line study.

In each of these sections, using information technology as the means of delivering course materials will be the major focus of the discussion.

Prior Knowledge and skills. The knowledge and skills that participants bring to the courses is significant in developing a framework for on-line delivery of learning material. Students' prior knowledge will influence how easily they can assimilate new information.

Participants' prior knowledge is an important factor to be considered in developing the pace of delivery of the program. If participants have low prior knowledge the pace of delivery of the presentation may exceed their capacity to process information, resulting in a comprehension failure. While the pace of the program can be changed in flexible learning programs, this is probably not possible for pre-prepared material or a CD-ROM. If there is a synchronous delivery of material to a number of different sites, then the site-facilitator may play an effective role in monitoring participants' understanding. There are some suggestions

that it is difficult for the course presenter to monitor participants' understanding when the material is sent to number of different sites. If this is the case then the site facilitator can monitor participants' body language and ask for clarification of the information at appropriate points during the delivery of the learning material.

The Curriculum Model. Distance education courses have to be prepared and well structured. Reed and Woodruff (1995) suggest early communication of expectations also needs to be considered. In the study of evaluating participants' learning from televised lectures, Martin & Bramble (1996) used word pictures and graphics to assist participants' understanding the information. While participants rated these as helpful, there is some indication that the pictures were too simplistic. Design of some study guides in this project appeared to encourage only lower order engagement such as the recall of factual details. These suggest that care must be taken in developing supports to ensure participants do a significant amount of the cognitive processing (eg. concept mapping, summarising information for a peer). Redding (1995) suggests cognitive task analysis is needed when developing materials for distance education classes.

There should be a logical structure between the main point and issues and the illustration of examples. The visual material should match the message. If the argument is essentially abstract then the visual material need to support this in the form of "a talking head" or the discussion panel. This is supported by Cennamo (1993) who found that adding complexity in both auditory and visual recognition such as sentence syntax, and visual elements (eg: zooms, pans, movements within the scene) reduced learners' mental effort and their recall of factual details. Secondly, a high correspondence between visuals and auditory messages was associated with higher recall of facts. Finally, providing identified breaks in the content following complex elements may provide time for perceptual processing and for participants to make sense of the message

Interaction with Other Participants. Learning is an active process. Students need to engage with (read, think about, critically analyse, discuss, consider, reflect on) the appropriate reference materials. Evidence suggests that these processes of engagement are likely to be encouraged if participants interact with each other and the course presenter or convenor. Thus techniques which facilitate participants' interactions need to be identified and incorporated into pedagogical techniques of alternative modes of instruction.

Asynchronous discussions offer participants the convenience of being able to contribute in their own time, and allow them time to reflect on other contributions and to consider what they are going to say before contributing. The discussion facility records what has been said. A facilitator who is summarising the discussion can refer this to. There is also a record of who has said it. This is useful for group members and teaching staff monitoring who has participated (and if necessary, to enforce participation).

Effective interactions involve a discussion among the participants. This is significantly more than just allowing participants to request further information. Oliver & Reeves (1996) highlight differences in effective compared with ineffective interaction. The dimensions examined by these researchers suggest the critical dimensions of effective learning with interactive television and four of these are listed below:

- **Collaboration** -promoted through the use of cooperative groups.
- **Generative Learning** - a metacognitive approach to teaching which encourages participants to reflect on their learning
- **Contextual Engagement** - where instruction is designed to present an event or problem situation to serve as a focus for the collaborative activity the new knowledge is situated in meaningful relevant contexts.

- **Personal Autonomy** - where the teacher moves to a facilitator rather than a purveyor of information as participants become active autonomous.

The points made above are deliberately general. A list of tips for presenters and participants could easily be generated, but would be of little lasting value without an overarching philosophy of teaching and learning. The learning models which are developed, based upon these three issues provide a conceptual framework within which teaching and learning behaviours can be planned, implemented and evaluated. This conceptual framework also provides a basis for evaluating the effectiveness of learning with information technology.

Technological Issues

Technological issues relate to Reigeluth's (1999) instructional-design theory, (figure 1) as the situated instructional conditions of:

- learning;
- learner;
- learning environment;
- delivery constraints.

