

Extending the academic comfort zone: Smooth transition from content rich linear courseware to problem based learning online

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This paper deals with the problem of what to do with legacy online courseware. The study reported demonstrates how old, content rich, linear online courseware may be restructured into a topic based learning resource suitable for supporting problem based learning. A process model is presented demonstrating how the conversion disaggregates the old course content from course management, facilitating reuse of the content in other learning contexts as required. Hence, the resultant online learning resource may be used to support a variety of pedagogic approaches. An added benefit is that the process requires minimal time commitment from the academic content specialist and the delivering academic.

Keywords: educational design, legacy online courseware, reuse, problem based learning, online

Introduction

Online learning has been available in a range of configurations since the introduction of the Internet and the World Wide Web (Web) to the world in the early 1990's. Initially, early adopters experimented and innovated, but they were soon followed by a push by many higher education institutions to put as much learning material online as possible, quickly, as many Australian universities ventured into global markets and the Web became the medium of choice for distance education. Over recent years much progress has occurred in improving the online learning experience for students as our understanding of the need for some variations in pedagogy, when using the electronic media, has evolved (Richardson, 2001). Although quality was always aimed for, much of the original materials are now quite outdated in style and effectiveness. Also, a lot has been learnt about the excessive time and cost of developing this material, and the value of reuse where possible is recognised (Downes, 2001).

In this context, and with ever decreasing budgets and academic availability, it became apparent that finding time and cost effective mechanisms for redevelopment and reuse of some of our early fully online course materials could prove useful in many future course resource developments and revisions. This paper describes a process, requiring minimal input from the academic content specialist, for taking aged content rich linear online courseware and transforming it into online courseware that supports problem based learning. First, a short description of the background to this work is provided. This is followed by a description of the resource redevelopment process and a discussion of issues leads to concluding remarks.

Background

One of the first fully online programs developed by RMIT commenced in 1998 and is still delivered today through Open Learning Australia. An introductory course within this program, the Introduction to Information Technology (IIT) course, also gains a lot of exposure as a mixed mode course for on-campus students since it is taught in a number of other programs across the university (Zuluaga, Morris and Fernandez, 2002). With an audience of some 350 students annually, varying from extremely computer literate through to technically low skilled individuals, this course provides excellent opportunities for evaluations of effectiveness of learning experiences. Past student feedback has been both positive, such as 'I don't need to go to lectures', and negative, such as 'hard to stay motivated' and 'Lack of control of information' (Morris and Zuluaga, 2003; Zuluaga and Fernandez, 2003). Also, the Department of Infrastructure (2002) report on general feedback from employers in the IT industry indicates their desire to employ graduates with a mix of good technical skills and effective 'soft skills', where problem solving, and oral and written communication are highly valued in the latter.

Gurrie (2003) reported similar generic skill and motivation concerns with online learning courseware and concluded that problem based learning can address these concerns and achieve the desired instructional and curriculum outcomes. This view finds support in successful trials of online problem based learning implementations (Beasley & Ford, 2004; Gibson, 2002). With its emphasis on more student directed learning experiences, the problem based learning model embodies the constructivist learning principles (Duffy and Cunningham 1996) and one of its essential characteristics is to ‘...situate the learning in the examination of authentic, real life problems and questions of relevance to the learner...’ (Gibson 2002) to increase motivation for the learner. Herrington, Oliver and Reeves (2003) question the nature of authenticity in the educational setting, but provide ten broad design characteristics of ‘authentic activities’ that are useful as criteria when selecting appropriate problems and activities for study.

Although it is suggested that appropriate investigative learning occurs by replicating at least some aspects of the problem based learning process in our online problem based learning implementations, the nature of the online material that supports this particular pedagogy is unclear. Elliott, Efron, Wright and Martinelli (2003) suggest that ‘not all resources used within the PBL environment need to be designed according to principles of PBL. Books and journal articles, for example, stand alone as valuable supporting material.’. If online resource material is to remain a reusable resource then perhaps it should be included in this list of valuable supporting material for any appropriate pedagogy.

The problem

The issues of concern revealed for the IIT course are representative of a recurring theme in many, particularly older style, online courses (Oliver, 2001). With its history of regular evaluation and continuing extensive use this course presented as an ideal candidate for a study in addressing these concerns. Our target was to achieve a time effective conversion of the old materials to enable them to be used to facilitate a problem based learning implementation. Our online learning development team has experience in creating online materials that support problem based learning. In these implementations the ‘authentic’ problems and activities are presented within the Blackboard environment, and the supporting converted materials are available as a linked website.

