"THERE IS ONLY TWO WEEKS TO GO, CAN I GET MY SUBJECT ONTO THE WEB?": A CASE STUDY

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ABSTRACT

This paper explores the path taken from the perspectives of a lecturer in Educational Development, a lecturer and the students and recounts their experiences, both the failures and triumphs, as the task of mounting a subject onto the web became a reality. It was the academics' first foray into the complex world of on-line delivery. The decision to embrace the process emanated from the need to find a mechanism that may alleviate some of the logistical problems associated with presenting, for the first time, a first year statistics subject 'using an experiential approach', to over 300 first year undergraduate students in the traditional face to face delivery mode.

With two weeks to the start of session a chance encounter with an educational development consultant (Bob) allowed the Statistics lecturer (Anne) to pose the question "would you tell me to go away and come back later if I wanted to put my subject onto the web, I know there is only two weeks to the start of session?"

Very few academics appreciate the fact that migration to a web based delivery mode of their course materials which they have in the past delivered in a face to face mode is an involved process which can only be successful if several demands are met. Firstly the process requires thorough planning with a clear understanding and up-front statement of the aims and desired outcomes for both the academic and the students. The academic must have a commitment to the restructuring of materials where necessary to suit the new delivery mode and to a re-assessment of their pedagogical approach. A recognition that a long lead-time to allow for the necessary production phases to be initiated and completed is essential if the end product is to be an efficient and effective teaching and learning environment. Finally and perhaps most importantly, the academic must be aware that taking up such a challenge will involve them in an incredible increase in their work load and that their ability to cope with this will directly impinge on the success of the exercise in terms of student to student and student to teacher interaction.

> "Two weeks to the start of session I ran into the educational development consultant (Bob) and asked 'what if someone asked you about getting there work on the web, would you tell them to go away?" "No" was the response. We agreed to do this thing together and to make it doubly worthwhile to write it up as a case study."(Porter, 1998)

This innocuous question launched the lecturer Anne into one of her most hectic teaching sessions ever. Her day to day diary proved to be a rich source of information which could in itself provide others who might attempt to or be involved in the mounting of subjects on the web for

the first time excellent and timely guidance in the process. To read only the diary entries is to read mostly of frustration and anxiety and one must question why anyone would wish to proceed with such an endeavour. However, despite the numerous setbacks, equipment failures and hours of preparation the lecturer began to glimpse what could be and whilst many would consider this challenge a foolish one to take up, the experience has proved to be a rewarding for the consultant, the academic and the students.

The purpose of merging the academic's and consultant's perspectives of the process is to illuminate the lessons learned, to provide the wisdom for what comes next for the self and others in developing a web based approach to teaching. In the second section of the paper the educational consultant and co-author (Bob) provides a state-of the-art commentary and analysis of the process of mounting a subject on the web. As he says 'very few academics appreciate the fact that migration to a web based delivery mode of their course materials which they have in the past delivered in a face to face mode is an involved process.' All the pitfalls the lecturer experienced exemplified why planning and clarity of purpose are essential when contemplating such a shift in teaching pedagogy.

In the final section of the paper, the lessons learned are expressed in terms of the resource issues and planning for the next implementation. However the end of this experience signifies the beginning of the next and even though the next steps are identified there are still issues for the lecturer to confront. This foray into providing an additional resource for her students has been for her a necessary step towards developing an alternative delivery system for her students.

1. PROBLEMS AND ISSUES (THE ACADEMIC)

The issues and problems with which one must contend to mount a subject on the web are many and varied and they emerged almost from the instant the decision was made to do this. The issues included: the totality of involvement; technical problems; the need for support; the time commitment and many crisis's which arise; the difficulty of working with Mathematical formulae and the lack of resourcing. They can be exemplified by extracts from the diary (Porter 1988).