Learning. The model in this context is a constructivist model using information technology. Students who undertake on-line study within our model use the information technology a means of accessing information but also as a means of constructing knowledge within an information technology environment. The use of the World Wide Web as a delivery medium allows for the development of a flexible learning environment that used the following instructional design metaphor:

- **Welcome:** Contain this welcome information, the unit outline and the assessment details
- **Resources:** Software, journal articles and other internet resources
- **Modules:** Topic material and Activities updated according to the Unit Schedule
- **News:** Updated weekly with important events and reminders
- **Forum:** Participant location map, profiles of the group and a gallery of participant work



The screenshot shows the homepage for EDST501: Instructional Systems. At the top left is the ACU Faculty of Education logo, featuring a red shield with a white cross and the text 'ACU Faculty of Education'. Below it is an image of the Sydney Opera House and a building labeled 'School of Education NSW'. To the right, the text 'EDST501: Instructional Systems' is displayed in a blue, shadowed font, with 'Home Page' below it. A navigation menu on the left consists of purple buttons with white text: 'Home', 'Welcome', 'Resources', 'Modules', 'Forum', and 'News'. Below the menu is the text 'EDST501 Instructional Systems'. In the center, the main heading 'Welcome to EDST501 online' is written in large, blue, shadowed letters. To the right of the heading is a photograph of three people (two men and one woman) sitting on a bench. Below the heading is a yellow oval button with the text 'Latest News'. At the bottom left, it says 'Page Updated: 08/11/99'. In the top right corner, there is an image of a computer keyboard and a mouse.

Learner. The learner becomes responsible for the developing and maintaining information and communications technologies to work in an on-line environment. In this model learners need to have the following skill sets:

- able to set up and access the internet for
- world wide web
- e-mail
- sending e-mail attachments
- down loading and accessing Adobe Acrobat files
- effective word processing skills
- understanding file structure and file formats
- software installation and management

Learning Environment. A World Wide Web site represents the learning environment. The elements of the site are:

- Visual design characteristics

Significant issues for graphic design are:

- a corporate logo, identifying the ownership of the study material;
- a unifying graphical theme underpinning all web pages an study material;
- developing an inviting place to study in which the user is supported;

- the use of clear non ambiguous graphic elements;
- limited use of large graphics.

The key elements relating to text are as follows:

- text is of a consistent style and colour;
 - the initial perception of print course material should seem easy;
 - instructional material is well organised;
 - physical attributes are consistent with learner expectation, i.e., use of white space, complementary colours and background;
 - plain typeface and font are used.
- Graphical User Interface (GUI)-uses icons, graphics, windows and a pointing device, instead of a purely character-mode interface

The Graphical User Interface for WBI is a problematic area. Hyperlinks and representations can create new meaning not previously considered. To be effective with the interface it will be important to develop a "bounded information landscape and the tools necessary to explore and investigate the information". Hedberg, Brown & Arrighi (1997) provide some examples that include:

- the position of elements in the screen to indicate their relationship to the underlying metaphor;
- simple use of contextual clues;
- regular use of standard format of basic word style format to indicate links with other sources of information;
- written directions, which appear in separate areas or windows to indicate the underlying information, structure;
- simplified mnemonics or preferably the use of icons to provide standard and immediately comprehensible support for navigation or learning;
- the development of visual and text based search strategies and links to maps which show learning path choices.

Delivery constraints. The delivery constraints of the instructional conditions are as follows.

- Student familiarity and literacy with information technology.
- Internet connections including:
 - Network speed
 - Reliable connectivity
 - Cost
 - Gateway Service Provider, Internet Service Providers
- Situation of learning:
 - Personal workspace
 - Shared workspace
 - Institutional
 - School
 - Library

- Institutional support for delivery web server, e-mail, discussion boards
- Software tools
- Time

- Student time
- Development time
- University study periods
- DEETYA requirements

Management Issues

Our model relates management to the desired outcomes of effectiveness, efficiency and appeal. Reigeluth (1999) states; "The desired instructional outcomes are not concerned with what the learning goals are, but how well they are achieved." The examination of the Hedberg, Brown & Arrighi (1997) model of time-place-size is a useful in considering a management model to assess the desired outcomes of effectiveness, efficiency and appeal. However, further examination of the desired outcomes also relates to how on-line delivery is packaged and made available to the user. Managing on-line delivery requires an effective communications with students, sound instructional systems development and the creation of a learning environment where the user is supported.

The management of on-line of flexible methods will depend upon the relationship of teachers to learners in the three dimensions of of:

- **timing** of the presentation of the material
- **location** of study sites and
- **group size**.