The challenge in this study is to perform the conversion of the old linear, content rich material into a resource that is not only well indexed and fully navigable, to facilitate searches and student controlled, self directed learning, but also to provide module independence based on learning objects to enhance reusability. Known constraints on this work include the rapidly changing nature of the content and the very limited availability of the content expert, as well as the need to engage the delivering academic in a change in the pedagogic approach.

The redevelopment process

Our study and analysis of the conversion of the content rich, linear online IIT course resulted in the definition of a two phase redevelopment process, as depicted in Figure 1. The first phase results in disaggregation of the old course content from the course management, changing the structure and style of presentation of the material and transforming it into a topic based online learning resource that is web based, fully indexed, and readily navigable. The second phase creates the problem based learning overlay that resides within the course management shell, in our case, within Blackboard, and provides a link to the renewed learning resource. This pedagogy specific ‘overlay’ can be simply viewed as an application that uses, but is external to, the topic based learning resource created in Phase 1. Other applications, employing different pedagogic approaches may also use this topic based learning resource. Unfortunately, the paper page limit precludes a full description of the problems and inquiry processes established, in Phase 2, to guide the learning and the use of the renewed resources. Hence, the complexities of the problem based learning design are not dealt with in full here, and remain as a topic for a future paper. However, we do provide a brief discussion of this aspect in the ensuing text in order to place the redevelopment process reported for Phase 1 into context.

Phase 1: Change presentation

In performing the first phase of the redevelopment of the old online courseware a generic process model for converting the presentation of the materials from course based content into a topic based learning resource, depicted in Figure 2, was developed. It clarifies the detail of the Phase 1 process and will assist in future redevelopment projects. Discussion of this first phase concentrates on the four key tasks

(depicted as rectangles in the figure) that are central to its operation and these are performed almost entirely by our online learning development team, consisting of html production, creative design and educational media specialists. The associated decision points (shown as diamonds) heavily rely on input from the academic team, comprising instructional and content specialists, and delivering and reviewing academics.

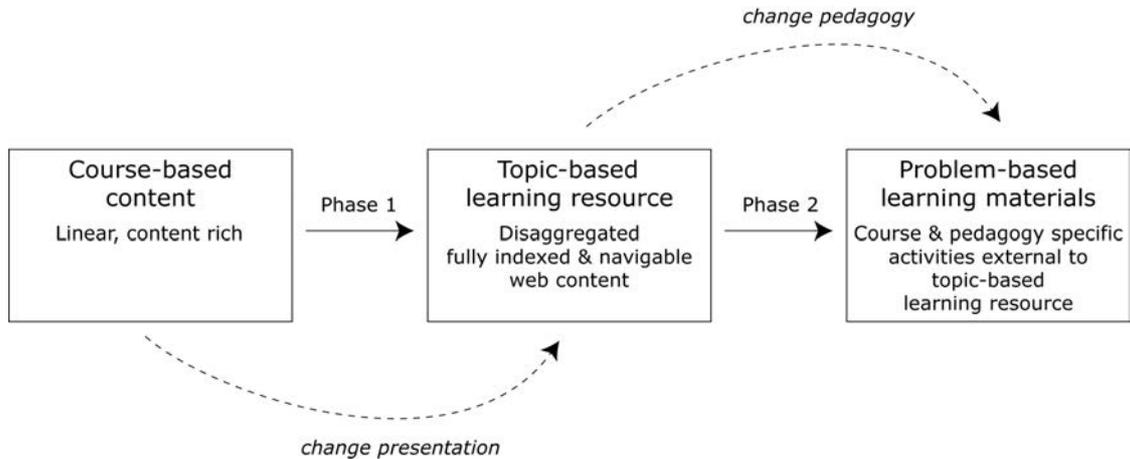


Figure 1: Overview of the resource redevelopment process

The Phase 1 process consists of three distinct stages (indicated at the left of Figure 2) that are performed sequentially, provides four deliverables (seen at the right of Figure 2) and features continual evaluation throughout. In the first stage, the old content is restructured. Only when this is complete and the full project team, comprising all members from both the online learning development team and the academic team, has agreed on the accuracy and balance of the new web based structure is the second stage entered and the new structure populated with existing, redistributed and updated content. The last stage of the process extends and enhances the ‘raw’ restructured learning resource. This stage may be dealt with quite separately although some minor alterations, such as to existing graphics, may be essential during this initial redevelopment in preparation for the next delivery of the course. However, academics are encouraged to leave any major extensions and enhancement for iterative development, after students have used the material and usage patterns and problems have become apparent.