1.1 TOTALITY OF INVOLVEMENT

> "That same week (two weeks from the start of session) Bob had contacted the graphic designer who requested that I send him some formulae for use in constructing the web page. Alarm bells were ringing. The totality of involvement hit home at this early stage. The cookbook formula approach to learning Statistics was an approach I wished to dispel. Two themes kept running through my head. I had settled on neither but had thought that either or both would provide the framework for teaching my subject. These themes were "the what, how and why of statistics?" and the introductory exercise "seashells on the seashore". Maybe the formulae giving way to graphics would be suitable and I set out to find some examples."(Porter 1998)

and

> "I met with the graphic designer late that week. I arrived with a set of formulae and graphs for him to use. The first attempt at a web page was ready. It had a red zig-zagged interface using the faculty colours. I did not like it nor did the designer. I spoke to him about my themes and was to return with a photograph of the seashells. I was to decide at this stage what menu items I would require.
>
> By early the next week I had discovered that not only were my photographs not suitable, but the two digital cameras were not going to function for me in the short term. This was the start of a run of equipment and software failure for me. I returned to the graphic designer with a box of shells. On my next visit I was absolutely delighted with the interface, it captured the formula so identifiable

with Statistics very subtly, but gave prominence to the seashell theme. The harshness of the red gave way to the softness of nature. It may be all in my head, but every message that I present in my teaching is important. Seashells were used to set the scene both in the lectures and on the web." (Porter 1998)

1.2 TECHNICAL PROBLEMS

Week 1 of session:

"My documents were handed to the programmer Monday, Week 1. The first lecture was Tuesday 2.30 pm. Late Tuesday morning and horror of horrors. When I opened the site, window upon window opened over the top of my beautiful seashell frame. The second of the technical problems. I was using a version of navigator lower than 3. This version did not use frames! At 12.30 that day I went to the lecture theatre to trial the site and reality again hit. The web was down."(Porter 1998)

and

"Dreamweaver is the software that the developer uses to convert my files to html. However this I cannot run on my computer as I need an update to a system past 7.5 and before I can do this I need to increase my computers memory. I am running with a PowerMac 7100/66AV. I have 16 Meg of memory on board. With my computers memory upgraded to 64 Meg, other options are presenting themselves. To use Microsoft Office to convert my documents to html, I need a computer which has a faster CPU."(Porter 1998)

and

"I was fairly happy composing with Netscape 3 Gold except for the irritation that my computer kept crashing. I had a problem sorting out the layers – in which folders should I put material so that it could be found when I clicked on a link. Where should I put material so that I could keep track of it? I felt the need to clarify whether a set of separate files was in order or whether a large file with markers in it would be most useful. My knowledge of html needed to be improved... However it rapidly became necessary to leave the conversion of files to html to the programmer."

1.3 SUPPORT AND GUIDANCE OF SOMEONE WITH THIS KNOWLEDGE, THE CONSULTANT.

"I would have given up many times over in the early stages if it had not been for the consultant (Bob). His support and knowledge was an integral part of the whole process, not just in guiding me in terms of the process but in the management of the process. He provided the link between me as the academic/content expert/content provider/ teacher and the production side of the end product (web site), the programmers and graphic artists". (Porter 1988)

1.4 THE TIME FACTOR

Week 7:

"After the Easter break. It is after marking 284 exam papers and another 100 assignments If I were asked about putting work on the web at this time I would say forget it! I have put so much into examining what happened in the midterm, identifying the language

> problems and the listening problems that I am exhausted. Just having given my first double lecture after the break, I am now behind for I need to get it ready for the web. They are a terrific class and I want to do all possible for them. If they did not know about this option, I would not at this point in time make them aware of it. How do I inspire students to do better?"
>
> "It is not simply a case of putting it on the web, it needs to be tested and checked and tested and checked again." (Porter 1998)

1.5 IN CRISIS MODE

Much of the session appeared to be spent in crisis mode. I wondered if I had more time to simply focus on the next lecture rather than focussing on the one just passed whether the state of crisis would have been avoided.

