RESOURCES, ACTIVITIES, INTERACTIONS AND NETWORKS IN THE CONTEXT OF FLEXIBLE LEARNING

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ABSTRACT

As part of flexible learning strategies, the ability to deliver courses over the Internet is growing at a rapid rate as the number of users, schools and tertiary institutions who are online increases proportionally to the sale of multimedia computers and modems. The cost of building these courses is both expensive and time consuming. At present the ability to deliver high quality sound and vision on the web is increasing and the demand for more authentic, engaging and dynamic learning environments is growing. Unfortunately, most users are limited in their access to the Internet, and the cost and time spent online waiting for a sound or video to download is both very distracting and frustrating. It breaks up the flow of concentration and the thread of learning.

A strategy to consider in the design and deployment of on-line learning environments is to locate high quality resources and learning activities onto a CD-ROM and provide a link between them so the user has a seamless experience. The CD-ROM then acts as an active learning environment with a storehouse of information (resources) contained on it, which the user can navigate through to build knowledge. This can be done by using a number of key features such as Graphical Navigation landscapes, Iconic Metaphors, Intelligent Software Learning Agents, Vignettes, Keywords, and Glossaries all containing various types of media such as, video, sound, text and graphics, plus On-line web links to key external resources.

At present standard CD-ROM's can hold up to 650 Mb of information and multiple platform capability. By developing high quality resources and learning activities independently of the learning objectives, and storing them on a CD-ROM the user is able to access information rapidly and efficiently on their own local machine or via links to the Intranet/Internet network.

The development of a CD-ROM with no preset learning objectives gives the activities and resources a long-range shelf life. Akin to an information bank (analogous to a library) this storehouse of information could be available to a broad section of disciplines and is only limited by the number of learning objectives and performance outcomes that can be developed by the educator.

The key to the flexibility for this mode of learning is the use of the web as a delivery platform for the course. Learning objectives, key activities, evaluation and feedback can now be run online.

This provides maximum learning flexibility so that the course can be changed each time with a new set of learning objectives and questions, or it could be incorporated into other courses or disciplines.

This paper will present examples of how this can be implemented into a teaching and learning strategy using projects and CD-ROM's that are part of these flexible learning environments.

KEY WORDS

Resources, activities, vignettes, interactions, agents, networks, metaphors, navigation.

1.   INTRODUCTION

The demand to produce information rich environments for students is increasing. This demand has put pressure on academics to come up with more and varied types of media sources other than text to enhance the learning process and to expand the flexible learning environment.

At present, World Wide Web access speed is slow, over standard modems, at down loading large amounts of high quality data, such as video and audio. Waiting for this data creates an interruption to the learning process. The need to provide plug-ins and extras for web browsers to view this media other than text, places greater technical demand on the platform of delivery and on the student/lecturer who is not technically inclined, adding further to the complexity of developing an on-line learning environment.

A solution, which could be employed, is to use CD-ROM, to contain large files of information, such as video, text, animation, graphics and audio. By developing small self contained learning environments and vignettes, storing them on an external medium, i.e. CD-ROM, and linking these to the web pages, the active learning component is stimulated rather than retarded and the learning environment is enriched as opposed to encumbered.

A major project developed, which utilized this concept, was Professional Challenge 98 – Murder Under the Microscope. This Problem-based Learning role playing game, which had its inaugural year in 1998, was developed to challenge University students, High School students and anyone else from the general public on there understanding of catchment management and wetland environments.

Due to the immense amount of varied material related to wetland environments, the project required the design of a resource CD-ROM linked independently to a Web site which provided the rules and regulations, objectives, assessment and evaluation criteria of the game. Having the CD-ROM and the Web site independent from each other allowed the CD-ROM to be used as an independent learning environment after the game was over. Teachers would then have the ability to create their own personalized education game to reflect their own learning objectives in relation to wetland environments.

This paper will present how this can be implemented into a teaching and learning strategy using Pro Challenge 98 and CD-ROM's that are part of these flexible learning environments.

2.   RESOURCES

2.1   WHY THE RESOURCE FOCUS?

Boyle (1998) noted that "Resource-based learning emphasises providing learners with access, usually through networked computers, to a rich set of basic resources for learning" and this was one of our main aims in developing the CD-ROM. The amount of different types of information available on wetlands was vast and came from many different sources such as textbooks, magazine articles, video libraries, and educational web sites. A subject matter expert was brought in to sort through the information available and it was found that the information could be re-useable with other courses and discipline's.

Hall *et al* (1995) stated that education has always been resource-based and it is a simple move from using traditional based media such as books to electronic based media. As much of the material was collected from traditional sources it was important that it could be transformed into an electronic format.