Restructure old content

Define learning resource outline in terms of topics and subtopics

The initial task involves defining a clear outline of the course in terms of topics and sub-topics, and considers the range of learning objectives covered by each subtopic. The process is one of ‘chunking’, widely accepted in computer interface design (Miller, 1956) and useful in the development of online educational courseware since it is based on the contention that students tend to comprehend information in 7 +/-2 chunks rather than as isolated facts. The steps the online learning development team engage in include:

Finding the list of topics

Most courses seem to cover about six topics. And, although the temporal based lecture rarely coincides with the concept based topic format, these topics basically reflect the main topic addressed by lectures, although usually more than one lecture deals with a particular topic. The list of topics determined represents the first deliverable.

Finding the subtopics for each topic

The first step in finding the subtopics is to identify all the learning objectives within the topic. These are generally stated explicitly in the existing online courseware. If not, they may be identified in a number of ways, perhaps by referring to the textbook where chapter sub-headings give clear indications or even explicit statements of the learning objectives dealt with, or by scanning through previous exam questions and descriptions of assignments set.

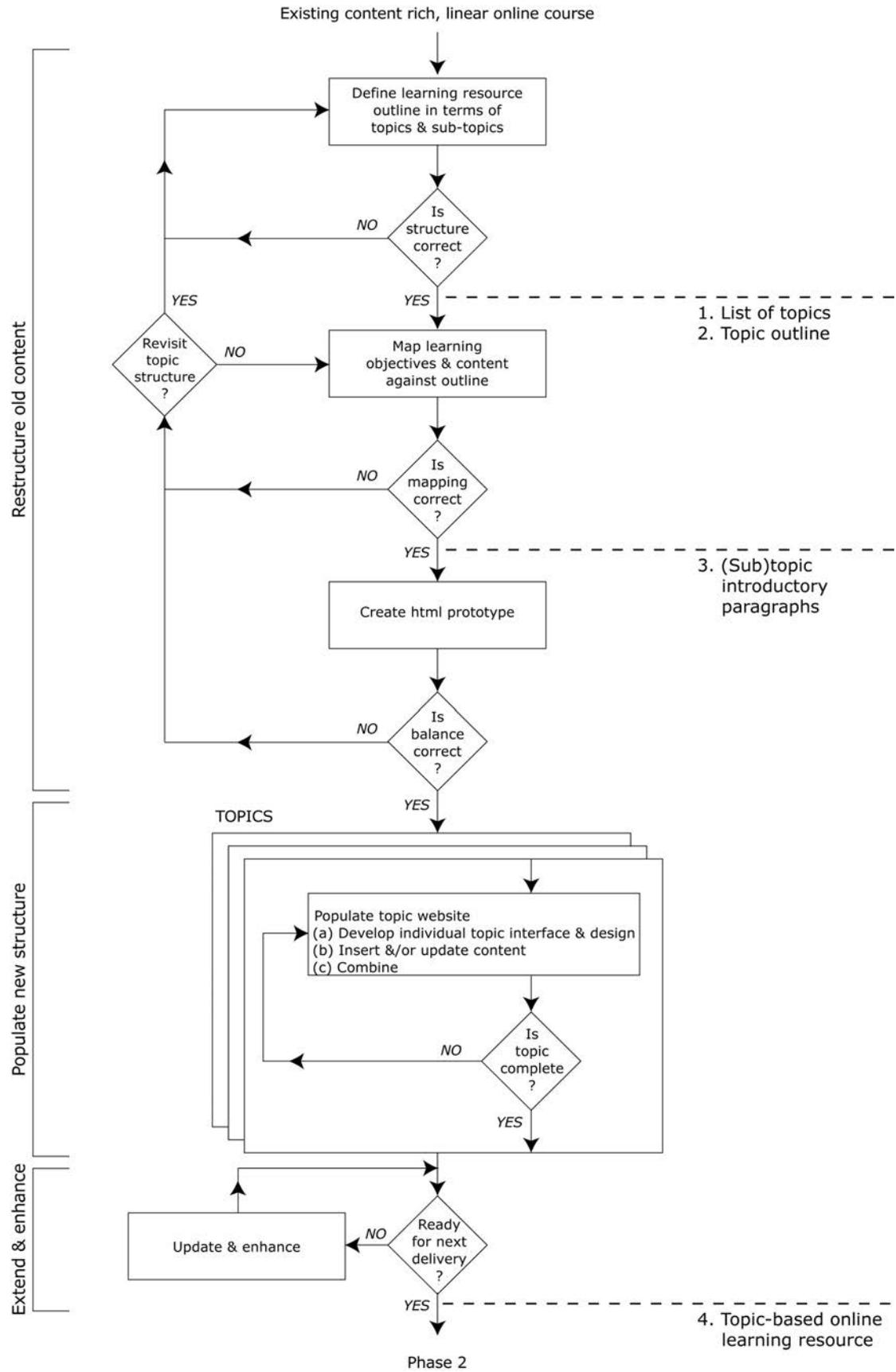


Figure 2: Detail of Phase 1 of the resource redevelopment process

Next, the subtopics are established by extracting the key objectives as a short title from the full list of learning objectives. The process is called *rubrication*, achieved by reducing the list of objectives to a smaller number of grouped objectives that aligns with the student's process of understanding the information. The short title description of each group doubles as the subtopic title. From experience each topic generally consists of 7+- 2 subtopics, supporting Millers theory (1956), and each subtopic needs to deal with about four learning objectives, although there are certainly no hard and fast rules.

Completing and reviewing the topic outline

The topic outline is the second deliverable and is presented as a text document with numbered subtopics and learning objectives. The numbering system is eventually discarded but is useful in the development stage.

At this point the academic content specialist and another academic stakeholder review the topic outline to ensure that the topic is sufficiently covered. A meeting with these academics then provides an answer to the question 'Is the structure correct?'. A negative response causes reconsideration of the topics, and subtopics. A positive outcome leads to the next task, to map learning objectives and content against the outline.