> "That double lecture was a disaster just averted. It was not the web but the other things that went with it. Here is what the morning of my Tuesday lecture was like. My printer at work ceased to print! Is it that I have new software and hence incompatibilities? I rushed to the laboratory some buildings away to print but some manipulations of the data were not possible so I returned to my own machine. Two printers were highlighted simultaneously, what does this mean? Of course neither print...I rushed to the admin officers room but my disk is not readable on either of the two machines. I had few overheads for the lecture, everything was on the disk. I took the disk to the lectures, but it was Word 6. Someone has fiddled the preferences and I could not find the elevator to move up and down the document. A student helped. In the haste I did not bring my OH pens and transparencies. I started the lecture with what I had, took a diversion to a video clip...then an activity (in the sunshine), then regrouped. I wondered if my time wasn't spread over the web and preparing lectures whether I would have been ready those few hours in advance... Whilst the lecture for the students remained coherent my mind felt fragmented. The feeling was ghastly. This is not the way to teach to 300 students." (Porter 1998)

1.6 COMPLEXITY OF THE CONTENT (MATHEMATICAL FORMULAE)

> "The work in putting mathematical formulae onto the web was horrendous. I need a better system. Lectures required symbols in size 18–24pt font, the web about size 12pt font. The formulae were created in 'pict format' with Equation Editor as using symbol font or subscripting often led to translation errors when the material was converted to html. I need a better system and will need to trial working with Tec and other mathematically based systems rather than just Word." (Porter 1998)

and

> "The laboratory assignment used a specially designed font which also needed to be downloaded and installed before the assignment was opened, otherwise on opening the special font reverted to text. Changing fonts remains problematic." (Porter 1998)

1.7 FUNDING

Probably the most debilitating of all the problems faced. There was no official funding. A small amount of funding was advanced on the basis of providing 'new comers' with a 'start in the medium'. Unfortunately, structural changes in the personnel and operation of the production unit resulted in a shortfall in the overall budget. The result . . .

> Week 10–14:
>
> "No more work is mounted on the web. The consultant is keen, I am keen, the programmer is overloaded with paying work. To undertake this work one needs to be resourced and/or to have the lead in time and skills necessary to do it oneself." (Porter 1998)

2. REASONS TO CONTINUE

There were many good points coming from this trial**.** Despite the many problems, delays in availability of promised content, lab exercises and the like, there were advantages for the current students.

- "As the session progressed I found myself preparing a lecture for delivery and then after that delivery, I sat down to modify it for the web. Rewriting the delivered lecture in this manner prior to the next lecture resulted in a better linking of the lectures and review of previous work. If I felt when giving a lecture, I can do that better, then that could be incorporated into the document." (Porter, 1998)
- "Students did have and did utilise an additional resource for much of the session. The up side and the down side of this is that students are telling me 'I'll get that off the web'. I am pleased with the response, it is pushing me a little to do more than I had fully intended. I feel that when it is up, particularly for future years that it will give added flexibility. I am already being pushed to think of structural changes – instead of class teams, perhaps internet teams working together."(Porter, 1998)
- "From the very first lectures students emailed me, providing an additional vehicle for communication. By the end of week two students were beginning to communicate their concerns about learning Statistics. This is a positive, many students do have difficulties, communicating about those difficulties is the first step in fixing the problems. The prospect of monitoring the access to the STAT131 site emerged." (Porter, 1998)

The trial with this subject helped me identify how I need to proceed in order to accomplish what I now can see more clearly.

- "In retrospect my reasons for doing this seem ill formed. The web appeared to be a more powerful presentation tool than PowerPoint. In the previous year I had used PowerPoint, but it seemed that if I prepared my material and delivered it via the web, that there was the potential for students to access it. I also thought that the web would allow for a more dynamic presentation. I was not totally naive. I had done some programming in html – enough to see its potential. My class numbers were up from 200 to 300+, a new venue was being sought and the prospect of need an alternative form of delivery was also at the back of my mind." (Porter 1998)

Despite the fact that the workload became horrendous, and I was often extremely frustrated with technical problems 'A mess, a mess, a mess! This is not what I want! 'Never was there a feeling that it was not worth the effort. The frustration was borne of my seeing more clearly how it could be if only we could do... The vision continued to grow throughout the session as students conveyed what it was they wanted and as I saw other peoples' work.

3. A CONSULTANTS' VIEW OF THE PROCESS

A number of papers, conference proceedings and reports, Simbandumwe (1997), Bannan & Milheim (1996) and Parson (1997), suggest that there has been widespread increase in the level of interest and use by academics of on-line, particularly Web based, instructional systems in the last few years. Fyvie (1997) identified fifty-one institutions (forty-four from US, four Australian and two from UK) which offered either undergraduate or post graduate online courses.

