

Designing the World Wide Web as an Educational Delivery Medium at the University of Sydney

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Abstract

The World Wide Web (WWW) is evolving as a natural forum for the presentation and delivery of information resources in an educational institution. In a university setting, web applications are dispersed among the faculties and research service centres such as libraries, IT departments, and staff development organisations. This paper will identify and describe a set of working ideas towards 'best design' criteria for creating, organising, and coordinating web resources with the goal of integrating web technology into teaching practices and information services. The criteria are based on experiences of the Education Faculty and the Library at the University. These two units are involved in several web-based projects including: collaborative writing and publishing, electronic scholarly publishing, delivery of course materials for students, subject-based resource organisation, and Internet training.

Details of these projects will be presented as they relate to establishing 'best design' criteria. Best design is oriented mainly around the user: ease of use, usefulness, and effective applications of the medium, i.e., web links. Learning and cognitive theories are incorporated into web design. Because of the high visibility web endeavours create on both a national and international scale, a cohesive approach to an institution's identity and contribution is also considered.

Keywords

WWW, teaching and learning, information services, design, libraries

1. Using the web in teaching and learning

Within the Faculty of Education at The University of Sydney (SU) efforts are being made to use the WWW as a subject resource within the classroom, and to instruct training teachers as to the methodology. This process involves the use of searching and browsing to find relevant materials, using those materials within the classroom, perhaps by their integration into the design of specific lessons, and publishing the outcomes on an appropriately linked web page. Such browsing and searching can be put to use in developing student's investigative skills (Pennell and Deane, 1995). One such project with graduate students studying teaching methodology in Computing Studies (Eklund 1995c) [HREF4] involves students working collaboratively to find interesting and relevant sites, suggesting specific ways in which the material may be used in teaching of their discipline, and compiling these into an indexed web document. Another larger, funded project (Walker and Lambert, 1995) involves the design and implementation of a collaborative learning environment

called HENRE. This system provides a web-based environment with specific links to educational sites, including electronic journals, conference databases, library catalogues and listservs. HENRE is essentially a web filter, a local construct with links to the WWW, facilitating the delivery of a specific undergraduate course, and has as its theoretical underpinning the collaborative construction of knowledge in the constructivist tradition. It is also designed to foster group co-operation and collaboration on WWW publication. Teaching with an electronic, web-based journal as a resource, emphasising the process of publishing and collaboration, has also been tried with some success (Marriot and Brittain, 1995). This form of collaborative production of student material is now widespread (*see for example* (Dhaliwal et al., 1995) [HREF5]). These efforts are also being reproduced within The Faculty of Education, which has established an electronic journal to facilitate the publishing efforts of the students (*Compute-Ed* 1995) [HREF3], along the lines of the Infotrain Project (Marriot and Brittain, 1995) at the University of South Australia.

2. The Web as a medium for publishing

The HTML protocol is a world wide standard, and as such provides an opportunity for special interest groups to advertise widely their presence on the WWW. Research groups, together with technical papers are commonly available, and bring academics with similar interests in closer contact with each other. Further, electronic scholarly publishing (*see* Treloar, 1995) is an area of web activity that promises to bring the academic community closer together, both in space (in that electronic journals and conference proceedings are available to anyone with a web browser) and in time (in that the turn-around time from submission to publication is typically greatly reduced from the paper counterparts of these journals). A number of reputable, international journals now reside solely on the web, such as The Journal of Computer Mediated Communication (JCMC) (JCMC 1995) [HREF6]. Publishing conference proceedings in HTML has become commonplace *eg* AUSWEB95 [HREF7], and ASCILITE95 [HREF8], although some limit access to registered users *eg* ED-MEDIA95 [HREF9]. The SU Library Web provides links to both local subscriptions of e-journals, and e-journals available in the public domain (University of Sydney Library, Electronic Journals 1995).[HREF11]

3. Teaching about the creation of Web resources

Disseminating expertise about the creation of web resources through the introduction of beginner's Hypertext Markup Language (HTML) (Clarkson 1994) [HREF2] is underway in both undergraduate and postgraduate courses, specifically, and perhaps unfortunately, once again in the teaching of Computing. The value of the web as an across-curriculum teaching tool is not to be underestimated, yet like many technological endeavours, it requires some initial training that teachers of technology-based courses tend to have more access to. In these classes, most students, given no prior experience in this area and with the aid of appropriate notes (Eklund, 1995b), take about 3 hours to create a simple web document that includes an embedded graphic and a hypertext link. Staff at the Faculty of Education are also being in-serviced to create their own home pages. The ownership of the material, of which the ability to create and edit is an important part, is considered critical.