Map learning objectives and content against outline

Now that the course has been defined in terms of topics, each topic is dealt with as a discrete learning object. The first step in expanding the structure is to include descriptive introductions for each of the subtopics; these may be available in the old content or may need to be written by the academic. These short introductory paragraphs simply state the learning objectives dealt with and their relationship to each other and the subtopic. Then, a descriptive introduction to the topic is written. It mentions each of the subtopics and provides the student with a context for each. For instance it should be clear that each of the subtopics needs to be understood sequentially or not, or how each is related to the other in a conceptual framework.

So far the learning resource outline is populated with these brief topic and subtopic introductory paragraphs, each topic consisting of a list of about nine or so paragraphs inserted beneath the appropriate headings. This represents the third deliverable. At this point some evaluation of what has been produced is required. A review by the content specialist and other academics in related areas, followed by a meeting of the whole project team, is required to provide an answer to the question 'Is the mapping correct?'. A positive outcome leads to the task of creating an html prototype.

If the mapping is not correct a further decision on whether to 'Revisit topic structure?' may lead to a new learning resource outline being created and a renewed mapping. However, the original topic list should have set tight parameters as to the extent of the content dealt with and any temptation to extend it beyond this needs to be considered very carefully. Alternatively, the topic structure may not need any alteration and the problem may be more simply rectified through a rearrangement of the mapping of learning objectives and content.

Create html prototype

The balance of subtopics and content is difficult to conceptualise in a linear format and problems are more readily identified in a website structure. Creating an html prototype is essentially a functional test of the mapping. It includes topics and a functional subtopic navigation that contains the topic and subtopic introductory paragraphs and other existing content and offers an insight into the learner's online experience, highlights thin and dense content areas, and hence, assists in identification of inappropriate mappings of subtopics. The prototype is reviewed by all members of the project team to decide 'Is the balance correct?'. A positive response leads to the task of populating the new learning resource with current content, achieved by populating each topic website separately.

