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ADOPTING AN INNOVATIVE MULTIPLE MEDIA APPROACH TO LEARNING FOR EQUITY GROUPS: ELECTRONICALY-MEDIATED LEARNING FOR OFF-CAMPUS STUDENTS

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Abstract

Students that come from disadvantaged backgrounds have more that their fair share of obstacles to overcome when seeking a university education. This paper describes an innovative approach, adopted by the course designers, that uses a mix of educational media and technology to deliver a high impact and quality learning experience to disadvantaged students seeking to enter university via non-traditional means.

Media and learning style research has shown that learners come to education with a wide range of learning preferences based on their cognitive styles, as well as significant levels of prior knowledge and experience. This paper details how the course designers have designed and developed a number of media products with a view to supporting as many individual learning differences as possible by providing overlaps in the respective media and technologies. The paper describes the course design and details reasons for those design decisions.

The paper also presents and interprets the course evaluation data collected from the first two offerings and makes some recommendations for course designers working in this area, based on an analysis of this data.

Keywords

online, education, equity, learning styles, computer skills, media, video, cd-rom, computer mediated communication, learning communities

Context

The "Computing for Academic Assignment Writing" course is a core subject in the "Skills for Tertiary Education Preparatory Studies", or STEPS tertiary bridging program run at Central Queensland University. This subject provides students with the necessary computing skills to enter any undergraduate program at an Australian University. The STEPS program was initially developed in 1986 to facilitate entry into university programs for adults who had not enjoyed success at high school sufficient to permit them to gain entry to an undergraduate program at university. The majority of these students come from disadvantaged backgrounds and carry with them the emotional baggage associated with failure in prior learning environments (ESLS, 2001). Since 1986 the STEPS program has grown from an intake of 15 students to in excess of 360 in 2003. The popularity of this program has meant that the division responsible for the running and support this program, the Division of Teaching and Learning Services (DTLS), needed to look for flexible ways to expand the their offerings. In Autumn term 2001 DTLS offered two of its STEPS subjects off-campus in flexible learning mode. These two subjects were run as a pilot to see if there was sufficient interest amongst students who, because of work commitments or geographical location, were not able to attend the full-time or part-time programs offered on campus. This was also a test to see if the STEPS philosophy could be transferred to a flexible learning environment. One of the subjects offered externally was "Computing for Academic Assignment Writing" (CFAAW).

CFAAW was seen as a particular challenge to offer in this mode as many of its students had little or no experience operating a computer, or connecting to an online course, and the vast majority of the course involved using a computer and interacting/contributing online. This paper chronicles the design, development, trialling and evaluation of what proved to be a very successful approach to facilitating learning.

Media theory

The learning design for CFAAW relies on the provision of a range of media that allows the students, many of whom need to be able to effectively set up their computers and connect to the Internet, to succeed in the course. For this reason, the authors have provided below, a brief review of the relevant media theory and more specifically, how that relates to the media chosen for this course.

Clark (1983), argued that *"...media do not influence learning under any conditions" (p. 445) and that "...media are mere vehicles that deliver instruction, but do not influence student achievement any more than a truck that delivers our groceries causes changes in our nutrition"* (p. 445). Clark bases his assertions on a meta-analysis of previous media research that sought to establish links between learning and media types. Clark takes the view that it is the instructional design of the learning materials rather than the media itself that influences learning.

Kosma (1991) takes rather a different view-he asserts that media has symbolic and process attributes. He contends that how the symbols are presented have a direct bearing on the perception and level of integration experienced by learners. As an example, printed media can contain orthographic symbols that are placed together to form words in text, as well as image symbols. Learners can switch between these to interpret meaning. Kintsch (1988) suggests that with print-based learning the learner develops a *"textbase"* model from the reading which is held in short-term memory and then assimilates this model with a *"situational"* model which involves schemas held in long term memory. Most importantly, Kintsch believes that this process is guided by the learner's purpose.