A factor in design and development of the CD-ROM was cost, re-useability and flexibility, and Hall *et al* (1995) argue that resource-based learning due to its re-useability of materials is cost effective and flexible in allowing lecturers / teachers a choice of resources to suit a specific course. This fitted in with our objective to enable teachers flexibility to develop learning during and after the game was finished.

A final important aspect considered was to allow for a student centred active learning environment. Using the philosophy of rich environments for active learning, or REALs, which "are comprehensive instructional systems that evolve from and are consistent with constructivist philosophies and theories. To embody a constructivist view of learning" Grabinger *et al* (1997). This would allow students the flexibility to develop life long learning skill's. REAL's utilise high quality media to support the authentic learning context. Williams & Dodge (1992) stated "An authentic context incorporates as much fidelity as possible to what students will encounter outside school in terms of tools, complexity, cognitive functioning, and interactions with people". So, the transformation of traditional resources and the resource interface design would support this notion and empower students to learn using a real world context.

2.2   RESOURCE TRANSFORMATION

In the Pro Challenge 98 CD-ROM much of the information was derived from traditional based media and was digitised into an electronic based form that could be accessed and utilised by the student and teachers. Material available was vast and varied including; video, text, animation, graphics, and audio.

A suitable format for conversion and then viewing had to be considered. The number of different electronic based media formats/standards are many and growing and it was important to find a common ground in formatting.

A number of factors were used to determine the suitable format/standard. The resources had to be available for use on both Macintosh and Windows platforms, so compatibility was a key issue. Integration with the authoring language used and copyright and licence free use of the run time application. Research resulted in three main formats/standards to be chosen, these were Adobe Acrobat, HTML (Hypertext Markup Language) and QuickTime.

Adobe Acrobat was chosen for information gathered from pre-existing books and magazines. Text books and magazine articles were scanned and digitized into a JPEG format and then embedded into a PDF file. As information was copyright and could not be changed the scanned image PDF format did not allow the text or graphics to be manipulated by the user. Due to Adobe Acrobats common availability and use by many software package's, the PDF format was compatible on both platforms.

Content that was not pre-existing and needed to be created from scratch were developed into web based pages. Text was written as ASCI and images scanned and manipulated into JPEG format, this was then complied using HTML language to create a web page. The universal nature of web pages made it ideal for cross platform use.

Video and audio data was digitised from pre-existing information, using Apple Macintosh A/V hardware and software, it was then saved as QuickTime files. The QuickTime format is compatible on both Macintosh and Windows based machines, so only one set of files were needed.

The need to keep the number of doubled up files to a minimum due to the cross platform consideration, made the choice of the three file formats appropriate. All files fitted our criteria and were compatible on both Macintosh and Windows with only the appropriate platform run time application needed.

2.3   THE RESOURCE INTERFACE

By collecting traditional based media and converting it into an electronic format the issue of how the user would access this information had to be considered.

Three types of interface were used too match the three file formats.

Adobe Acrobat was chosen because it maintains a book style method of presenting information with the added ability to magnify the view of graphic images and this we felt was an efficient way of giving users an existing application to view the information. As Adobe Acrobat is a very common program and available on both Windows and Macintosh platforms it was a simple solution to creating an electronic textbook.

Most students /teachers would be familiar with its functionality and it would be already installed on their system, if not a copy of Adobe Acrobat was available on the CD-ROM, with a routine program written in Authorware, which guided the user through the installation process.

The second method was to utilize the capabilities of Internet browsers to access information, which was created in HTML web page format. This maintained the feel of a seamless environment between the on-line Web environment and the Pro Challenge 98 CD-ROM, while allowing the user to keep track of information and to use the features available in traditional Web based browsing techniques. It also allowed users in the Windows environment the ability to have multiple windows open to cross reference information.

The third method was the QuickTime format in conjunction with the Internet browser to give the user control of the video. The QuickTime video files were also embedded into activities for viewing.

3. ACTIVITIES

3.1 THE ROLE OF OBJECTIVES AND ASSESSMENT AND THEIR INFLUENCE ON ACTIVITY DEVELOPMENT

The availability of resources in any medium whether it be traditional forms, such as books or technology based, such as web pages make up only one part of the learning environment. The difference between a student acquiring information and their ability to apply knowledge learnt is dependent on the motivation of the student. Developing activities that stimulate and motivate learning and are linked contextually to learning objectives defined by the teacher/educator allows for flexibility in the learning environment for both teacher and student.

Effective problem solving and thinking are not based solely on motivation and knowledge of thinking strategies, but also on well-organized and indexed content knowledge. Learners must have rich knowledge structures with many contextual links to help them address and solve complex problems. This means that instead of trying to abstract a set of decontextualised general skills, we must make our teaching as contextualised as possible to provide as many possible links with other domains as possible (Grabinger and Dunlap).