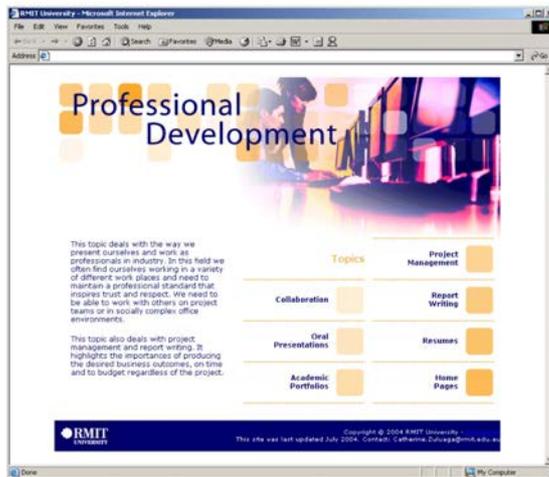
A negative response requires a further decision on whether to 'Revisit topic structure?' or a small reshuffle of the content against the learning objectives within the structure may be all that is needed. If a subtopic is growing large in relation to the others then consideration needs to be given as to whether that subtopic is in fact its own topic. There needs to be a balance of information throughout. It is important

that this weighting is done at this stage since the html prototype does not contain design elements and issues identified with the mapping can be easily resolved without time intensive redesign.

Populate new structure

Once a balanced structure and mapping is achieved the process can divide into two developmental streams: the web developer creates the interface and design for each topic website and the content specialist reviews and updates the content.

Topic splash screen



Topic content page

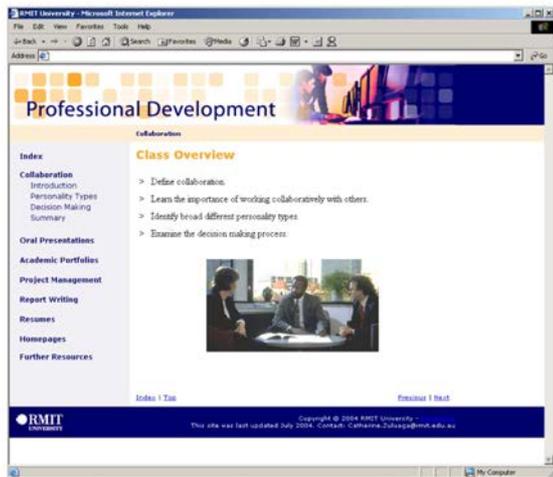


Figure 3: Example of topic splash screen and a content page

Since the topic should be able to sit within any course context it must be a truly independent learning object. On the server the topic will be a directory with a meaningful name relative to the title of the topic. Online each topic will open with a distinctly designed introductory screen that has the main purpose of identifying and describing the topic. This design is carried over into a banner for each subtopic (Figure 3) where it remains as a constant identifier. At this subtopic level the format is more formulaic allowing a template to be used, for easy editing and updating as required. Ideally each subtopic has an associated graphic to accompany its introduction and to provide visual stimulus.

The content specialist, or delegated content consultant, works within the parameters of the established outline, inserts and updates, to ensure that the content is current and that the writing style is appropriate for the computer screen and meets student demands (Nielsen, 1996). In essence, this style states an overview of the content first and then deals with the specifics lower down on the screen. Larger tracts of content are isolated and provided as separate files (html, pdf, rtf or .docs), references to texts are indicated with a box and icon, and reference to external electronic material, such as the www, connect to an anchor on an external resources page, where all external references are kept together so that they can be efficiently checked every so often to see if the links are still available. The advantage of this style is that content does not get lost a few scrolls off screen and also allows students to scan material in search of specific information.

As the text is completed the information can be inserted into the development website either by the website developer or directly into the html by the author; the version on the web is the latest version always, which helps to alleviate versioning problems. As each topic is dealt with it is reviewed by members of the project team, and updated and corrected until all agree to 'Is the topic complete?'

When all topics have been developed, updated and completed in this manner the full set of topic websites is reviewed by the content specialist and the delivering academic to determine if the course is 'Ready for next delivery?'. If so, the completed topic based online learning resource is available as the final deliverable from Phase 1 of the resource redevelopment process, and development progresses to Phase 2. If the response is 'No' then further updating and enhancement of the website is undertaken.

