MULTIMODAL DESIGN FOR HYBRID COURSE MATERIALS: DEVELOPING A NEW PARADIGM FOR DELIVERY

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Abstract

The University of Southern Queensland (USQ) is currently moving towards hybrid modes of course delivery across all discipline areas, reconceptualising many current teaching and learning practices as a consequence. Central to this new delivery is a resource-rich CD containing all the essential study materials, support materials and significant multimedia enhancements. In moving towards this delivery mode, the need to establish a range of pedagogically sound principles for developing these materials is regarded as paramount. In establishing these principles this paper contextualises important issues associated with hybrid delivery at USQ and considers how catering for a multiliterate clientele, by using a combination of multimedia elements and online support may enhance the learning opportunities for students. To support these claims this paper reports on a current research project investigating this new configuration of course materials and demonstrates the viability of hybrid delivery.

Keywords
Hybrid course delivery, multimedia, multiple representations, dual coding, cognitive load, multiliteracies, online.

Background

The University of Southern Queensland (USQ) teaches and researches as a dual-mode university with triple-option teaching modes (on-campus, 'traditional' distance education, online). Offering over 300 accredited awards, consisting of over 1,000 courses, across five faculties, USQ provides access to educational opportunities to approximately 25,000 students annually. Over the last 26 years the university has prospered across the four mainstream generations of distance education development, namely the;

- correspondence model (with print);
- multimedia model (print, audiotape, videotape, computer-based learning and interactive video);
- telelearning model (videoconferencing, audiographic communication, broadcast TV/radio and audioconferencing);
- flexible learning model (interactive multimedia, Internet-based access to WWW resources and computer-mediated communication). (Sankey & Smith, 2004)

Where appropriate, elements from each of these models are used across all faculties in the delivery of teaching materials. Although USQ uses these different models of delivery a clear delineation has existed between its on and off-campus offerings with many courses using very different teaching strategies to deal with the different modes. On a micro level, this delivery model is not economically sustainable in the long term. The pressures of constant technological advancement and increasing economic rationalism require university staff, both academic and general, to continually do more with less (P. Taylor, 2000). Linked with these pressures, Taylor (2004) believes that traditional university approaches to teaching and learning will not have the capacity to meet the escalating demands for higher education in the future.

On the macro level there has been, for some years, significant societal and technological developments resulting in major changes within the fields of higher education and lifelong learning (Jochems, van Merrienboer, & Koper, 2004). These changes have not been restricted to individual institutions, rather they have occurred on a global level, with institutions increasingly competing in the international marketplace (Van Damme, 2001) causing fundamental educational questions to be asked such as, "what to teach" and "how to teach it" (Jochems et al., 2004).

These pressures at both the micro and macro levels have made it increasingly impractical for USQ to produce different versions of materials for different student cohorts studying the same course at the same time, both domestically and internationally. This has required the university to look for creative solutions to deal with the burgeoning problem.

Introduction

At the beginning of 2003, as an ongoing response to the pressures mentioned above, USQ introduced a major policy shift requiring all courses of study (both on and off campus), to move towards development in a hybrid delivery mode over the following three to four years. Hybrid in this context being a composite or combination of delivery techniques. More specifically, this involves the provision of course content through a resource-based learning package. This package is the same for all students in a given course, whether enrolled on or off-campus, effectively reducing the duplication of different course materials.

Central to this new hybrid delivery (in most cases) is a resource-rich CD-ROM containing all the essential study materials, support materials and significant multimedia enhancements. The use of CD also allows direct linking to both course web sites hosted on USQ's learning management system USQ*Connect* and additional resources on the web. A variety of hybrid models are currently being developed and trialled to suit a range of disciplines and subject areas (Smith, 2004).

As USQ moves towards this mode of delivery, the establishment of a range of pedagogically sound guidelines for the delivery of course materials is regarded as paramount. To help facilitate the establishment of these design guidelines a number of research projects are currently being undertaken among the courses trialling hybrid delivery in 2004. This paper will report on one such study conducted on the course ECO2000 'Macroeconomics for Business and Government', run in first semester 2004.