The objective of Pro Challenge 98 was to provide an understanding and application of catchment management principles using a PBL approach. The context of the game was Wetland's, but the skills learnt could be applied to other kinds of environmental issue. Assessment of the problem matched the answers provided to the principles. There was no one solution to the problem, but more an appropriate solution in relation to the environment and context of the environmental issue.

The objectives and assessment influenced the development of activities and meant that they had to take into consideration the ability to present principles that would be transferable to other contexts. As people transfer learning from one situation to another with difficulty. Learning is more likely to be transferred from complex and rich learning situations. Rich learning activities help students think deeply about content in relevant and realistic contexts (CTGV, 1993c). The activities developed reflect an authentic and realistic context for learning, while developing skills and knowledge learnt to be applied to other problems and scenarios.

3.2 VIGNETTES

Vignettes can be defined as, first principle, first person, heuristic activities (components) from which courses are constructed. Chaloupka and Koppi (1998). Vignettes are activities, which can be integrated with other vignettes and or resources to build up a wholistic learning environment.

The vignette is based on a foundation principle of knowledge, which is unlikely to change over time and its presentation is not tied to any one look or feel, but neutral. For example a pH vignette will enable the student to carry out a virtual test for pH balance. This test is not found in just one field of study, but in many different disciplines, such as Soil Science, Chemistry, and Biology. As vignettes are based on object orientated programming they have a property sheet which can allow the user to change its in-built characteristics.

By placing vignettes into a learning environment it allows the teacher the flexibility to choose which components are relevant to the learning objectives for the course of study.

3.3   MIMETICS

Mimetics provide real life experiences in a virtual environment, by mimicking the conditions, as they would be in the real world environment, this is achieved by creating an interactive experience in the first person. Enabling the user to explore, participate in heuristic activities and devise strategies in a realistic context. The interactivity provided in these environments can enable learners to construct schemas and test hypotheses against the environment, and see the results of their actions, thus gaining experience, in relatively short time periods.

The more realistic the environment the greater the emotional impact for the user, allowing for a more sustained immersion and engagement of the imagination in the learning activity.

3.4   SIMULATION LEARNING

In the Murder under the Microscope Professional Challenge 98 game the student takes on a role-play character under various disguises. The student uses the resources and activities on the CD-ROM to help them achieve their objectives.

These Roles include:

Developer to submit a proposal for supplying electricity and water for increased cropping in the Fic catchment.

Dairy farmer designing a property plan too sustainably manage a dairy farm into the future.

Local Council officer assessing several eco-tourism proposals.

Urban developer who has to design and propose an urban subdivision to get approval by Council.

It was important to create an environment that reflected a contextually authentic look and feel. This is reinforced by the studies done by Jones (1980) who stated a central feature of a simulation is the provision of sufficient information to enable participants to achieve reality of purpose within the simulated environment. It was also important to create a resource that would stand the test of time and not date in its look and feel too quickly.

Simulations and role-plays can be used to create a learning experience for a specific educational purpose where the participants take on a role within a simulated environment (the scenario). The subject matter, setting and issues inherent in the simulation are not textbook problems or questions to which answers can be quickly determined or cut and dried. Participants are required to carry out functions associated with their roles and the settings in which they find themselves. The outcomes of the simulation are not determined by chance or luck; participants experience consequences that follow from their actions. McLaughlan, R (1998).

4.   INTERACTIONS

Interaction is one of the higher order levels of feedback that behaviourists and cognitivists agree are important in the educational process (Mory, 1992). Those who see education as a construct would also include feedback and more importantly interaction as a needed feature in education (Bruner, 1990; Laurillard, 1993).

In developing Pro Challenge 98 the object was to develop an environment in which students could be actively engaged in activities, which stimulate the learning experience and allow for critical thinking and reflection. The schools were encouraged to form teams and the team members to work together to solve problems. Whipple (1987) stated that knowledge is an interactive process, not an accumulation of Trivial Pursuit answers; education at its best develops the student's abilities to learn for themselves. By developing a learning environment with links between the resources, activities and the web site. It would then empower the students with complete autonomy to be actively involved in the learning process and through this activity discover and construct knowledge for themselves.

4.1   THE LINK BETWEEN ACTIVITIES, RESOURCES AND WEB SITE.

Links were achieved by imbedding information relative to subject areas in a cognitive and intuitive method.

4.1.1 Keywords

Keywords were highlighted in the body of text all through the CD-ROM and these were linked to various different kinds of media such as, videos, graphic images, sound and a glossary.

4.1.2 Graphical Navigation landscapes

The use of a graphic based navigation helped the student to be immersed in their role. By creating a map of the Fic catchment area the student is able to navigate very quickly around the CD-ROM giving the student complete autonomy to move when and where they wish. This left the student free to explore and investigate as much as possible.