Hedberg, Brown & Arrighi (1997) have developed a conceptual framework for the relationship of these three dimensions as depicted in Figure 4.

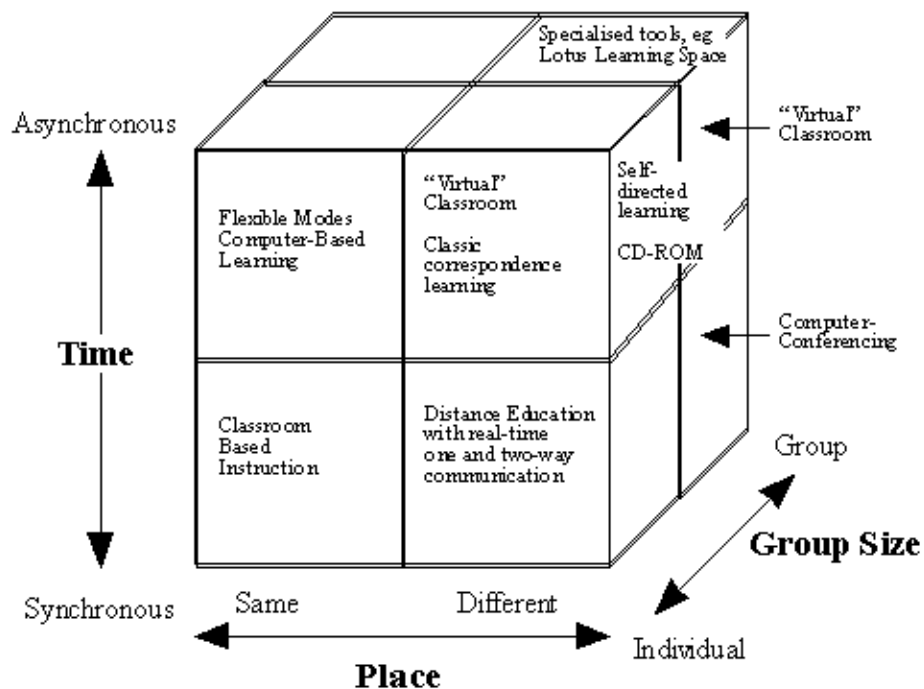


Figure 4. Hedberg, Brown & Arrighi (1997)

Timing of the presentation of the course. There are two methods of timing the interaction amongst the participants in a course, synchronous and asynchronous. Synchronous interactions occur in real time. These interactions range from face-to face communications such as lectures and tutorials through to on-line conferencing. Synchronous presentations may alleviate some management problems such as monitoring participants' attendance, as well as reducing participants' sense of isolation. These may be offset by pedagogical issues associated with reductions in the time participants have to consider the content before they are expected to respond (wait time). Synchronous interaction can present major access and equity issues when carried out across time zones, particularly those exceeding two hours.

In an asynchronous format participants have a greater time to consider and develop their answers. This may facilitate participants' deeper processing of the information as they are able to spend more time considering the information and formulating a response. There are some indications that participants who are reticent about participating in electronic discussions prefer asynchronous interactions as these provide them with sufficient time to formulate their responses. Asynchronous formats are not dependent on time zones and open up the possibility of global interaction and communication.

Location of Study Sites. Where participants are located to study in a course is somewhere on a continuum between a single location and multiple location or dispersed learning. Some universities provide a small number of fixed locations such as study centres. Alternatively with the developments in information technology, participants may "attend" the course at any convenient location such as their home or worksite. Thus courses would be delivered to multiple sites.

The use of a small number of fixed sites should reduce the difficulties in providing the necessary technical support for participants. It should also allow for more personal contact among the course participants and thus overcome the sense of personal isolation some participants' feel when studying through a distance education mode.

By contrast, deliveries to multiple sites should reduce participants' travel costs and increase their convenience in accessing courses. Many participants studying by distance education cite being able to participate at a suitable time as a significant benefit. Development in technology such as using web-based courses have allowed some presenters to form virtual teams so that participants can maintain some form of personal interaction with their peers.

Group size. Group sizes are important as they influence the range of learning options available and the types of information technology that is most appropriate. Groups of 5-10 appear capable of carrying on lively discussions, and being able to reach some form of conclusion. With larger groups, the discussions become harder both to follow and to manage.

The issue of the use of pre-prepared or live broadcasts provides an interesting case. Pre-prepared broadcasts will have lower costs and may increase the quality of visual content. It has been difficult to find research to investigate if improving the visual content also increases participants' learning. There are some comments that suggest distance education participants do accept lower quality visuals when the content supports their learning.