Such assertions would seem to reinforce the observation that on-line systems in general and particularly those which are Web based are rapidly being accepted as a legitimate alternative to the more traditional methods of teaching. Further, suggests Burnett (1997), the use of the Web will continue to expand as it becomes more stable, easier to use and more accessible to everyone and the bondwidth increases. What we are learning from using the Web today will provide the confidence and expertise to take advantage of the advances in its technology. Now is the time according to Alexander (1995) to stop focussing on the technology itself and to start focussing on what students are to learn, and the best way for them to achieve these learning objectives.

Berge (1995) points out that one of the key underlying assumptions must be that the use of such methods should create an environment that will promote individual and social interactions involving higher order cognitive processes for the students during their construction of knowledge. At the same time it is essential that process/method used is seated firmly on thoroughly developed learning objectives and instructional paradigms.

Jones & Buchanan (1996) suggest that the more traditional methods are proving 'ineffective and inefficient for the diverse student population' which institutions must contend with today. Flexible modes of delivery such as Web based instruction can provide an effective means of addressing the problems of increasing student demands, decreasing funds, the need to establish a presence in the international market place and rapid technological change.

Many still see web based instruction in the narrow context of distance learning, in that it is capable of providing a workable solution to the problems encountered by students who have no other means of gaining access to education. Increasingly however, institutions, and the students and staff working in them are discovering the value of the techniques of resource based learning and the Web is being utilised to provide materials for students who are at a distance as well as those who are on campus.

In recent times numerous tertiary institutions have experimented with the use of on-line delivery, particularly those which are Web based with the purpose of increasing access to education to a wider audience. The boundaries for what is possible change almost daily.

"An understanding of the techniques and protocols of on-line teaching and learning and the processes of both the design of new and the conversion of old courses has become essential for academics, as universities throughout the world embrace alternative delivery methods in response to the globalization of education." (Corderoy & Lefoe 1997)

4. ISSUES IN THE DEVELOPMENT PROCESS

By default, it is often the academic who takes on the roles of designer, developer and presenter without the necessary skills base. While the acceptance of these roles has been supported by the proliferation 'easy to use' course building software packages currently referred to by many as 'cookie cutters', the problems arising out of inadequate instructional design as well as poor design in terms of the structure and interface often negate the worth of the course package.

The authors suggest that the main reason for this is that, very few academics have the expertise in the varied disciplines involved in the production of an effective web based course. While the 'cookie cutter' development systems generally come from developers who are not unfamiliar with course development in a wide variety of content areas and have consequently based their 'template' on sound pedagogical models, the templates must by virtue of this variety be 'one size fits all' in their approach. This in itself would not necessarily represent a fatal flaw if it

were not for the fact that these development systems do not generally have a sufficient level of in-built user support to allow an untrained academic to use them correctly and efficiently. They are also in some cases, less than intuitive in their operation and are often used in isolation by the academic. In using and trialing some of these systems for the production of courses, the authors have found they present limitations in a number of significant areas. One such is the limited freedom that they allow in interface design. This can have important implications for the successful use of the course by the students. In general the result is often a very negative experience for both the academic as a developer and the students as end users. We would not suggest that these systems do not have value. They can be extremely useful and time saving starting points particularly when the user is provided with support in their use.

The marketing of these packages has been structured around the premise that the use of such 'authoring systems' will provide an easy and almost 'fool proof' means for everyone to be successful in 'putting resources on the web' including complete courses. The problem is exacerbated by a number of factors. These include: time and funding restraints which force individuals into the adoption of a 'cheap and quick solution' to 'getting on-line'; the often unjustified self perception of expertise in this highly specialised field; and the mistaken belief by many that providing a course on-line involves little more than providing the content of the course as a web based document. This may be done with or without the support of some 'flashy' graphics or other 'bells and whistles'.

Based on extensive experience in curriculum design and development in many delivery modes, the authors contend that the most successful methodology in developing web-based courses involves the use of a 'team approach'. No individual has the expertise in the many disciplines involved in the successful design and development of such courses. Such a team would have a minimum of four members. A content expert (the academic or lecturer), an instructional designer, a programmer and a graphic artist.