Print-based media

Print-based material is highly stable and allows the learner to move through the material at a pace which is proportional to the level of difficulty, or the amount of new material experienced by the reader (Kozma, 1991). LaBerge and Samuels (1974) indicate that the additional effort required by poor readers with print materials has an adverse impact on the amount of cognitive resources available to make an effective transition from Kintsch's *"textbase"* to *"situational"* models. Tindall-Ford (1998) found that while working memory can be expanded by integrating audio instructions in multimedia courseware, substantial increases in learning performance would not result unless the instruction was high in element interactivity and consequently intrinsically high in cognitive load. This expansion of working, or short-term memory is accomplished by removing the necessity for the words read being converted into what she called the *"phonological loop"*. Kosma (1991), suggests that the processing capabilities of particular media actually modify the properties of a learner's mental model. The processes employed by the media determine just how the symbols are used to effect learning. Salomon (1979) says that these characteristics should be used to define and analyse a particular media type as they are relevant to how learners interpret and learn from that medium.

Video media

There are very real differences between video, print and multimedia/online as learning media, and these differences relate to both the symbols and processing. Television is ephemeral and transitory in nature and the message is delivered at a rate determined by the designers (Kozma, 1991). Print, on the other hand, is stable and the pace of processing is controlled by the reader. Videotape and DVD media are more flexible in this regard, with the ability to fast-forward, pause and review the presentation. Video media is also perceived very differently by learners and can be used to quickly and easily create realistic and authentic learning environments which can contribute to learner engagement and enhance problem-solving

(Greeno, 1989). Video can also make the impossible real, through a suspension of disbelief (Herrington, 2002). Video-based educational materials are perceived in a different way to video for entertainment and the degree of learning can depend on the amount of invested mental effort (Salomon, 1983). Houston and Wright (1983) suggested that with educational video, there is an inverted "U" relationship between attention and the complexity of the content as shown in figure 1. They argue that the window of cognitive engagement provides the best chance for learner comprehension. Salomon (1983) has a similar view, but asserts that the *"amount of invested mental effort"* accounts for the differences in depths of comprehension experienced with video.

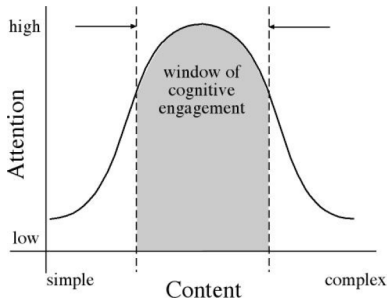

Figure 1 Window of cognitive engagement
(source: adapted from Houston & Wright, 1983)

If you were to distil the views expressed by Salomon, Houston and Wright, and Kintsch, we can see that the amount of mental effort (due to learner motivation), and complexity of the content, determine the amount of learning that can take place from video for a particular audience.

Multimedia and online media

Multimedia and online learning offer a great variety of learning approaches. When the learning involves screen-based interaction it is highly visual with learners choosing to scan rather than read the text (Nielsen, 2000). This means that while the learning environment retains much of the stability of print-based media, its symbolic representations are much more variable. The addition of narration and audio in sync with animation or motion screen capture, is just one example of the possibilities. Animation and simulation are also relatively easy to achieve these days with modern software and hardware.
One on the major differences with online learning environments is the ability learners have to communicate synchronously and asynchronously with a facilitator. This ability opens up a range of support and collaboration options not easily available via other media/technology.
Online learning research has also led us back to some fundamental questions about contemporary teaching and learning. Issues such as constructivist learning as opposed to an objectivist/behavioural approach and process vs. information transmission. The underlying instructional design for online educational learning environments is a holistic process and should provide media and learning opportunities that cater for individual differences in learning (Felder, 1993; Koumi, 1994; Kozma, 1991; McVay Lynch, 2002; Riding, 1999). So it is important to consider the holistic design of online learning environments in the context of the elements described below.