A pre-prepared broadcast appears to be more the appropriate for asynchronous presentation of content. Pre-prepared broadcasts may reduce some of the pitfalls associated with using television to teach distance education courses. There is very little discussion of

the use pre-prepared broadcasts with synchronous interactions. As effective interaction among participants needs to be guided by course presenter, this suggests only the video component of broadband technology can be pre-recorded. Alternatively it may be possible to broadcast pre-prepared television programs and supplement this material with web-based interaction using the Internet.

Conclusion

Delivering instructional material on the World Wide Web using on-line flexible learning is a challenging initiative. The uses of instructional design models need to be examined as a means of providing more flexible delivery of teaching within universities. The possibility of creating virtual classrooms of learners where time space and distance are not major factors in delivery is a challenge for all educators.

The model developed within the School of Education (NSW) is based upon issues related to teaching and learning, technology and management. The model incorporates Reigeluth's (1999) instructional design theory to model effective on-line teaching and learning. Maguire & Matejka (1999) assess how the implementation of this model has met the needs of the post graduate students who have studied our units on-line and how this has affected their role as learners.

References

- Banner, B. & Milheim, W. D. (1997). *Web-Based Instruction Courses and their Design*. In Khan, B. H. (1997) *Web-Based Instruction* (p 385) Englewood Cliffs: Educational Technology Publications
- Cennamo K.S (1993) learning from video: factors influencing learners' preconceptions and invested mental effort. *Educational Technology Research & Development*. 41 (3) 33-45
- Cook, C.J. & Fine, C (1996). *Pathways to School Improvement: Learning for All Students Through Professional Development* North Central Regional Educational Laboratory, Illinois, (<http://www.ncrel.org/sdrs/areas/issues/educatrs/profdevl/pd200.htm>)
- Deakin Centre for Academic Development (1996). *Flexible Teaching and Learning at Deakin University* Geelong: Deakin University
- Descy, D. E. (1997). *Computers and Connections, Servers and Browsers, HTML Editors, and Other Helper Applications*. In Khan, B. H. (1997) *Web-Based Instruction* (pp 277-281) Englewood Cliffs: Educational Technology Publications
- Farquhar, J. D. & Jones, M. G. (1997). *User Interface Design for Web-Based Instruction*. In Khan, B. H. (1997) *Web-Based Instruction* (pp 240-242) Englewood Cliffs: Educational Technology Publications
- Goldberg, M. (1997). *Using a Web-based Authoring Tool to Develop Sophisticated Web-Based Courses*. In Khan, B. H. (1997) *Web-Based Instruction* (pp 307-312) Englewood Cliffs: Educational Technology Publications
- Hansen, L & Frick, T. W. (1997). *Evaluating Guidelines for Web-Based Course Authoring Systems*. In Khan, B. H. (1997) *Web-Based Instruction* (pp 299-306) Englewood Cliffs: Educational Technology Publications
- Hedberg, J., Brown, C. & Arrighi, M. (1997). *Interactive Multimedia and Web-Based Learning: Similarities and Differences*. In Khan, B, H. (1997) *Web-Based Instruction* (pp 51-54) Englewood Cliffs: Educational Technology Publications
- Hiltz S.R. (1995) Impacts of college-level course via asynchronous learning networks: focus on students. Paper presented at Sloan Conference on Asynchronous learning networks, Philadelphia
- Jonassen D.H. (1997) Instructional Design Models for well-structured and ill structured problem solving learning outcomes. *Educational Technology Research and Development* 45(1) 1042 -1629
- Jonassen, D. H., Dyer, D., Peters, K., Robinson, T., Harvey, D., King, M. & Loughner, P. (1997). *Cognitive Flexibility Hypertexts on the Web: Engaging Learners in Meaning Making*. In Khan, B. H. (1997) *Web-Based Instruction* (pp 119-133) Englewood Cliffs: Educational Technology Publications
- Khan, B. H. (1997) *Web-Based Instruction* Englewood Cliffs: Educational Technology Publications

King A (1989) Effects of self-questioning training on college students' comprehension of lectures. *Contemporary Educational Psychology* 14 366- 381

Kourilsky M and Wittrock (1992) Generative Teaching: an enhancement strategy for the learning of economics in cooperative groups. *American Educational Research Journal* 29 (4) 861 -876

Kozma Robert B. (1991) Learning with Media. *Review of Educational Research* 61(2) 179 - 211.

