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#ITP4351

A framework for the implementation of a collaborative flexible learning environment for academic institutions.

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INTRODUCTION

Over the past few years the enormous advances in multimedia and Internet technology have started to affect how we live, play, enjoy and conduct our businesses. At the same time, these technologies have begun to creep into our learning and training environments.

Many educational institutions are experimenting with the use of the new technology to enhance existing teaching methods. The traditional instructor-centric method of teaching is giving way to the learner-centric model of learning in which information is interpreted rather than merely received by the students and new knowledge is created (Lotus Corporation , 1997).

In the learner-centric model , students learn through discovery. The traditional textual and verbal-based learning method is becoming less acceptable. The new learning model is often driven by interactive multimedia which gives the learner full control over the learning process and hence, the focus is on what the learner does not already know. Interactiveness increases the student's motivation and rate of retention (Bielenberg & Carpenter-Smith, 1997). The term *flexible learning*, a contemporary buzzword, is often used to describe the above-mentioned model.

Flexibility can be introduced in difference forms, which include:

- *Time:*
  The course materials and resources are kept up-to-date and are available on demand at any time that is convenient to the learner (just-in-time).
- *Place:*
  Students can access the materials from any place in the world where the course can be delivered. Consistent materials are delivered regardless of the access point.
- *Delivery mode:*
  The delivery modes include On-line, Off-line (including VCD/ DVD) or the hybrid approach with push technology (Louey, 1997).
- *Curriculum:*
  Students are given the opportunity to take greater responsibility for their learning and to be engaged in learning activities and opportunities that meet their individual needs. The courses are flexible in terms of entry and exit points.
- *Pace:*
  Learners decide how fast or how slowly they should learn. Students proceed through the course at their own pace, respond actively to each step in the sequence, and receive immediate feedback before proceeding to the next step.
- *Payment*:
  Charges are related to the resources that a learner uses and the syllabus he/she chooses to cover.

In the student-centric model, teachers are facilitators who help the students with self-teaching (Reid, 2000). The model provides a rich learning environment in which the student can receive new experiences, promote knowledge acquisition activities, and develop and share knowledge and responsibility (Guillermo, 1996).

COLLABORATIVE LEARNING APPROACH

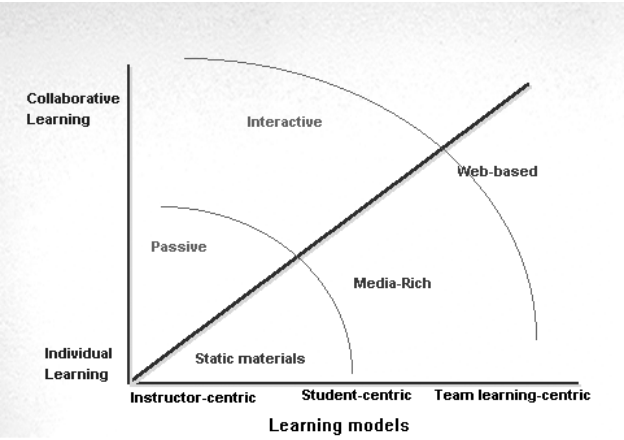
Active learning is not a new concept in learning.

If you tell me, I'll listen.
If you show me, I'll see.
If I experience it, I'll learn

Lao Tse, 420BC

Human beings learn better by doing but best in a collaborative environment. Tracey (1992) found that group collaborative learning (peer-to-peer interactions in conjunction with the teacher) can result in higher level reasoning strategies, greater diversity of ideas, more critical thinking and increased creative response, compared to individual learning. The team learning centric model (see Figure 1) is therefore more suitable for training to support management objectives and the performance of an organization. It provides the opportunity for the development of effective teamwork, and interpersonal communication and listening skills. However, there are barriers to be considered.