5. MANAGING THE PROCESS

The University of Wollongong is moving down the pathway of providing students and academics with flexibility in the way the teaching and learning process occurs. The Centre for Educational Development and Interactive Resources is a service unit within the University which can provide staff with advice, support and full production facilities to enable them to mount subjects on the web, re-develop their on campus subjects to embrace more flexibility in the mode of delivery or develop text based or interactive, multimedia based resources to support their existing subjects.

The unit comprises a number of lecturers in Educational Development who act as consultants and guide the academic through the process and a number of production groups including, TV and video, Electronic Publication, Interactive Multimedia Production and Audio visual Services. Each of these units become part of a 'team' as required for the development of courses and resources.

In terms of the Web based delivery of subjects, we are currently using two distinct processes. Our early subject development took place using pure 'html' markup of content and other resources within 'subject specific' interfaces developed by the unit. Such a process was relatively quick, efficient and cheap. Interactions such as synchronous chat were conducted using 'add-on'commercial/shareware components such as Discuss. A number of subjects are still being developed using this methodology, the subject of this paper being one such.

The major short coming of this approach is the lack of or poor quality of student management processes available and for this reason, we are now moving towards the fully integrated subject/ student management systems, such as TopClass™ and WebCT™. Purely web based html developed subject frameworks require external mechanisms for the management of students. Class lists, passwords when used, communications access assignment submission and return and so on all have to be created manually and managed individually.

There are savings to be made using such systems, but the 'programming and administrative overhead' may negate them when small scale 'trials' such as the one which is the subject of this paper are attempted. The decision to 'go down the html track' was also partially driven by the possibility of the lecturer being able to 'pre-process'some of the materials, thus speeding the process.

6. PROBLEMS AND ISSUES (THE CONSULTANT)

Although the migration of subjects to the web is one of the tasks carried out by the team of Educational Developers in the Centre for Educational Development and Interactive Resources, the normal process for such development takes place over some months before the subject is due to 'go live'. In such a 'measured timeline', both the academic and the consultant have time to consider all aspects of the process, consult on a regular basis and organise an ordered development. With such a short timeframe and what turned out to be an extremely limited budget, the 'quality' of process is compromised. So why did we attempt it? The main reason was a need to provide solution for a colleague and friend in need. Secondly, it would be interesting to see just how quickly we could 'mount a subject' from scratch given a reasonable budget line. We believe that had the projected budget held, the end result would have been much more satisfying. We believe that with enough money to 'buy production time' 2 to 3 weeks could suffice in the mounting of an infrastructure and the basic content required. Some of the identified issues include;

- Contact and consultation with academic was limited and usually rushed
- Expectations of the academic. They were often unattainable in a trial situation. The academic needs to come to terms with the notion that the materials they present in the face to face format may not be suitable for the web without modification. Complex mathematical formulae and symbols may be better handled by other means of presentation. This stems from a lack of understanding of the medium. It improves with time.
- Delays in supply of materials. All members of the team are 'pushed for time'.
- The work as it is put up needs to be tested on the machines that the students use. In our institution the common mode is both Macintosh and PC.
- More testing of work needs to be undertaken so that access to the web is transparent. Students cannot afford to spend large amounts of time working out why the acrobat reader they have is not functioning.
- Providing the maximum work for a limited budget. This is related to,
- Competing with 'paying jobs' in the 'production line'. Even though the content needs to be 'up on the sit' on time, (the students have been given the expectation that it will be), the needs of 'full paying clients' should and does take priority to the detriment of the non-paying jobs.

7. PROBLEMS AND ISSUES (THE STUDENTS)

7.1 STUDENTS HAVE EXPECTATIONS

When students are made aware of a useful resource they will want it, now! They certainly want it before their exams. They want lecture notes, what they saw, heard and did. They want their handouts, exercises and solutions. They want it without the anguish of technical failure. They want to be able to print it our easily. When the material does not arrive on time the reaction is negative. They too shared the frustration and expressed it when this did not happen (usually using the chat line). However many are tolerant. They persevered in their requests for this type of material, and when they realised the technical difficulties began to inform Anne as to the easiest way of accessing materials and when they had solved their access problems. (Many students were Computing Science students or studying Information and Communication technology). For a sizable proportion of the students this was an efficient vehicle for delivery and provided them with a way of communicating with the lecturer (via email or chat).