Social presence

Social presence or teacher immediacy (Richardson, 2003), can be described as the trust to engage with other learners and facilitators in a way that promotes learning and personalises the learning space. Social presence provides the main distinction between the traditional view of distance education and effective modern online education. Harasim (2000) asserts that many online courses are more social and convivial than face-to-face courses. Harasim goes on to say that *"collaboration provides the social glue of a community that engages learners and motivates them to participate"*.
Kearsley (2000) believes that online learning is a social as well as individual activity.
Richardson (2003) suggests that social presence affects course outcomes as well as student and instructor satisfaction with the online course-this could also be said of face-to-face learning environments.
Gunawardena & Zittle (1997) found that social presence was affected by the media technology used as

well as the strategies employed by facilitators that *"cultured"* interaction.
It is worth noting that social presence is a "double edged sword"-if the facilitator's skills in online communication are poor or too controlling, it is possible that social presence could be so adversely affected that the students may disengage from the course. Where the student perceives that there will be no penalty, this may mean withdrawal from the course. If a penalty is perceived, it may simply mean a withdrawal from the communication process and a re-focusing on what it takes to pass the course. The authors have observed and experienced both of these behaviours in online courses.

Interaction
Interaction is initiated by the learning activities that spawn vigorous content and personal interaction, both at peer and facilitator levels. Brennan et al. (in Anon, 2003) suggests that "interaction in and of itself is no guarantee of effective learning. The Teaching and Learning Development Unit at the University of Adelaide asserts on its Website that there are two distinct forms of interaction-interaction with content and social interaction (Anon, 2003).
Kearsley (2000) suggests that to learn effectively, learning needs to be active. Collaborative learning achieves this end. Interaction can also involve individual activities embedded in the design of the learning activities (G. Kearsley, 2000; Paulsen, 1995).
A study undertaken in 2002 at Hunter College in the US found a significant correlation between the level of communication interaction and student performance in higher order learning tasks. Other similar studies conducted, found there was also a strong correlation with student and staff satisfaction (Picciano, 2002). What was also interesting about the Hunter College study is that it failed to establish any significant correlation between the level of communication and objective tests designed to elicit lower level knowledge. This would seem to suggest that high levels of communication interaction are not required for adequate student performance where the lower level learning outcomes are required.

Cognitive strategies
Cognitive strategies, embedded in the learning tasks, provide the mental processing required to effectively learn and integrate a body of knowledge.
Cognitive load theory suggests, amongst other things, that short-term or working memory is finite and small and that there is a limit to the amount of unrelated items that can be held and processed simultaneously (Chandler, 1998). Taylor (1994) argues that long-term memory can be *"..conceived as a repository for schemas consisting of domain specific knowledge"*. This argument is consistent with cognitive load theory in that experts and novices can be differentiated by the way in which they group items into known schemas, stored in long-term memory. This results in a number of items being processed as a single schema thereby reducing the level of cognitive load and allowing a simpler and easier knowledge transition into long-term memory, which it is argued, has infinite storage capabilities (Sweller, 1988).
The links between affective and empirical knowledge provide an important clue for those developing learning activities since the strength of the cognitive structures developed depend on the intensity of the experience-specifically how real the experience is perceived by the learner (Taylor, 1994). This can apply to both social and content related aspects of the learning activities. The more real the experience, the stronger the cognitive structure developed and the greater the learning.