Laurillard D (1991) Mediating the message: television programme design and students' understand. *Instructional Science* 20 2-23

Lynch, SP. J. (1996). *Web Style Manual* Yale Centre for Advance Instructional Media, URL:http://info.med.yale.edu/caim/StyleManual_Top.HTML

Maddux, C. D. (1997). *Interactive Multimedia and Web-Based Learning: Similarities and Differences*. In Khan, B, H. (1997) *Web-Based Instruction* (p51) Englewood Cliffs: Educational Technology Publications

Maguire, M., & Matejka, D. (1999). *Better than sliced bread: An evaluation of on-line delivery*. In proceedings of AARE-NZARE'99, pp.

Martin B., & Bramble W. J., (1996) Designing Effective Video teletraining instruction: The Florida teletraining project. *The American Journal of Distance Education* 9 (1) 6- 26

Mayer R. E (1999) *Designing Instruction for Constructionist Learning*. In Reigeluth, C.M. (Ed) (1999) *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory, Volume II* (pp141- 159). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.<http://www.indiana.edu/~idtheory>

Mayer R. E (1997) Multimedia Learning: Are we asking the right questions. *Educational Psychologist* 32 (1) 1-19

Mayer R. E, Bove W., Bryman A., Mars R. & Tapangco L., (1996) When less is more: meaningful learning from visual and verbal summaries of science textbook lessons. *Journal of Educational Psychology* 88 (1) 64 -73.

Oliver R., Reeves T. C., (1996) Dimensions of Effective Interactive Learning with Telematics for Distance Education. *Educational Technology Research and Development* 44 (4) 45 -56.

Osborne R., & Lafuze (1997) Team Teaching a Dual-Site Interactive Video Course: Trials, Tribulations, and Triumphs.<http://www.ind.net/fdpapers/>

Peraya D. Haessig C., (1995) Course development process: design and production of teaching material at the *FernUniversitaet* and *OpenUniversiteit*. A comparison between two European universities. *Journal of Distance Education* 10 (1) 25-52

Perkins, D, N. (1992). *Smart schools: Better thinking and learning for every child*. New York: The Free Press.

Phillip Windley Laboratory for Applied Logic, Brigham Young University

Ransden P. (1992) Learning to teach in higher education. London: Routledge.

Redding R. E (1995) Cognitive task analysis for instructional design: applications in distance education. *Distance Education* 16(1) 88 -106

Reed J. Woodrull M (1995) An introduction to using videoconferencing technology for teaching. *The Distance Educator newsletter*. <http://www.kn.pacbell.com/wired/vidconf/Using.html>

Reeves, T. C. & Reeves, P. M. (1997). *Effective Dimensions of Interactive Learning on the World Wide Web*. In Khan, B, H. (1997) *Web-Based Instruction* (pp 59-66) Englewood Cliffs: Educational Technology Publications

Reigeluth, C.M. (Ed) (1983) *Instructional-Design Theories and Models: An overview of their current status*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Reigeluth, C.M. (Ed) (1999) *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory, Volume II* (pp141- 159). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers. <http://www.indiana.edu/~idtheory>

Rieber L. P. (1996) Animation as feedback in computer-based simulation: representation matters. *Educational Technology Research & Development*. 44(1) 5-22.

Romiszowski, A. J. (1997). *Web-Based Distance Learning and Teaching: Revolutionary Invention or Reaction to Necessity*. In Khan, B. H. (1997) *Web-Based Instruction* (pp 25-37) Englewood Cliffs: Educational Technology Publications

Sano, D. (1996). *Designing Large-Scale Web Sites*. New York: John Wiley & Sons

Sherron G. T. And Boettcher J. V. (1997) *Distance Learning: The shift to interactivity*. Cause Publication Boulder, Colorado

Siegel, D. (1997). *Creating Killer Web Sites* (2nd ed.) Indianapolis: Hyden Books

Taylor S. (1997) Cooperative learning in distance education. <http://www.ind.net/fdpapers/>

Voithofer, R. J. (1997). *The Creation of Web Sites*. In Khan, B. H. (1997) *Web-Based Instruction* (p. 197) Englewood Cliffs: Educational Technology Publications

Widley P (1997) <http://lal.cs.byu.edu/people/windley/using.www.to.teach.html>