7.2 MOUNTING THE CONTENT

Whilst I still want the subject mounted in a manner that students could progress through the subject (deliberately at this point in a linear manner). Students as a minimum want access to the resources. The easiest manner is to mount them in '.pdf' for students to print them off.

7.3 ACCURACY OF CONTENT

The work needs to be proofed by another so that errors in formulae are omitted.

7.4 TECHNOLOGY PROBLEMS AND THE NEED FOR PRE-TESTING AND SUPPORT

> "Downloading is problematic on other machines. At the end of Thursday I finally have the version of Acrobat on my machine and have been able to unstuff the lectures and print them. In time for the lecture tomorrow. I can inform the students.
> The difficulty is that the accessing of this information needs to be transparent. If I have a problem so too will my students. My students use PC's – I have not been able to test it on these. I know the PC users are also having problems." (Porter 1998)

7.5 INSPIRATION . . .

> Week 9. Sunday:
>
> "The work is piled up in front of me. The lectures have been given, prepared in large font for overheads. The teacher talk which is practiced and rehearsed for between the foils has receded and needs to be recreated. The mess of foils need to be re-ordered – I've never been one to leave the lecture with the overheads in the order in which they came. It is only the students and Bob who has put in so much energy that carries me forward. Also there were 37 hits last week to nearly 956 ish sites, that is a thorough visitation when there but there were no updates. If students are using the site then they are using resources put there to aid their learning. A student in week 8 has requested the material be put in closed reserved. He has a PC and downloading is problematic. We are only checking the Macintosh version." (Porter 1998)

7.6 STUDENT SUPPORT

Students need support, both technical and content wise and outside normal hours. This is a global issue though with the whole process of subjects on line for any institution.

8. NEXT TIME ROUND

Can you mount a subject two weeks before term? No! Not without money or more know-how. Will I utilise the web next year? Yes. How then shall I approach it?

The trial with this subject helped me identify how I need to proceed in order to accomplish what I now can see more clearly.

8.1 DESIGN ISSUES

- I need to further investigate the nature of the web work. Is it an additional resource for a lecture based subject? or is it to be a total delivery system for both local and distance students? Where on this continuum is it to fit. For the moment I have chosen to develop it as an additional resource, but in twelve months time I need to teach to students at another campus. When I have the time and skills to make it more interactive and visual, when I can include video, sound and graphics more readily, and access a statistics package

over the web (things technically possible) then perhaps I can move further along that continuum of providing better teaching rather than providing an additional teaching space.

8.2 SUBJECT ADMINISTRATION

- I would like students to be able to use an automatic tutorial allocation system, including a providing a digital image of the student.
- Automatic email or mailout system so that students who have missed more than a certain number of labs would be sent a message re their progress.

8.3 MATERIALS AND PRIORITISING

Before the start of session

It should be possible to mount:

- All subject outlines.
- All tutorial work and solutions.
- All laboratory work and solutions.
- A selection of past exam papers and solutions.
- A databank of questions and solutions (perhaps connecting to a question and answer testing system such as Ralph).
- Supplementary materials for students who do not have the prerequisite skills.
- Links into other exciting data sources and statistics sites need to be included (and incorporated into the tutorial program).
- Access to statistical software via the web (New for this subject, but technically possible).

During session

Given that my lectures are based on eliciting ideas, data and questions, the precise nature of the lecture depends on the interaction which occurs. My lectures are not pre-packaged. Hence I would like to provide the students with:

- Downloadable lectures in '.pdf files'.
- Lectures which allow for participation over the web. For both lecture and web alike there needs to be a development of suitable activities so that ideas can be exemplified or simulated.
- Movement incorporated in the form of video, as well as graphics and sound.