Collaborative learning
Collaborative learning allows learners to articulate, conceptualise and re-conceptualise their own conceptions of learning, based on their collective knowledge and experiences.
Harashim (2000) suggests that *"..collaboration provides the social glue of a community that engages learners and motivates them to participate"* and also that group goals motivate individual group members. Gilly Salmon from the Open University in the UK claimed (in a videoconference conducted from Sydney on the 21st February 2003) a 75% participation rate in the "e-tivities" she conducts as the mainstay of her online courses in the Faculty of Business. Gilly proposes a five step learning model for these "e-tivities" (Salmon, 2002).
Group sizes, for communication purposes should be 15 to 20 (Anon, 2000; Greg Kearsley, 2001). This depends to some extent on the type of communication in the learning activity designed-the co-inventor of Fablusi (an online role-play simulator), Roni Linster, has found that in his political simulations, up to 50 participants can comfortably co-exist in the simulation cyberspace with a 100% participation rate (Linster, 2002).

Learner-centredness

This is a concept that encourages learners to take control of their own learning by a negotiated process that stimulates and encourages learning. The literature attributes a wide variety of meaning to the term "learner-centred".

Jeanette Muzio (1999), in a literature review for her dissertation for a Doctor of Education award, suggests that the characteristics on a learner-centred course are: accessibility; affordability; return on learner's investment; individualised course material and instruction; maximised learning; user friendliness and support systems.

Combs (1976), whilst describing ways to create effective learning situations in classrooms, describes three important characteristics:

1. *The atmosphere should facilitate the exploration of meaning. Learners must feel safe and accepted. They need to understand both the risks and rewards of seeking new knowledge and understanding. The classroom must provide for involvement, interaction, and socialization, along with a business-like approach to getting the job done.*
2. *Learners must be given frequent opportunities to confront new information and experiences in the search for meaning. However, these opportunities need to be provided in ways that allow students to do more than just receive information. Students must be allowed to confront new challenges using their past experience without the dominance of a teacher/giver of information.*
3. *New meaning should be acquired through a process of personal discovery. The methods used to encourage such personal discovery must be highly individualized and adapted to the learner's own style and pace for learning.*

While there is some overlap between Combs and Muzio in terms of learning style and individualised learning materials, there would seem to be no real consensus of opinion.

Robert Marzano (1992) in his book *"A Different Kind of Classroom"*, makes the following six assumptions about creating a learner-centred classroom:

1. *Instruction must reflect the best of what we know about how learning occurs.*
2. *Learning involves a complex system of interactive processes that includes five types of thinking-the five dimensions of learning.*
3. *What we know about learning indicates that instruction focusing on large, interdisciplinary curricular themes is the most effective way to promote learning.*
4. *The K-12 curriculum should include explicit teaching of higher-level attitudes and perceptions and mental habits that facilitate learning.*
5. *A comprehensive approach to instruction includes at least two distinct types of instruction: teacher-directed and student-directed.*
6. *Assessment should focus on students' use of knowledge and complex reasoning rather than their recall of low-level information*

While the above authors differ in some aspects of what they believe to constitute a learner-centred learning environment, there are some constant themes that carry through the literature.

Firstly, there is the need to provide learning opportunities regardless of the learners' circumstances and learning preferences. Secondly, the learners need room to explore, discover and assimilate knowledge at a speed that suits their abilities and circumstances. Lastly, the learning environment must be perceived as safe, free to explore with the ability to experiment and make mistakes free of adverse consequences.

Course design

After an extensive review of the media literature, the course designers decided on a model that sought to exploit the symbolic and processing qualities of a range of media that were available to, and could be used by, the identified student cohort. Of particular concern to the designers was the ability of the remote/off-campus students to overcome their fear of computers and to effectively set up their hardware so that they could begin the course. The design selected is represented pictorially in figure 2.