Figure 1: Learning models



THE BARRIERS TO COLLABORATIVE FLEXIBLE LEARNING

- *Bandwidth limitation*
  Broadband Internet services are now available, but the costs are often beyond what most students can afford. In many places the infrastructure does not support broadband services. Therefore, most systems are now designed specifically to work within a low bandwidth environment which means that there is more textual information with little sensory stimulated temporal enrichment. (Gallego, 1998)

- *Lack of feedback*
  Most current flexible learning environments rely solely on the web for the delivery of their courses. In this mode, an absence of feedback in the form of facial expressions and body languages between the learner and the educator may give rise to some misunderstanding (Pennell 1996).

- *Campus lifestyle*
  Most people enjoy meeting new people and interacting with lecturers. Studying on campus enriches the life of a student and provides opportunities for the development of social interactions and other life enrichment skills. The idea of a virtual campus will, however, deplete what is considered by many to be the best reason for going to a university.

- *Copyright and protection of unauthorized access*
  Developing an on-line learning package can be very expensive: obtaining copyright for all the materials and resources embedded within the package adds another strain to the slim budget of most academics (Inglis, Webster and Ling 1999). Online learning packages need to be protected against hacking and copying. Although the technology to secure a web site is currently available, most institutions do not address the protection issue due to time or financial constraints.

- *No team based learning*
  Many on-line learning systems currently focus on flexibility of delivery and access and are often based on the student-centric learning module. Team-based learning factors are often neglected.

THE PROPOSED COLLABORATIVE FLEXIBLE LEARNING FRAMEWORK

The framework consists of the following components:

- *Flexible delivery of the course material and resources*
  Ideally, both on-line and off-line delivery media should be used. The course material should be delivered within an environment simulating traditional face to face teaching. Question and answer sessions should be provided.

- *Collaborative team learning*
  The environment should promote peer interaction, sharing of ideas and information, and team-based learning. It is aimed at providing a meaningful framework in which students can extend their knowledge, capacity and application of knowledge (Philip 1994).

- *Learning packages development considerations*
  Bandwidth and related constraints should not limit the development of the learning packages. The packages should be supported by full multimedia enrichment to suit each student's learning style (see Table 1) and interactivity to promote *learning by doing*. Students should be able to learn through their preferred medium and by engaging with the same material in several media.

Table 1: Learning Styles

Learning style	Description	Multimedia Solution
Visual-Spatial	Drawing, jigsaw puzzles, reading maps and daydreaming. Learning is through drawing, verbal and physical imagery.	Hyperlinks, pop-up windows, audio and visual conferencing, texts with images and graphs.
Bodily-kinesthetic	Moving, making and touching things. Learning is through body language and physical activity.	Interactive space of images and 3D objects for writing, drawing, calculating, rearranging things can be introduced: for example, a Virtual Reality world can be used to simulate real world problems.
Musical	Sensitive to rhythm and sound. Learning is through lyrics, speaking rhythmically and tapping out the tempo. Tools like CDs, multimedia and radio would appropriate.	Teaching materials converted into lyrics and rhythms.
Interpersonal	These students learn best through interaction. Learning is through seminars and/or group activities.	E-mail, video-conferencing, chat-rooms to reach out to others.
Intrapersonal	This type of learner tends to shy away from others, but has strong will, confidence and opinions. Learning is through independent study and introspection.	Privacy in learning and progress is at learner's pace.
Logical-Mathematical	Think and reason conceptually, see patterns and relationships. Learning is through logic games, investigations and mysteries.	Concept modelling tools can be used to help students to learn and form concepts before they can deal with details.
Linguistic	Reading, playing word games or making poetry. Learning is through reading books or encouragement to say and see words.	Internet is virtually a huge repository of information. Web pages are more interesting than books and often more updated.

Adopted from: WestEd Home 1998 Jayne & Johnson 2000

- *Course material and resource must be current and consistent*.
  The content of training materials must be accurate and consistent across different media as discrepancies in the material may result in trainees losing confidence in the program (Hawkins 1997). Facilities must be provided to allow the materials to be corrected and distributed with minimal disruption. They should provide for easy updating of materials and resources.