8.4 COMMUNICATION

- The email system was effective and needs to be included in future years.
- The chat session required more input so that it became other than the place to voice a gripe.
- When this system is running smoothly with students able to complete the subject through this flexible mode I would like to include teamwork – cross universities and cross cultures.
- Noticeboard. A simple and effective mechanism for communication both between students and between the students and myself.

8.5 RESOURCING AND FUNDING ISSUES.

- I need funding to support me whilst getting the bulk of the material (critical mass, simple text and graphics) up including time release to collect collate and prepare materials.

- I need funding to support me through the phase of learning how to manage the files and linking myself and to be able to put up simple additions.
- I need funding to support me through the phase of learning how to do the non simple text work. I wish to include audio, pictures and video clips. The one audio clip I used was not successful.
- I need a better system for including mathematical formula. I need to trial working with Tec and other mathematically based systems rather than just Microsoft Word.
- The work as it is put up needs to be tested on the machines that the students use. In our institution the common mode is both Macintosh and PC. My computer is too slow to use many of the development packages.
- More testing of work needs to be undertaken so that access to the web is transparent. Students cannot afford to spend large amounts of time working out why the acrobat reader they have is not functioning.

8.6 COPYRIGHT

As a lecturer one quotes others, uses data sets, illustrations and materials developed by others all acceptable in the context of lecturing. As one produces materials and 'publishes' them on the web, the issue of copyright becomes an issue. The solution, if perhaps only partial, to this problem may rest in the password protection of the site so that only students enrolled in the subject have access. It might then be argued that the material provided in such a manner falls under the same guidelines as those applied to materials presented during a 'closed lecture session'.

9. RECOMMENDATIONS

Although there are many things we would do differently and indeed many we would not do at all, the experience has given the authors special insight into the process. The recommendations that follow stem from this insight and could act as useful starting points for those that follow this 'road to web delivery'.

For clarity, we have divided them into three major categories, namely Organizational, Technological and Pedagogical.

9.1 ORGANIZATIONAL

- Allow sufficient time for careful pre-planing.
- Allow sufficient time materials preparation.
- Allow sufficient time for conversion of materials to the web.
- Allow sufficient time for testing before going live.

Above all, ensure sufficient funding to cover both

- the production cycle, and
- the release time needed by the academic during the materials development stage. This process is very demanding and a full teaching load may 'make the task impossible to do well'.

9.2 TECHNOLOGICAL

Again, all of the points listed below depend on time and funding:

- Ensure that the technology is seamless in its operation.
- Close collaboration with those responsible for the supply of the 'technology of delivery on campus' is essential.

- Carry out extensive testing of both the site and its function and student access mechanisms early.
- Test for 'platform' compatibility.
- Provide support for students at all times. In built help in the form of guides can be helpful in minimising the frustration that comes from simply solvable 'glitches'.
- Both the student and the lecturer need to become familiar with 'how the system works' if it is to be seamless in its operation.

9.3 PEDAGOGICAL

This is a new medium for both the student and the lecturer. Both need to be prepared to be accepting of the problems of all involved. Students need to be guided and supported while they adapt to the 'new learning modes'==. Lecturers need to be supported in coming to terms with the need for change. 'You cannot lecture on the web'.

10. CONCLUSION

The design, development, running and management of on-line teaching and learning environments are costly and time consuming. Considerable planning and organisation is required as well as support teams for the technology. Following a 'team model' approach in the development of web based courses is proving to be the most effective and efficient means of achieving a consistent and satisfactory outcome. A minimum of six months development time is recommended before accepting a full student load. Successful on-line teaching and learning will only occur when outcomes are clearly defined, content and activities are thoroughly prepared and identified, and an infrastructure is in place which supports both students and staff. Perhaps in this 'short notice' trail, using one of the many 'cookie cutter' management systems such as TopClass in a 'team' based supportive environment may have resulted in a more effective experience for all concerned.

'Innovative practice will always provide challenges for early adopters of new strategies for teaching. As web-based instruction moves beyond the early adopter stage, institutions will need to put structures into place to support teachers in this new role.'(Lefoe & Corderoy. 1998) A key component to the effective preparation of academic staff in this new role is 'web based staff development which models effective practice'(Wills, Nouwens, Dixon & Lefoe, 1997).

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