4. Delivering courses on the Web

The Web is being used at a number of other institutions (*eg* Nott, Riddle and Pearce, 1995; Brown, 1995 [HREF1]) to offer high quality specialist graduate courses to students across a number of campuses. This medium is being combined with CD-ROM based multimedia (Omari and Brogan, 1995) to increase flexibility and diversity in teaching and learning in experimental new courses. The off-campus delivery is independent of student numbers and timetabling considerations. The University of New England's Department of Science, Technology and Mathematics Education offers

a course 'Computer Concepts, Skills and Curriculum' which has its materials on the World Wide Web. This is an introductory three-hour per week course, the aim of which is to 'give participants the skills and knowledge to enable them to use computers and information technology in their teaching' (Brown, 1995) [HREF13]. Content of the course is the internet, databases, wordprocessing and graphics. The materials are on the web to encourage student use of the WWW, so that they may gain specific skills in using the medium. This course is part of a research project to evaluate the effectiveness of delivering materials in this format. A major rationale for Web use in this regard is economics, in that it is less expensive to produce materials in this way than in printed form, and the materials may be kept up to date. There are two categories of rationale for delivering instructional materials the web: practical and educational. We hope that there will be common ground between the two so that if web courseware is implemented at places like SU, it is done, not just because of a distinct practical advantage, but also as an educationally sound one.

In the use of the web for instruction, implementing a combination of media is important, as there are problems embedding courseware into the web (Andrews, Nedoumov and Scherbakov, 1995). HTML does not support animation or simulation well, and the links in a document are always present, so reusing documents is somewhat unsatisfactory. At present, there is some limited use of the WWW for this purpose on the SU campus, and the fundamental reason is that there is neither the hardware availability to students to gain access to course materials, nor any worthwhile advantage within existing course structures to deliver them in such an alternate form. The new Master of Teaching (MTeach) degree currently under development within the Faculty of Education at SU makes substantial use of a problem-based learning approach, and the integration of reliably available resources in diverse forms is a key factor in the success of the course structure. As part of a quality grant at SU, the development of a 'virtual school' for the MTeach is underway. The virtual class (Tiffin and Rajasingham, 1995) makes a significant use of a variety of forms of IT (of which the Web is certain to feature), and is based on the belief in the autonomy of the learner. The virtual school project provides an important set of tools for students to solve the case problems presented in class. It includes a number of components, including email, video and web links with schools; resources in the form of listservs, web materials and CD ROM; as well as a forum for the presentation of case solutions as described above.

5. Library Web supporting teaching and research

SU Library is developing its Web as a means of providing further support to the university's teaching and research activities (University of Sydney Library Web 1995) [HREF12]. An excellent organisational and access tool, the Web is significantly changing the face of library services. Prior to the Web, librarians settled for the front-end menus to library databases and information provided by online catalogue systems. These menus have been designed with the online catalogue and other vendor-supplied resources as the main focus. With the phenomenal growth of information resources, a library's online catalogue is now just another database. The Web empowers libraries to design their own interfaces that are not commercially oriented but are focussed on the user.

In large library systems like that at SU, the Web can also work to bring together in one place, actually in many places via the hypertext links, a myriad of information. Tedious hierarchies of tiered information with only one way in and out have been superseded by the Web.

Presently, many libraries are caught between two distinct information formats, the world of printed, in-house collections and the exploding world of networked, remotely accessible databases. All the typical problems / challenges generated by transitional periods such as funding, staffing, space configuration, and indeed restructuring of goals and services, are present. If libraries are willing to support a Web effort, they will be propelled into the rethinking process necessary not only to design a Web interface, but also to redesign their very structures.

Initial development of the SU Library Web has been managed so far by the Senior Reference Librarian responsible for networked electronic information. Contributions have been made by a combination of Subject and Branch Librarians and staff from several other library departments. As Web development becomes integral to a wide range of library departments, reallocation of staffing resources is needed. Many libraries are working out models for staffing their Web efforts. (University of California, Berkeley Library Web Model, 1995) [HREF10]

The list below summarises some of the Library Web-related endeavours:

- Updated Library Homepage with improved use of graphics
- Expansion of subject guides to print and e-resources
- Information and direct links to trial databases
- Forms-based search capability for the library's new online catalogue
- Internet Training Team addressing the library research needs of academics and post-graduates
- Interactive Internet and Web training packages using image maps
- Scholarly e-text and resource centre for the analysis and mark-up of texts and other resources
- E-journal collaborations.