Update and enhance

This process is very much an iterative one. Further updating and improvements need to be carefully linked to learning outcomes and to enhancing the clarity and appeal of the material to boost user motivation. Although the pedagogic overlay, to be developed in Phase 2, will drive student access to the learning resource and must incorporate its own learner motivation enhancement, all materials presented online need to capitalise on any intrinsically motivating aspects to engage the users' interest. Hence, including quizzes for use in both formative and summative situations, possibly with direct links to relevant content, simple image maps with links to very specific information, and simulations and high end interactivities can be successful motivating factors to give students a definite and relevant context for their learning (Phillips and Lowe, 2003).

Some alterations and additions may be essential during the initial redevelopment process in preparation for the next delivery. However, academics are encouraged to leave any major extensions and enhancement for iterative development, when more time and more information on student need and usage patterns have been established. Once the topic based online learning resource is 'Ready for the next delivery?' the development progresses to Phase 2 of the resource redevelopment process.

Phase 2: Change pedagogy

The change to the presentation of the online courseware described above constitutes about half of the online delivery content development required. The pedagogic engagement with this newly structured topic based content must reflect the needs of the course, the student cohort, and the medium across which it is presented. The pedagogic overlay may take any form, although for this IIT course online problem based learning activities are deemed appropriate to fulfil these requirements and provide students with the necessary impetus to access, understand, assimilate, and use the information. The Blackboard course management system is used to provide the problem based learning interface to the newly developed topic based online resource.

The problem based learning activities need to be designed to be engaging and authentic, using scenarios in which the student can be totally immersed (Herrington, Oliver and Reeves, 2003). The key concerns in this online IIT course are the need to develop first year students' independent learning, and to address the need of employers to employ graduates with a rounded education, including good technical skills as well as excellent oral and written communication skills. Traditionally, the first year students are secondary school leavers so their new world of university is their principal environment, not industry. Therefore, we believe that a smoother transition to the new pedagogy, and also to development of the generic skills, will be achieved if they are presented with an initial authentic problem with a strong emphasis on university life, while a subtle introduction to issues of Human Resources, IT, and Project Management is imbedded within the problem. The use of several deliverables at specific milestones simulates an industry project setting while also assisting with keeping the students on track and on time.

Further scenarios developed are graded in their use of real industry situations to which students can apply conceptual knowledge, skills in critical thinking and problem solving, and provides them the opportunity to conduct research while studying the topics, learn in an iterative manner and develop their creative experiences.

Discussion

The process for development of the external problem based learning overlay, and evaluation of its effectiveness, is very much in the preliminary stages. It has been presented here, in brief, to allow our process for redevelopment and reuse of legacy online courseware to be placed in context as the first phase of a larger process allowing upgrades in online content to support variations in online pedagogy. However, we believe that the many forms and different complexities available in the problem based learning approach will make it useful online in motivating student engagement with the online learning environment, offering advantages such as cross referencing between the problem and the required information, at any time.

The resource redevelopment process we have described in this paper is equally applicable to new developments and may be applied in a number of different development modes. The chosen mode will depend on the intended course delivery mode and pedagogy. For example for development in:

- **Project mode:** The material can be prepared on a project basis with defined deadlines and appropriate time management. Meetings are designed to coincide with the completion decision points of each main task. All materials are developed prior to commencement of course delivery.
- **Just in time mode:** The material can be prepared as done in the project mode to the point where the 'Restructure old content' stage is complete: the html prototype exists with each topic's structure outlined and introductions inserted. The interface design is added. Then the bulk of the content material is updated or developed in conjunction with sequential delivery of each topic.
- **Minimal academic time mode:** The online development team completes the 'Restructure old content' stage guided by the academic team only as needed, such as at decision points. They add the interface design. Then the bulk of the content material is updated or developed by an academic content consultant. All materials are developed prior to commencement of course delivery.

Our team has experience with the first two of the above development modes in creating completely new online topic based learning resources. The minimal academic time mode cannot be applied to the creation of a new resource because no initial online material is available, and academic team input is required from the start of the process. However, this minimal academic time development mode was used successfully in the redevelopment of the IIT course. It addressed the limited availability of the academic team in this instance. Our experience indicates that the two development modes with less strict deadlines, that is the just in time mode and the minimal academic input mode, may take a little longer but are most successful in production of quality online materials in an academic setting, probably because it fits into the normal academic work schedule (Bates, 2000). Naturally, the time sensitive project mode takes precedence where development is required for external and commercial production.