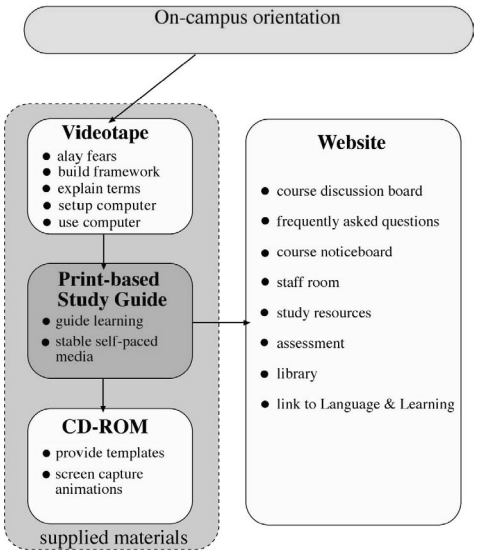

Figure 2 Computing for Academic Assignment Writing course design

On-campus orientation

The designers for the two external courses believed that for the students to fully understand the STEPS philosophy, a face-to-face orientation/induction was required. This orientation involved a weekend of talks, discussions and organised activities that would provide a solid grounding for the learning experience the students were likely to experience at a distance.

For the CFAAW subject the course designers believed that the most important activity was tuition in using the discussion board tool on the Website, as this would provide an important lifeline for those who may experience difficulties with any of the course content or skills.

While this orientation was conducted for both of the first semesters, not all of the students were able to attend.

Videotape

The videotape was an essential aspect of the course design and sought to provide a broad overview of the course as well as provide some basic information that the students could access non-sequentially throughout the course.

A major aim of this tool was to allay the fears of students with little or no prior experience with computers. The course coordinator has run this course in a face-to-face mode many times before and this was a constant issue for on-campus students-she believed that the problems may well be exacerbated by the isolation and distance of an external course.

The technology chosen to deliver the video media was VHS tape. There were two reasons for this decision. Firstly, 89% of Australian households have at least one VHS video recorder (AFC, 2002) and so the chances are high that the media can be easily viewed. This is particularly important as the videotape contains information relating to how to setup and use the computer. Lastly, if the course designers were to provide the video on CD-ROM media, this would likely cause the students' attention to be split between the application and the instructional video, thus resulting in additional and unnecessary levels of cognitive load which would have the potential to interfere with their learning (Cooper, 1998).

Print-based Study Guide and Course Profile

The stability of print was chosen to provide the appropriate scaffolding and guide the learners through the learning materials. The Study Guide was written in modules that corresponded to the desired learning path, but provided sufficient flexibility for those students with prior knowledge and experience in computers and their applications.

The methodology adopted in the modules was designed to provide step-by-step instructions accompanied by regular, annotated screen captures that illustrated the requirements in text and images. This was done to assist learners with both visual and verbal learning/cognitive styles. Each module contained an advanced organiser in the form of an overview and articulation of the learning objectives as well as a set

of review questions at the end of the module that allowed the students to test their knowledge. Activities were also included in the modules and many of these required the students to access the Website, or other supplied media, in order to complete their tasks. The activities were designed to encourage the students to engage in the learning tasks and to use the computer technology in progressively more complex interactions. This way the basic skills learned at the beginning were progressively re-enforced and extended throughout the course.
The Study Guide and Course Profile were distributed to the students at their on-campus orientation, or posted out to those who were unable to attend the orientation. A copy of both were available in the "Study Resources" area of the Website prior to and throughout the duration of the course. This allowed those who were keen to make an early start to do so before the course orientation.

CD-ROM
The CD-ROM was designed to provide a low-cost alternative to broadband Internet access to which few of the students had easy access. The CD contained screen capture movies that were voice annotated/ narrated by the course coordinator and template files required for some of the interactive activities. To view the movies students needed to install a "TSCC" CODEC supplied on the CD. This provided a level of reliability not easily achieved using other media types. Some of the movies made using this technology were exported to the VHS videotape and constitute some of the sections on that particular learning media.

Website
While much of the information on the Website overlapped with the other learning media, its main function was to provide a significant level of interaction, social presence and opportunities for collaborative learning. As this was a relatively new course being offered via a new approach the "Announcements" and "Frequently Asked Questions" or FAQ sections of the site were heavily used. As issues arose notices were posted and a bank of FAQs were quickly collected and published on the site.