Specifically, the study into ECO2000 examines student perceptions of the CD based hybrid environment and the appropriateness of the multimodal design principles used to develop a range of multimedia elements used in this course. The materials use a combination of media, image, text, animation, audio and/or video files to represent key concepts in multiple ways. This is done with a view to enhancing the learning opportunities for students by catering for a broader range of student learning modalities.

This paper will explain USQ's rational for selecting a hybrid delivery mode, discuss why it has chosen this option over relying on online technologies. It will then give an overview of the design rational used for the ECO2000 course and finally, give a brief report on the initial findings of the research conducted into this course.

Hybrid Delivery at USQ

The term 'hybrid', in an educational context, covers a range of teaching approaches that integrate an array of delivery mechanisms facilitated by the proliferation of information and communication technologies (Parsons & Ross, 2002). This proliferation has allowed considerable expansion of support mechanisms for both on and off-campus courses, and made them available en masse (Cookson, 2002). The aim of hybrid delivery at USQ is to deliver a consistent quality package of course material to all students regardless of their study mode. CD based delivery provides the

opportunity to supply a resource rich learning environment, supported by a combination of related teaching activities and by USQ's e-systems (Smith, Sankey, & Cottman, 2004).

The initial focus has been on developing additional content, or 'value adding' existing teaching strategies utilising a combination of activities to support learners in different contexts. Importantly, hybrid delivery is required to be economically viable and sustainable in order to develop, produce and deliver courses and programs on a very large scale both domestically and internationally.

Although USQ has, over recent years, presented a considerable quantity of course material both on CD and online, this new initiative seeks to focus these efforts to establish a common format to deliver all future courses. The look, feel and core generic information, such as the USQ Handbook, the Student Guide, getting started information, help files, software updates and plug-ins are all provided on the CD and remain the same for all students. On an individual course level the CD contains elements such as, course introductory materials, a study guide, study modules, selected readings, multimedia elements, PowerPoint presentations, reference lists and web links.

As all students are expected that have access to the Internet to fully participate in a course, this allows the CD delivery to be further supported in variety of ways. USQ*Connect* provides each student with their own electronic Study Desk with links to each enrolled course. This facility also offers the opportunity for course leaders to establish and use either asynchronous or synchronous discussion forums enabling students to interact and communicate with each other and the lecturer. Announcements and updates may also be made available where appropriate. USQ*Connect* also provides links to all library services, the Bookshop, USQ*Assist* (where students may find answers to questions related to USQ systems and individual courses), USQ*Admin* (where students enrol, access results and change personal details) and other course related resources. The use of USQ*Connect* plays an extremely important role in student support and communication.

The CD delivery may also be supported by context specific strategies such as face to face sessions, field work and the like. What varies is the type of teaching support provided to different student groups and individuals. This suggests that the hybrid model may take on different configurations depending on the course content and pedagogy. These combinations may include; a CD supported by USQ*Connect* (online); CD, online and print; CD, online, print and tutorials; CD, online and residential school/labs; CD, online and lectures/tutorials; and in limited cases where minimal content is required, Online only. Regardless of the combination, the basic design of the learning environment stays the same.

The Processes of Hybrid Development

The primary delivery mechanism for distance education at USQ has for many years been print based material with the addition of audiotapes, video and/or CDs where appropriate. In considering the change to a more integrated form of delivery both new and existing materials require conversion for electronic delivery. In 2000 USQ launched its Generic Online Offline Delivery (GOOD) project. The GOOD project is essentially an e-content management system that allows cross-media publishing from a single document source. This allows courseware to be rendered in a variety of delivery modes (print, CD, DVD or online) from the single document source (J. C. Taylor, 2001). At the core of the content management system is the ability to automate these processes through the use of eXtendable Markup Language (XML) standards.