Although some discussion of issues has already occurred in the previous section, by way of explanation of process steps taken, there were challenges addressed during the IIT course redevelopment process that have not been discussed. Some that are more pertinent to achieving success are mentioned here.

- During the 'Restructure old content' stage it may be cost effective for a third party, a content consultant, to extract the topic outline from the existing content and distil the topics and subtopics into one or two paragraphs, for later review and cross referencing against the learning objectives. Also, for the 'Create html prototype' task it is recommended that an automated html chunking program is used (Barnes, Pannan and Arora, 2004).

These tasks are time consuming and can be major hurdles for academics, particularly if this redevelopment is undertaken as part of a normal teaching workload. Some legacy online courseware clearly states its learning objectives, but often it doesn't. Although our online development team found some workarounds, mentioned earlier, background issues can exacerbate the problem. These include the weekly or lecture scheduled structure of much material, the variety of formats, such as Word documents, photocopied handouts, PowerPoint slides, URLs, and OHTs, and the fact that the material may be the combined legacy of several former delivery and content academics.

- During the 'Populate new structure' stage the online writing style and content structure (Nielsen, 1996) and a balanced topic structure need to be enforced to ensure ease of use and access to the materials, and to encourage user motivation to engage in exploring them.

Unfortunately, these two formulaic aspects may appear rather rigid to academics who have always enjoyed enormous freedom in their presentation of materials in face to face contexts. In some respects the styles may also be at odds with academic perceptions of their student learning needs. For example, a well structured topic should only deal with the set learning outcomes. This appears to facilitate surface learning, but it does allow for deeper learning through further additional material provided as links. And, these need to be clearly defined as 'additional material' as students today may not have time for further study and may resent studying anything that does not pertain to that which is assessed. Initially, most academics are unable to work within these strict structural parameters and, consequently, changes to the topic outline are inevitable.

- During the ‘Update and enhance’ stage of the resource redevelopment only additions and alterations that are essential to the next course delivery should be performed, such as the need for current examples and data caused by the rapidly changing nature of the content of the IIT course.

By keeping the production of high end media rich interactivities, video and graphics separate from the basic web development process any inextricable linking between the two may be avoided, and an evaluative stage before the addition of such material is encouraged. Anything that moves, clicks and talks need not equate to better online education, but it will add to the download times and may distract the user from the objectives at hand?

In summary, the main hurdles for academics in the proposed development process occur when defining the initial course outline, when writing topic and subtopic introductions, in weighting the content into equal chunks to establish balanced topic structures, and in conceptualising the structure and function of the topic as a website. Some acceptable solutions and workarounds are suggested, but efficient solutions still need to be identified. Also, further work is required to determine if the topic based learning resource does adequately support the problem based learning methodology, and to perform a cost benefit analysis of development and reusability to determine if long term cost recovery, due to reusability and economies of scale, exceed initial development costs, and are effective.

Conclusions

As our experience and understanding of online pedagogy grows the need to change and redevelop online resources is inevitable, albeit expensive in terms of time and resources. This paper presents a process for redevelopment of legacy online courseware that is time effective, in that it requires minimal time commitment from the academics, and resource effective, in that it reuses existing online course materials and restructures them into discrete learning objects in the form of topic based websites. This gives the new resource a greater modularity that enables flexibility, reusability and, because topics can be adapted readily due to their independence, there is likely to be a much higher uptake by other academics. The example redevelopment presented successfully converted aged content rich, linear online IIT courseware into a fully indexed and navigable topic based online learning resource suitable for supporting the online problem based learning pedagogic model that is to be used for the first time in delivery of this course. The resultant online learning resource may, in fact, be used to support a variety of pedagogic approaches since the course and learning specific activities have become part of the external course management shell.

The generic process model presented demonstrates how the conversion process disaggregates the course content from the course management. The intended markets and course delivery, and the quality and specific nature of the legacy courseware, influence the manner in which this conversion process may be implemented and dictates the extent of the academic involvement required.

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Please cite as: Pannan, L., van der Craats, C., Zuluaga, C. & Barnes, D. (2004). Extending the academic comfort zone: Smooth transition from content rich linear courseware to problem based learning online. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* (pp. 743-752). Perth, 5-8 December. <http://www.ascilite.org.au/conferences/perth04/procs/pannan.html>

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