- *Real world experience*
  Students learn better when they can see the real application of the knowledge that they are going to gain. The learning environment should therefore simulate a real world setting so the student can collaboratively tackle the real world problem using the information provided, the methodology instigated and the knowledge and skill gained. This scenario-based learning supports the Anchorage Instruction learning theories of Murphy, Jamieson and Webster (1998) in which an anchor or focus is created that generates interests and enables students to identify and define problems. Hence, students can pay attention to their perception of these problems.

- *Campus life*
  The flexible learning environment should not be seen as a potential replacement of the University campus. It should be used to enhance learning and encourage students to be self-directed and self-teaching. The teacher becomes a facilitator and spends more time in improving course content and contexts for better learning.

- *Minimizing changes to the course context and structures*
  After the implementation of a flexible delivery mode, changes to how the course is run should be minimized. All the useful learning components of the course must be retained.

- *Modularization of contents*
  A course built using modular design enables both teachers and the students to construct customized pathways through the content to match their learning requirements. Modularization has two advantages: it gives the learner just-in-time training (Gordon 1997) and improves the retention rate as it conserves the bandwidth (Filipczak, 1996). Modularization also enables pre-

requisites to be incorporated in the learning process so a student would not be allowed to proceed from one module to the next if the latter relies on the acquisition of knowledge from earlier modules.

- *Secured access and student progress monitoring*
  No unauthorized access to the course materials and resources should be allowed. The progress of each student should be monitored automatically.
- *Courses should be available at affordable cost varied according to the resources that each student uses.*

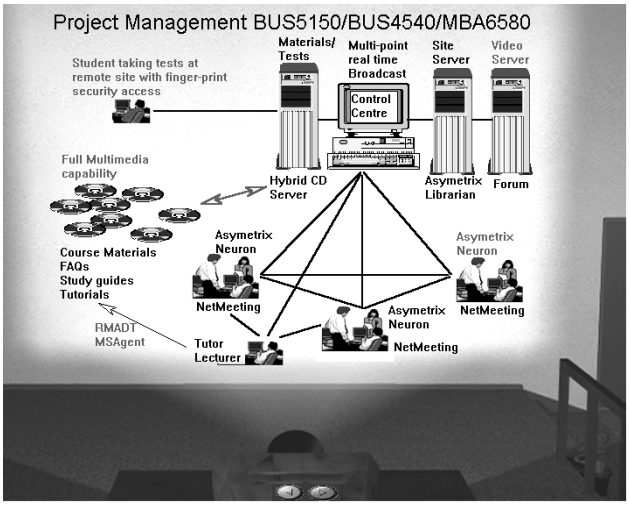
A PROTOTYPE TO DEMONSTRATE THE FRAMEWORK

Figure 2 shows an implementation of a flexible system developed in line with the proposed framework. The subject unit is BUS5150/BUS4540 Project Management and is taught at the School of Business Systems, Faculty of Information Systems, Monash University, Melbourne, Australia

The course is taught at Master Degree level twice a year. The average class size is 180. The whole course comprises a 2-hour per week face to face lecture for 13 weeks and a 1-hour tutorial for 12 weeks. Most students are international, from Asia, and are studying Business Systems. They have Bachelor Degree from different disciplines.

The subject matter is project management. The contents are based on the recommendation of Project Management Body of Knowledge (PMBOK) of Project Management Institute (USA). The main aim of the course is to equip students with the skills, knowledge, methodology and techniques unique to project management and to prepare them to take on a role within a project team in their future careers. The main author of this paper who teaches the subject, combines over a decade of industrial experience as a project manager with eighteen years of academic research in Project Management. The focus of the subject is to clarify some of the myths about project management and keep students abreast of the latest developments in the field of project management.