This system allows study materials to be automatically rendered from the XML content into Hyper Text Markup Language (HTML) for web/CD/DVD delivery and into Postscript Document Files (PDFs) for print delivery concurrently. Further, once converted to XML, individual faculty and/or staff from the Distance and e-Learning Centre are able to source documents directly to edit and make changes at will. Updated versiona are then automatically accessed and rendered to whichever format is required for the next offer of that course.

The hybrid CD initiative however should not be viewed in isolation; rather it should be seen in the context of developing a total learning package. van Merrienboer, Bastiaens, & Hoogveld (2004)

suggest that media other than computers will typically be required to design powerful integrated e-learning environments. For example, the use of textbooks, additional stand-alone programs, communication technologies and in some cases face-to-face instruction may all still need to be used. The focus is therefore on making the most of, and supporting, the e-learning experience.

Why Not Just Put It Online?

USQ has chosen to deliver material on CD as against solely online for a number of reasons. Primarily it is due to the 'tyranny of broadband' (Bruch, 2003), or the variability and inconsistency of Internet connection both within Australia and in the many countries to which course materials are supplied. This inconsistency has made the delivery of high quality web based resources problematic. The National Office for the Information Economy in Australia recently released the 'Australian National Broadband Strategy' on behalf of the Federal Government. This report indicated that due to population densities in most rural and remote areas in Australia it is unlikely that equitable access to broadband technology will be achieved in the near future (NOIE, 2004, p.4).

Given that over 75% of USQ's students study by distance education both domestically and in at least 67 different countries equitable broadband access is a major consideration, particularly for those living outside major metropolitan centres. Internet delivery therefore cannot be realistically considered until a consistent level of national and international broadband technology is freely available (van Merrienboer et al, 2004) across the full range of USQ's target markets. As there appears to be no short term solution to this problem, CD offers the most reliable delivery platform for the foreseeable future. The CD gives USQ the ability to provide access to large quantities of electronic information directly to students' computer, thereby limiting the need to access this core data from the Internet.

Considerations when designing ECO2000

Fundamental to the design of the ECO2000 hybrid CD are the tenants of multimodal design. These are based on solid research that demonstrates that learners, for many reasons, use a variety of learning/cognitive styles to process information. Although most researchers agree that different learning styles exist, and freely acknowledge their significance on the learning process, current research indicates that many instructional events, particularly at university, only target genetic cognitive styles, or certain types of learners, usually read/write learners (Sarasin, 1999). Unfortunately, this flawed approach inadvertently leads to some students feeling disenfranchised, particularly student's whose learning modalities do not match the style of the information presentation, which may inturn result in a student's performance being reduced (St Hill, 2000). If however, multiple sensory channels can be allowed for in the presentation of learning materials the design of these materials may become more effective.

An important aspect in catering for a variety of learning styles, particularly relevant in today's highly visual culture, is the use of images. Stokes (2002) asserts that using visual strategies in teaching results in a greater degrees of learning. Felder and Soloman (2001) agree, further suggesting that if sufficient visual content were included in learning materials students would retain more information. Although visual images are an integral part of human cognition, they have tended to be marginalised and undervalued in today's higher education systems (McLoughlin & Krakowski, 2001).

This discussion however cannot be limited to simply visual literacy though, as literacy generally is on the verge of reinventing itself, and by implication require learners to decode information from a variety of media (Grisham, 2001). Once material such as verbal texts (audio), graphs, drawings, photos, videos and other communicative devices are seen as texts to be read, they may then be applied to the development of new, inclusive curriculum (Roth, 2002). Being multiliterate in a society that recognises a full range of learning styles requires the development of theories and strategies for the multiple representation of a whole range of instructional concepts.

The use of multiple representations, particularly in computer-based learning environments, has been recognised for many years as being a powerful way of facilitating understanding (Ainsworth & Van Labeke, 2002). For example, when the written message fails to fully communicate a concept, a visual element may be relied upon. This research into multiple representations is further supported by Ainsworth (1999) who found, 'where the learner employed more than one strategy, their performance was significantly more effective than that of problem solvers who used only a single strategy' (p. 137).

