Evaluating the impact of Internet provision on students' information-gathering strategies

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This paper explores the use of the World Wide Web (WWW) as a teaching and learning tool. In particular, it focuses on the impact of new technology on students' learning. An investigative study was undertaken using two cohorts of students taking modules supported by WWW pages. Two modules were selected. These were taught by the same lecturer but adopted distinctly different approaches to delivering module content via the WWW. The administrative structure of both pages was similar in the delivery of basic information, lecture themes, assessment details, outline of essential reading, etc. However, the depth of the material provided in support of each lecture topic, and the styles of assessment for each module, were quite different. The study identified distinct differences in confidence in using the WWW and perceptions of its value for learning, between the two student cohorts. It is proposed that this is a reflection of the depth of material provided and the type of knowledge acquisition encouraged by the contrasting styles of the WWW pages.

Introduction

The problem

Universities may invest millions of pounds in the provision of computer hardware without ever seriously considering the educational results such investment may deliver. Equally, academics may be committed to the use of IT in teaching and learning because it is expected of them (cf. Dearing, 1997), and rarely give serious consideration to the impact which the effective use of IT may have on student learning (Lauillard, 1993). The use of the WWW to deliver material in support of university teaching is still in its infancy, yet already two distinct approaches to its use can be seen. The first approach uses the WWW passively to deliver existing lecture notes in a technologically impressive and, perhaps more importantly, highly convenient fashion. The second approach attempts to shape the material delivered to maximize the teaching and learning potential of the WWW and to develop students' skills in the use of the medium. But which approach works more effectively? And how does one balance the needs of an academic community pressured by the Research Assessment Exercise with the need to develop effective teaching and learning

strategies which maximize the potential of IT for the academic community, for the students and for their future employers?

The context

> New technology is changing the way information is stored and transmitted. This has implications for both the skills which higher education needs to develop and the way in which it is delivered. (Dearing, 1997, para 20)

The range of high-quality material now available on the WWW, and the increasing ease of use of HyperText Mark-up Language (HTML) to stage material on the WWW, make it imperative that the potential of this medium is exploited (Whalley, 1995). However, the student must be exposed to the technology in a meaningful and stimulating way if learning and confidence in using IT are to be encouraged (Brown and Williams, 1995), and if essential IT skills are to pass from the academic to the wider community (Mumford, 1995).

Use of the WWW as a medium for teaching: a case study

The Internet is an excellent vehicle for teaching and learning in the area of geological and environmental issues (Newnham *et al*, in press). Particular advantages are the immediacy and quality of resources which the WWW offers on particular subjects such as volcanic activity and geohazards which include floods, earthquakes and landslides. A challenge when teaching such subject areas is to make students realize that volcanic activity and geohazards occur around the world all the time. However, it is difficult to communicate that immediacy when relevant literature may not reach the Library shelves until three or more years after an event, and newspaper coverage is regionally and culturally biased. Intelligent use of the WWW offers an ability to monitor developing situations and to obtain data and images of hazards as they occur, thereby stimulating the students' perception of the world and developing and challenging their information-gathering strategies (Grattan, 1995).

Aims and objectives
The aims for introducing the WWW as a medium for teaching in the Institute of Geography and Earth Studies were to:

- communicate essential information in a cost-effective way (green learning);

- economize staff time in teaching-administration;

- encourage students to use the WWW to explore related issues;

- develop students' transferable skills in the use of Communication and Information Technologies (C&IT).

The objectives were to:

- develop a sophisticated and versatile teaching resource;

- motivate students, and encourage them to take an innovative approach to their work.

Structure of the Web pages
The structure of the WWW pages was similar in the delivery of basic 'housekeeping' such as lecture themes, assessment details, outline of essential reading etc. (see

http://www.aber.ac.uk/~jpg/johng.html), but the depth of the material provided in support of the modules was distinctly different.

Volcanic Activity. Each lecture theme for *Volcanic Activity* was supported by extremely detailed notes, often in excess of 8,000 words of text which were designed to relieve pressure on Library resources, and to ensure that each student had access to relevant literature. Assessment was via conventional essay and examination. Pre-selected WWW resources were listed on a separate page. Students were encouraged to use the WWW as a resource for learning, but practical sessions were not incorporated into the module timetable.