Figure 2: An implementation of the proposed framework



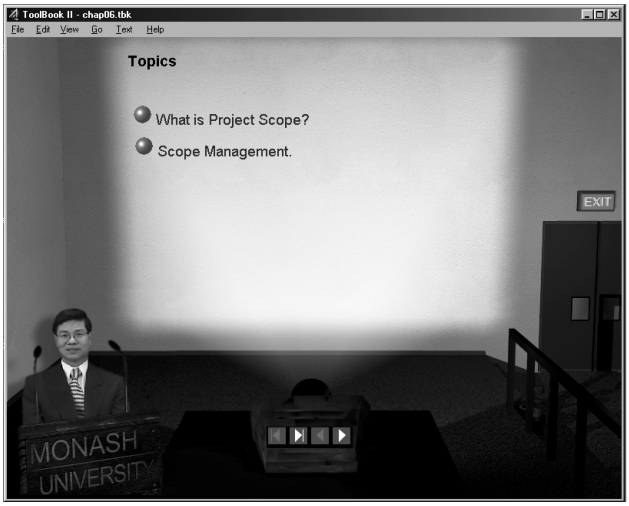
The major assignment of the subject is team based and focused on a case study developed jointly between the team and the teacher/tutor. The process of project management is simulated over the duration of the project and problems/solution are created to demonstrate an understanding of the subject and the appropriate application of methodology and technique.

Project Management practitioners are invited as visiting lecturers during the course. Students in previous years have found these sessions both beneficial and stimulating.

The implementation consists of the following components:

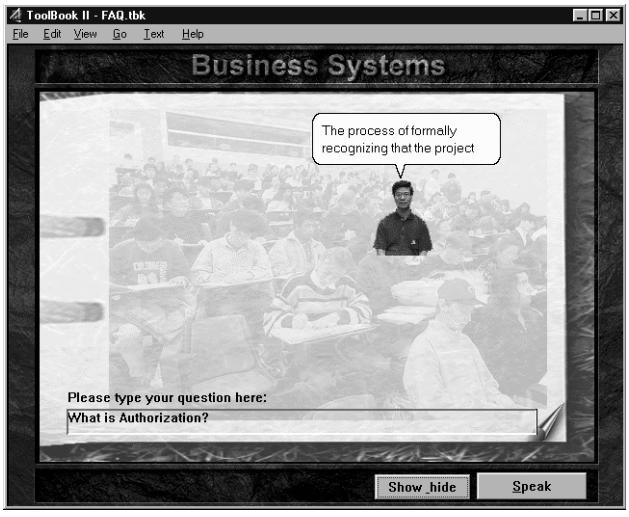
- *Virtual Classroom*
  The web-based static course materials are support by a virtual classroom teaching (see Figure 3). The lessons are delivered using a hybrid CD-ROM approach wherein the parts of the course subject to frequent change are delivered transparently from the Web server. The video at the bottom left hand corner is real and synchronized with the PowerPoint style display but the classroom setting is artificially generated. The users are given total control to pause or replay the video, or to select any topic.

Figure 3: Virtual Classroom



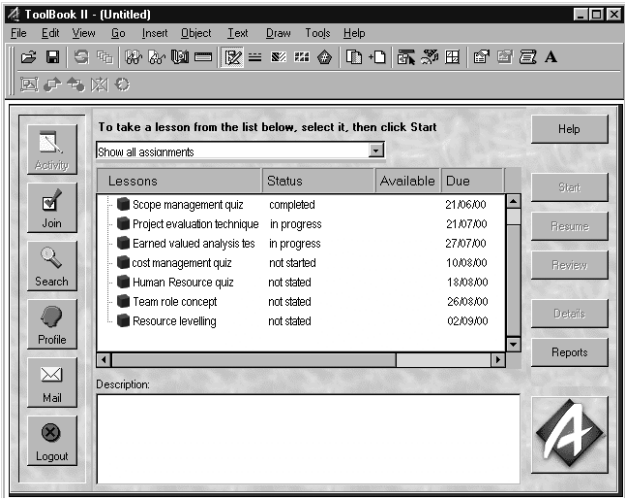
- *Frequently Asked Questions Module*
  This module provides the opportunity for students to clarify certain concepts or jargon that they find difficult to understand. The student types in the question and the teacher gives an answer verbally with textual response displayed within the bubble, as shown in Figure 4. Free text format entry is allowed and the best matched answer is retrieved from the database. The teacher (a MSAgent implementation) provides a lip-synchronized spoken response.