Representing information in multiple ways in the electronic environment however, if not handled correctly, may prove detrimental to the learning process, as multiple representations on the screen may place additional and quite often unnecessary, cognitive demands on a learner. For example, learners may have to direct attention simultaneously to different representations that combine other dynamic components, such as complicated sound, animated movement and interactive text. These can overburden student cognitive capabilities, resulting in them learning very little (Bodemer & Ploetzner, 2002). Therefore, if multiple representations are going to be used there are important issues relating to cognition that need first to be considered.

Two specific cognitive processing theories should be taken into account when considering the design of instructional multimedia. These are Dual Coding Theory and Cognitive Load Theory. Both theories focus on the use of short-term or working memory, where text (auditory or written) and images are processed simultaneously.

Cognitive Load Theory suggests that when large amounts of information are presented together the learner can experience overload in their working memory, due to limited capacity. In effect, the learner becomes overwhelmed with what is presented, resulting in a loss of direction and focus (Sweller, 1999). Consequently it is essential that presentations are made clear and concise, rather than utilising the 'bells and whistles' that can impede a students learning (Doolittle, 2002). In the context of multimedia, the main factors influencing cognitive load are the overuse of designs incorporating text, graphics and animation. These may steer a learner to the exciting or entertaining aspects of a presentation, but usually at the expense of thoughtful analysis of the underlying meaning (Stokes, 2002). Utilising illustrations or simple (not complex) images can also minimise the load on working memory. Text, by contrast, is read in temporal sequence and requires extra memory to keep all the parts in one place, therefore requiring more cognitive processing (Kirsh, 2002). Some cognitive psychologists however now acknowledge that a more effective processing capacity is available if instruction can be presented in multiple modes, given reasonable constraints are provided.

Dual Coding Theory suggests that the working memory consists of two distinct processing systems, verbal and nonverbal. The verbal system processes narrative (spoken) information, while visual information (both image and text) is processed by the non-verbal system. Thus, one way to enhance the capacity of working memory is to utilise both processing areas simultaneously, allowing both narrative and picture to be processed at the same time (Mayer, 2001). By utilising the human visual system to process information in parallel with verbal information, one can bypass or reduce the 'bottleneck effect' that can occur within working memory (Zhang, Johnson, Malin, & Smith, 2002). In essence, if text can be presented as audio the learner can listen to a narration while viewing an illustration, thereby utilising both areas of the working memory.

A further advantage of using that CD based multimedia is that it allows the ability to hyperlink to a number of different media elements that can be included to suit a combination of learning styles. For example, where the learner is presented with a choice of representations the one that best suits their needs can be selected. Evidence in research conducted by Ainsworth & Van Labeke (2002) suggests this strategy can significantly improve learning opportunities for students. Jona (2000) believes that this notion of learner choice is a paradigm shift that needs to occur in the delivery of education. If students perceive they have a level of control over their learning experience they are more likely to both enjoy the experience and utilise appropriate information processing approaches (Shu-Ling, 2001).

To contextualise the above discussion, the ECO2000 course uses a combination of resources including; CD based text and multimedia, textbook/workbook and links to online materials. The USQ*Connect* portal also hosts discussion forums, interactive quizzes and PowerPoint slides from each lecture. This combination of resources is designed to cater for a wide range of learning modalities. As teaching material for this course have traditionally been text based, a considerable amount of multimedia enhancements have been used in order to represent the key concepts on alternate ways. These enhancements include; combining point form text with video and audio in the form of mini lectures, animated examples with voiceovers, interactive graphs, audio explanations and still images. All these enhancements were created using Macromedia 'Flash' and utilise the features on HTML to allow contextual linking within the learning environment.

In week three of the course all students are encouraged to complete a learning styles inventory to help them understand the types of representations that would best suit their preferred learning modality. This further supported by providing a series of suggested study approaches to suit particular modalities or combinations of modalities. It is emphasised to students that this is only a guide and that if they preferred or had established other approaches these are equally relevant.