The discussion board provided significant levels of support to the students. This support took the form of answers to questions related to the course and a level of social discourse that related more to how each of them were coping with the two courses. There were in excess of 200 postings each time the course was run. This was reasonably high for the low enrolment numbers (total of 48 students over two semesters) typical of this trial.

Evaluation

An evaluation instrument was developed specifically for this course to assess the effectiveness of the multiple media approach and to test the design assumptions made. In particular, the authors were looking for evidence of the type of usage, level of integration and student perceptions of effectiveness. The evaluation also sought data as to how well the course met the stated learning objectives and the students' needs.

The instrument was delivered in identical print and online formats with fifteen responses via the Web and eight returned via prepaid mail. While this is a relatively high return rate (48%), the sample is still quite small and the authors would like to conduct this evaluation across a larger population.

Findings
Overall the data collected provided high levels of learner satisfaction with 53% indicating that they agreed and 47% indicating that they strongly agreed with the following question: *"I was satisfied with my learning experience"*. More specifically, 40% agreed and 47% strongly agreed that *"the learning materials were well integrated"* which was the aim of the authors when they designed the media for this course.

Videotape
Of particular interest was the lack of a clear-cut preference for video over print media-it seems that the students believed that each media had a role to fulfil although it was clear from the data that the media usage varied widely for different students.

One of the aims of the videotape was to assist in overcoming students' fears of computers. The data indicated that 27% found the video *"very helpful"*, 67% said that it was *"OK"* and 7% indicated that it did not help. The data showed a strong correlation between those students who indicated a high degree of anxiety about using computers at the beginning of the course and the ability of the videotape to allay those fears.

Another aim of the video was to help to establish a conceptual framework that would serve as an advanced organiser for the rest of the course. The qualitative data seems to indicate strong support for this proposition with the following comments relating to what the students believed to be the most useful part of the videotape:

the whole video
the whole lot
overall good
introduction
I referred to it when I couldn't understand the study guide
description of the hard drive and how everything is together

The data showed a strong correlation between those students who indicated a high degree of anxiety about using computers at the beginning of the course and how successfully the videotape was at introducing the course and explaining its requirements.

Some, however, saw the video as being too basic, but the authors expected that this would be the case.

While 93% or respondents indicated that they had used the discussion board and 80% said that they found it *"useful"*, only 67% indicated that they felt *"part of a learning community"*. Qualitative data collected showed that the students found the flexibility and peer support provided by the discussion board to be extremely useful.

Not surprisingly, the Study Guide was the most heavily used component of the course. The students expressed high levels of satisfaction with this document and explained that it was easy to follow and understand. There were also comments that indicated students enjoyed the flexibility afforded by a print document.

Conclusions

The authors set out to create a course that would do what seemed like the impossible-provide rich learning opportunities to disadvantaged students with little or no prior experience in computing and run it from a distance with little or no face-to-face support. They sought to achieve this by designing a blend of media that would seek to take advantage of the symbolic and process nature of each media type in a way that provided a rich and engaging learning environment. The data collected in the evaluation provides strong support for the contention that this course met both student expectations and its stated learning outcomes. It also provides evidence to support the efficacy of the design decisions made and offers a possible design algorithm for future courses.

Further research

The evaluation instrument developed examined the relationships between the videotape and the other learning materials, but did little to explore relationships between some of the Web-based material and tools. Anecdotal evidence collected throughout the course suggested that the FAQ section of the Website provided substantial assistance to the students and saved the facilitator significant amounts of time. There are also issues related to the degree of intervention adopted by the facilitator and how much of the discussion board space should be "owned" by the students.

While the learning design was heavily influenced by the proposition that there would be significant variance in the students' learning styles, the study failed to test for this. A future study may well include

the introduction of a learning styles instrument such as Riding's Cognitive Styles Analysis (1999) or Felder's Index of Learning Styles (1993)to test the efficacy of some of the design assumptions made.

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