Figure 4: FAQ Module



- *Web-based course management systems (CMS)*
  Asymetrix Librarian is a client-server course management system designed to provide centrally-control institution-wide learning activities including learner authentication, course delivery, collaboration and performance tracking. Librarian also enables the modularization of course materials. Rules can be set to determine how a student should progress from one level to another. Different modules can be selected to build courses to meet the needs from other schools. Librarian embraces industrial standards which allow quiz sessions (that were developed using professional authoring tools such as Asymetrix Instructor or Macromedia Authorware) to be automatically tracked and assessed (see Figure 5). The progression of each student through the course can be individually tracked and reported, including how much time a student spends on each page. Senior staff can use the output reports from Librarian to measure the effectiveness of the learning package.

Figure 5; Asymetrix Librarian

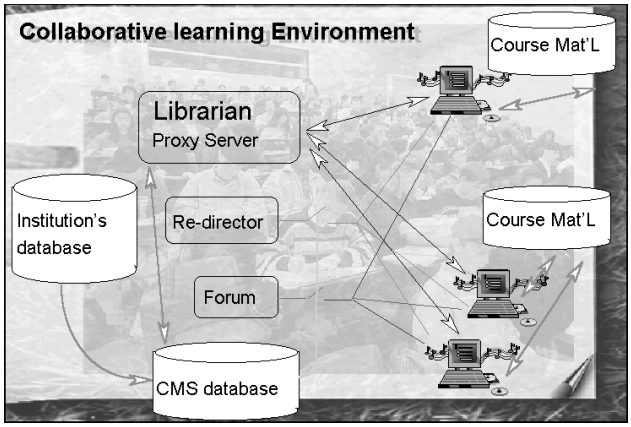


Asymetrix Librarian is a database driven proxy server. It centrally controls student access while allowing stored course materials to deliver on-demand to locally enrolled students (see Figure 6).

- *Collaborative learning environment*
  The environment contains two modules: the Allaire Forum (see Figure 6) and Microsoft NetMeeting video conferencing system. The tutor/teacher can monitor the message tracks with each assignment group and offer helps when necessary. A Microsoft Site server facilitates the control of the point-to-point tutor/teacher to student consulting sessions and multi-points conferencing between the assignment team members.

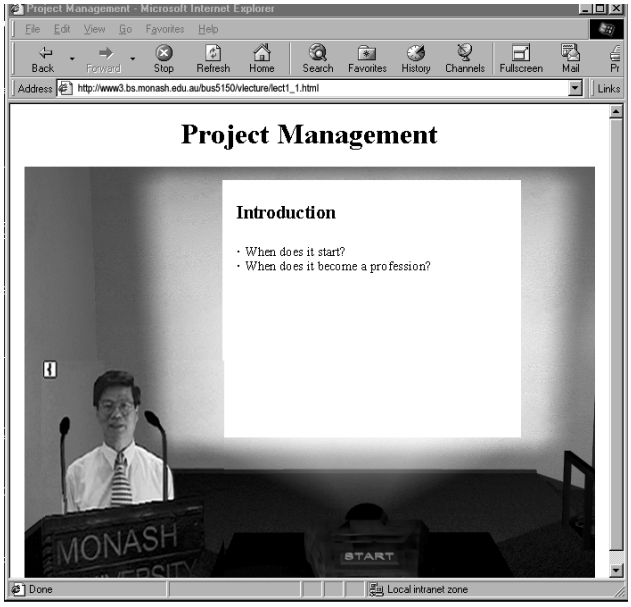
  NetMeeting's application sharing (collaborative writing using Words), white board (electronic sketchpad) and chat system enable collaborative discussions and hence, the sharing of ideas and knowledge.