Investigating Student Perceptions of Hybrid Delivery

Research into the ECO2000 course began in March 2004 and has focused on the use of the hybrid CD and more particularly, the multiple representations of key concepts embedded in the course material. In week three of the course two surveys were administered, a self reporting learning styles inventory and a 10 item questionnaire. This questionnaire is based on a five point Likert scale instrument and investigates student's initial impressions of the new CD based hybrid materials. These surveys were completed by 95 students (out of a possible 120). Two focus group sessions were also conducted with four off-campus students and six on-campus students. In the focus groups similar questions to those in the second survey where asked to provide an opportunity to triangulating data. In week 14 a longer survey of 30 questions was administered with 65 responses being received. This survey contained a combination of qualitative and quantitative items. A further two focus groups were conducted with two off-campus students and twelve on-campus students. These later instruments closely examined the student's perceptions of the study materials and more particularly the use of multiple representations and multimedia elements utilised in the learning environment. At the time of writing the final data had only been in the hand of the researcher a short time and not all the variables have been fully analysed. This paper therefore can only report on initial findings. A web link has been provided below where a full breakdown of data and an analysis of current results may be accessed. A fuller explanation of these results will also be presented at the conference.

Early analysis of the data shows a very strong acceptance of the CD based environment and more particularly student's approval and use of the multiple representations. Initial student reactions measured in week three found that this acceptance was moderated by a desire to still receive print based materials with the CD being seen as a nice extra. It should be noted that most students had already been studying at USQ for at least a year and had previously used print based materials. A very interesting shift occurred however between weeks three and 14. By week 14 students indicated they would rather receive the CD based version over the print version if they had a choice. It was also seen that the use of the learning styles inventory that students had completed in week three had helped them in their approach to the materials, with 75% of students reporting they felt more confident with their learning materials having identified their preferred learning modality. Only 3% of students reported negatively on this item. Also by week 14, 91% of students believed that their use of the animations and multiple representations contained in the course materials had catered for their preferred learning modality. Only one student disagreed on this point. In relation to the use of hyperlinking within the study materials, 88% of students found the CD based materials easy to navigate with 63% believing this form of navigation suited their approach to learning. 22% however did not find this approach helpful, preferring a more traditional approach to their study, 15% had no opinion on this point.

At the completion of the semester initial discussions with the lecturer has indicated that the student pass rate had risen by a statistically significant 12% from the previous offer of the same course (prior to hybrid delivery). There had also been a statistically significant improvement in the distribution of grades with 14% more students receiving higher grades. This result will need to be examined more thoroughly, however due to the emphasis placed on multimodal design in the restructuring of this course it can be expected that this result would be supported after closer examination.

In summary, there does appear to be some distinct advantages in providing study materials in this way (hybrid CD). There also seem to be a clear indication that students find the inclusion of multiple representations extremely helpful and that they would like to see the same thing repeated in other courses. Understandably students still want access to print based materials but are prepared to print or buy their own so as to receive the materials as a resource rich CD.

A full breakdown of the results along with associated graphs may be accessed from the following website: http://www.usq.edu.au/users/sankey/MDML/pages/ECO2000results.htm

Conclusion

USQ has taken a seemingly bold step in implementing a policy that will see most study materials committed to a CD based hybrid mode of delivery over the next few years. This challenge, if handled correctly, will provide resources to students in a highly user-friendly, pedagogically sound way. It will also keep USQ in the forefront of the provision of distance education and e-learning opportunities for many years to come. It is hoped that through further research a greater understanding of the way students access CD based hybrid course material will be gained. Of particular interest are the ways in which multiple representations are used by students to enhance their understanding of the core concepts contained within course materials. This and similar research currently being conducted into the use of hybrid delivery at USQ should lead to a greater understanding of the most appropriate ways in which to develop future course material. This paper has demonstrated that considering such a change in delivery direction must be thoroughly investigated from both a theoretical and practical perspective. More research in this area is needed, but the results to date have been most encouraging.

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