4.1.3 Iconic Metaphors

Iconic metaphors are a graphical representation of an idea as a narrative, they provide a language to the interface, where by the user is able to interact with the program to gather information, navigate and or initiate an activity.

4.1.4 Intelligent Software Learning Agents

Intelligent Software Learning Agents are context-based characters who can provide motivational benefits to the learning environment, by providing customized advice to the student. Types of advice provided can be principle-based, task-specific, navigational information, and prompting.

5.   NETWORKS

The key to the flexibility for resource-based learning environments is the use of the web as a medium for delivery. Learning objectives, key activities, assessment, evaluation and feedback can now be run on-line over an Internet or Intranet network. This mode enables flexibility so that changes in the course can be executed to provide a new set of learning activities and questions. Dependant on the learning objectives of the teachers course.
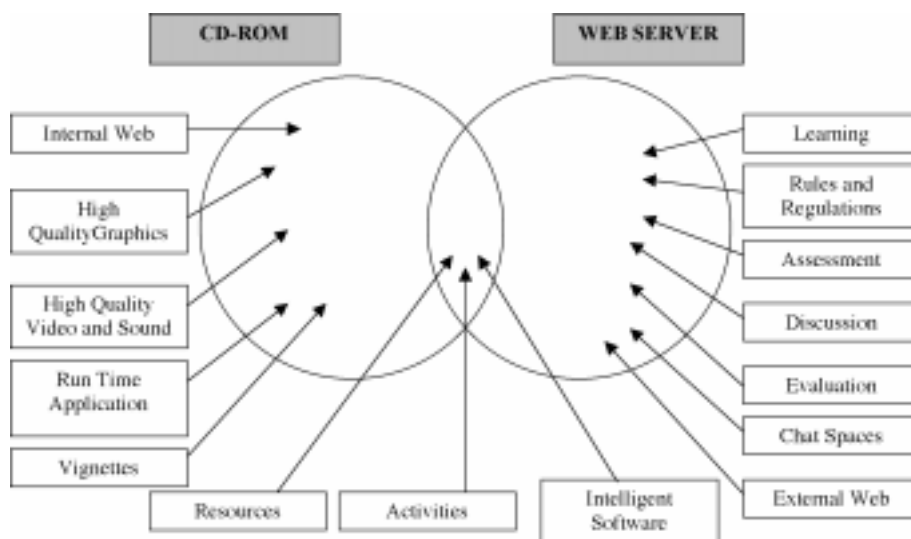
Flexible Learning Environment

6.   CONCLUSION

In this paper a strategy for the design and deployment of a resource-based CD-ROM was discussed. By dividing the elements that make up the resource-based CD-ROM into Resources, Activities, Interactions, and Networks the user is provided with an autonomous flexible learning environment in which all the elements are linked seamlessly to enable the process of active learning. Further research is being carried out on balancing the integration between learning activities and resources between the CD-ROM and the web site.

7.   REFERENCES

Boyle, T. (1998), "Principles for the selection and integration of education multimedia materials", ALT_J, 6: 1.

Bruner, J. (1990), Acts of Meaning, Harvard University Press, Massachusetts.

Cognition and Technology Group at Vanderbilt (CTGV). (1993c). Integrated media: Toward a theoretical framework for utilising their potential. Journal of Special Education Technology, 12(2), 76-89.

Grabinger, S., Dunlap, J.C. and Duffield, J.A. (1997), Rich environments for active learning in action: *problem based learning.* ALT-J, Vol 5, No 2.

Hall, W., Hutchings, G. and White, S. (1995). "Breaking down the barriers: an architecture for developing and delivering resource based learning materials" in Tinsley, J. D. and van Weert, T. J. (eds), World Conference on Computers in Education VI: WCCE '95 Liberating the learner, London: Chapman and Hall.

Jones, K. (1980). Simulations: Handbook for teachers and trainers, London: Kogan Page.

Koppi, A. J. and Chaloupka, M. J. (1996). The Soil Investigation Kit: A Mimetic Environment for Introductory Soil Science (software), University of Sydney, http://nettl.usyd.edu.au/sik

Laurillard, D. (1993). Rethinking University Teaching: *A Framework for the effective use of Educational Technology*, London: Routledge.

McLaughlan, R and Kirkpatrick, D, (1998). Developing effective frameworks for electronically supported simulations. Higher education research development society of Australasia conference, Auckland, New Zealand.

Mory, E. H. (1992) 'Use of information feedback in instruction implications for future research', Education Technology Research and Development, 40-3.

Williams, M. D., & Dodge, B. J. (1992,). Tracking and analysing learner-computer Interaction. Paper presented at the 1992 National Conference of the Association for Educational Communications and Technology, New Orleans, LA.

Whipple, W. R. (1987). Collaborative learning: Recognizing it when you see it. Bulletin of the American Association for Higher Education, 40: 2, 3-7.