Figure 6: Collaborative environment



- *On-demand video streaming and live broadcasting*
  Streaming video is a technology that enables a video to start playing on the web while it is being downloaded. Products from Real Network are used to facilitate web- based video-on-demand and live broadcasting.

Figure 7: Video-on-demand



Video-on-demand sessions are used for the delivery of new lecture materials created after the term has started. It can also be used for the delivery of materials to replace existing topics on the CD-ROM. It can be used as the medium to deliver materials on topics that are useful for other courses. An example of a video-on-demand lecture is shown in Figure 7. The format of the on-demand lecture is identical to that on the CD-ROM. A small low-quality streaming video appears at the bottom left hand corner over a full-sized matching background. The video is synchronized to the PowerPoint style texts using RealText technology and Synchronized Multimedia Integration Language (SMIL) language.

Visiting lecturers use the live-broadcast sessions for broadcasting their presentations.

- *Fast updating of course materials and resources using server-pushed technology*
  When the course CD-ROM is used on a computer that has Internet access, the course web server checks the content on the CD-ROM with that on the server. If there are differences, the server downloads the new contents to the hard disk of the client machine. The course CD-ROM, the web server and the client machine work collaboratively to ensure all data are up-to-date. The lecturer can use this facility to replace any section of the course when needed.

- *Automated self-paced tutorial session to provide software skill*
  Students use Microsoft Project to plan, monitor progress and help better decision-making to address the variations to the original plan of the assignment case project.

  The multimedia-mediated tutorial system provides step-by-step interactive guidance on the learning of Microsoft Project. Video and voice-over, help learners to understand the relationships between the input to and output from Microsoft Project.

- *Smart card and Finger print device*
  Finger–print devices are used to allow students at remote locations to sit for the competence tests at a nearby designated examination centre such as a community library The finger–print device can be sent to the examination centre when required and the only thing the library staff has to do is to ensure that only one person is at the computer station. Each student requiring remote authentication is issued with one smart card on enrolment and the fingerprint of the student is stored on the smart card.

VALIDATION OF THE IMPLEMENTATION AGAINST THE FRAMEWORK

The implementation adopted a hybrid CD-ROM approach for the delivery of the course to reduce the network bandwidth requirement. The rich data on the CD-ROM provides the sensory enrichments. The web connection, together with the server push technology, ensures that the contents can be kept up-to-date. Any inconsistency existing amongst the course materials can be replaced as soon as it is identified, using the same technology. The course materials can be delivered on the CD-ROM and Internet or both.

The virtual classroom on the CD-ROM and the web stimulates a real lecture environment, but in this class, the students have full control of the progression of the lecture. Students receives non-verbal cues from the lecturer and complex concepts can be explained using video, animations or bitmaps synchronized to voice–over. The FAQ module provides the questions-and-answers session. Students can now ask questions without worrying about whether others think they are stupid.

The proxy server of the Librarian (the web based course management system) authenticates students and prevents unauthorized access. Intellectual property rights are therefore protected. Competency tests involving multiple-choice, fill-in-the-blank, arrange-objects can be administered, tracked and accessed automatically by the Librarian.

The Allaire forum, together with the Microsoft NetMeeting, provides the collaborative learning environment. Members of the assignment teams can communicate amongst themselves while their messages can be automatically captured and tracked and used later for student evaluation purposes. The video conferencing enables tutors or lecturers to receive feedback from the students in the form of facial expressions and body language. This also provides the chance to meet new people and encourages interaction with fellow students. Team-based learning is therefore facilitated by this implementation. Under the collaborative environment, students can jointly establish the project case study, formulate the plan for the project, simulate the various parameters of the project and learn how to manage a project by actually doing it as if they are in the real world.