6. Concerns

Major concerns in the areas of Web activity mentioned so far in this paper are practical ones. Students must have access to web services for the implementation to be successful, at least in the form of an open access area with a reliable internet connection. At SU recently, the Faculty of Education's server was essentially down for a period of three weeks! Had we been relying on it to deliver our courses, how would we have fared? In terms of student access, a better situation exists for those students with computers and modems at home - hence an equity issue is immediately raised. But beyond the hardware considerations, we need to convey to students feelings of currency and urgency: that learning about the WWW - how to use it as an information source, how to integrate it into classroom situations, and how to teach with it and about it - is directly relevant to them. In this sense technology, and particular use of the WWW, should not be 'grafted' onto a learning area, but become an integral part of it. As Reiber (1995) suggests, curriculum constraints remain the biggest practical stumbling block in this matter.

7. Considerations in best-design criteria

Certainly there are now accepted standards as to what constitutes good design in Web endeavours from an interface perspective, and for developers at many levels there are a good deal of references for this on the Web itself. Aspects of creating web services such as consistency of graphics, dating pages, sizing downloads, providing navigational cues and so on are fundamental to the success of the medium. From a human computer interaction (HCI) perspective, Comber (1995) offers guidelines to writing useable Web pages based on learnability, efficiency, memorability, errors and satisfaction (Nielson, 1993; Lindgaard, 1994). Comber (1995, p 121-122) provides a useful checklist under the categories Content, Visual Appearance, Navigation and Testing.

Using the Web as a primary user interface to the wealth of information resources, university libraries have many similar design considerations. Our experience at SU Library has highlighted some of the following criteria:

- User expectations of consistency, ease of use, meaningful subject organisation
- Development of dependable search tools
- Integrity of links
- HTML standards applicable to multiple browsers
- Aesthetics: creative use of graphics; decreased use of text
- Flexibility to address a wide range of user expertise and needs
- Positive and professional representation of the university library
- Empowerment of Library Web contributors to incorporate the Web as one of their prominent tools

Most of the categories described above may be termed the 'interface' considerations for best design, but if we are specifically dealing with learning from Web based materials in a more structured sense than merely browsing or even information gathering, 'best design' becomes a question of structuring the material in ways that reflect learning in the domain. For instance, this may mean linking pages of like content in what is termed a 'conceptual neighbourhood structure'. Spoehr (1994) suggests that an important reason why many instructional hypermedia systems exhibit difficulties is that they are based on new technology that has not been designed on a cognitively-based theory. 'The design issue goes well beyond issues of navigational tools and screen layout. For if cognitive science is correct about the characteristics of effective conceptual neighbourhood structure, then hypermedia design must also incorporate an appropriate structure for the corpus itself' (Spoehr, 1994, p. 80). It has been suggested (Eklund, 1995a) that when designing learning environments based on hypertext / hypermedia, an important consideration is the way learning takes place in the domain, so that the structure of the hypermedia directly reflects the model of learning, specific to that domain. This notion has been acknowledged as a fundamental principle in learning from the web by designers of multimedia and hypermedia, 'Learners are not doing as well as they could if we were to help structure the connections, the directions, the intents, the treatments, the tracking, the recording... They are not doing as well as they could if we were to help mentor the learners about objectives, analysis, comparisons, matricing, conflicts, dead-ends... The hype you hear lately about the web emphasises the fact that it's a whole new web world and nobody's sure where we're going, but instructional designers are sorely needed to lead the way. We need to confirm our viewpoints on web design and learner mentoring issues.' (Simmons, 1995).

If we suppose the Web is fundamentally no different to any hypertext-based learning environment, then the principles applied to it to maximise learning outcomes for students must be the same as those applied to stand-alone courseware. One possibility is the creation of an adaptive system, which learns from its interactions with the user, perhaps providing navigational advice or remediation. Indeed, novice users often make poor judgements about where to browse, reflecting their unfamiliarity with the subject matter. Adding adaptive advisement to the system is one solution to this problem, with the system tracing the student's path and providing individualised help about where to proceed. Adaptive advisement requires a knowledge structure to be placed on the subject matter as well as on the system's own understanding of the current state of student knowledge. In this way web-based materials can become more than just passive teaching and resource materials in an associative database.

Evaluating the efforts described in the above sections will be an ongoing and complex task. Research in the area of evaluation of multimedia in public access systems (Kearsley and Heller, 1995), of which the WWW in 'public front-end to an institution' and 'teaching mechanism' mode is one, suggests a need for comparative evaluation that involves multiple assessment techniques.

As Web sites multiply at academic and research institutions, the need for some overall design criteria will grow. Different approaches to Web development within an institution should not necessarily be discouraged (Garrett P and Ritchie D, 1995). However, communication and joint efforts among university departments have the advantage of streamlining Web offerings and presenting a cohesive user interface.

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