Tutorial sessions and lectures conducted by invited industrial practitioners are part of the implementation.

The course is developed in a modularization format. Librarian allows a course administrator to specify the path a student should go through and to set rules to ensure that a prerequisite module be completed before progression to the next module.

CONCLUSION

Interactive course packages provide learners with stimulating features and opportunity for active learning. The growth of the Internet and related multimedia technologies provides new possibilities for educators. Flexible learning, in terms of time, place, curriculum, pace and cost increases the success of learning and teaching. Low cost tools are now available for building collaborative environments within which students are encouraged to learn by doing.

This paper describes a framework used to guide the development of a team-based flexible learning environment and proves that such an environment can be built using available technology.

This particular environment, however, is not a model on which a virtual campus should be built: the authors believe that campus life is an integral part of the learning process. Students can come to the lab to watch the virtual classroom lecture at their own pace and at a time that suits them. They can choose to use the video conference facilities to interact with the tutors and lectures, or meet them face to face. The role of the lecturer can be transformed to one of facilitator. The lecturer can spend more time interacting with students, advising them on their simulated real life projects and improving course materials.

The Asymetrix Librarian chosen for this project is an enterprise-strength collaborative learning facilitation system and therefore, the cost may be beyond the budget of an average school. However, it could become feasible if the package were purchased at the institutional level.

Finally, it has been found that the cost of the technologies, when compared to that of course material development, is relatively low.

REFERENCE:

Bielenberg, D. R. & Carpenter-Smith, T (1997) Efficacy of story in multimedia training, *Journal of Network and computer Applications*, 220, 151-159

Filipczak, B. (1996) Chunking CBT, *Training*, **33,** (9) 28.

Gallego, G.(1998) *The State of the Art in WBT*, Available at http://www.gracespace.com/weblearn/tlnotes.htm

Gordon, J. (1997) Infonuggets: The bite-sized future of corporate training?, *Training*, **34,** (7), 26-33.

Guillermo, E. P. (1996) *The Importance of The World Wide Web in Education K-12* Available at http://www.geocities.com/Athens/5461/paper_1.html

Hawkins, D. T. (1997) Web-based training for online retrieval: An idea whose time is Coming, *Online*, **21,** (93), 68-69.

Inglis A., Webster, L and Ling, P (1999) Costing Flexible Learning, Centre for Higher Education Development, Monash University.

Jayne, B. C. & Johnson E. C. (Access on 2.2.2000*) Pedagogy: A Primer on Education Theory for Technical Professional*, Available http://www.mircosoft.com/education/planning/online/wpPOP.doc.

Lotus Corporation (1997) White paper: *Distributed Learning* Available on-line at: http://www.lotus.com

Louey, O. (1999) *Hybrid CD-ROM strategies*, a Honours thesis, Monash University

Murphy, D., Jamieson, P. and Webster, L. (1998) *What is Flexible Learning?* Centre for Higher Education Development, Monash University.

Pennell, R. (1996) *Managing Online Learning* , Available at http://elmo.scu.edu.au/sponsored/ausweb/ausweb/educn/pennell/paper.html

Philip, C. G. (1994) *Distance Learning: A Different Time, a Different Place* Available at http://www.contarct.kent.edu/change/articles/julaug94.html

PMI (1999) *Project Management Body of knowledge (PMBOK)*, Project Management Institute, USA.

Reid, J. E. (Access on 2.2.2000) *What Every student Should Know About Online Learning*, Available at http://illinois.online.uillinois.edu/online/course1/redi.htm

Tracey W (1992) *Designing training and development systems* USA American Management Association.

WestEd Home (1998*) Learning Styles* , Available at http://www.wested.org/tie/dlrn/learning.html