Geohazards. In contrast, the WWW page which supported *Geohazards* contained outline lecture notes which incorporated references to relevant WWW resources. Assessment was via a team-produced project which required students to make extensive use of the WWW, and by a seminar presentation and an examination. The project teams were encouraged to produce a WWW page to support their written report, although this was not compulsory. A weekly practical WWW session was timetabled into the module. These practical sessions taught the students how to navigate the WWW and construct their own Web pages.

In summary, the rationale behind the two styles of Web pages was distinctly different. The pages which supported *Volcanic Activity* were constructed to facilitate the delivery of material produced by the lecturer, and students' use of the medium was essentially passive. In contrast, the pages which supported *Geohazards* were designed to encourage students to use the medium as an integral part of their learning.

Investigative study

How were the two different styles of WWW pages used and viewed by the students? It would be comforting to believe that whatever their style, students would be able to use the WWW pages effectively and confidently to support their learning. The different design of the two sets of pages provided the opportunity to investigate this supposition.

The broad objectives of the investigation were to:

- conduct a pilot study which would form the basis for future in-depth studies;

- assess the impact of new technology on students' learning;

- assess students' confidence in using new technology;

- see how students' patterns of working differed, i.e. which resources (books, journals, WWW) they were using.

A series of questionnaires were used which were quick and easy to administer within lectures. Pre- and mid-semester questionnaires were distributed to track changes in behaviour and attitudes as the modules progressed. The questionnaires focused on students' levels of confidence in using IT tools, their use of various information-gathering sources, and their views on how effective they felt a particular source was in assisting their learning. Some questions required students to rank responses, others required students to provide ratings (using a 5-point *Likert Scale*), and the remainder required qualitative replies.

Analysis of results

Confidence in using IT

In the pre-module questionnaire, 95 per cent of students in *Volcanic Activity* and 100 per cent of those in *Geohazards* noted a high level of confidence in their use of email. Most students in *Volcanic Activity* also noted a high level of confidence in their use of the WWW, although slightly less of those in *Geohazards* felt confident in their use of the WWW. See Table 1.

Question: How confident are you in your use of:		
	Volcanic Activity	Geohazards
Email	95%	100%
WWW	95%	74%

Table 1. Pre-module questionnaire ratings of 4 (fairly confident) or 5 (very confident)

The mid-module questionnaire in *Volcanic Activity* suggested that the majority of students' confidence in the use of email had remained about the same. However, their confidence in using the WWW had, overall, gone down. In the *Geohazards* cohort, confidence in the use of email had remained constant but, overall, there had been an increase in confidence in using the WWW. See Table 2.

Question: How confident are you in your use of:		
	Volcanic Activity	Geohazards
Email	90%	96%
WWW	85%	85%

Table 2. Mid-module questionnaire ratings of 4 (fairly confident) or 5 (very confident)

It is possible that this trend may be explained by the active support and encouragement which the student cohort taking *Geohazards* received. In contrast, *Volcanic Activity* students were presented with the WWW resource and expected to use it as they would any other information source such as the Library. However, it is interesting to note that although 20 per cent of *Volcanic Activity* students were initially more confident in using the WWW than *Geohazards* students, the two cohorts had the same overall level of confidence mid-way through their modules. This trend will be the subject of further research.

Frequency of use of information sources

Students taking the *Volcanic Activity* module used journals most frequently, whereas students on *Geohazards* used books most frequently. Both cohorts reported an increase in the frequency with which they used the WWW mid-way through the modules. However, the use of the WWW as a data source was not transferred to modules where the lecturer

did not provide a basic WWW resource as a starting point. Indeed, an apparent trend in this data is that the students surveyed appeared to require pro-active encouragement to promote active and intelligent use of the WWW as a resource on a module-by-module basis.

Qualitative judgements were sought to explain students' choice of information sources. The following illustrate the most common responses:

- Books = out of date very quickly but good for general background;

- Journals = up to date; detailed articles; know they are relevant because on the reading list;

- WWW = up-to-date information but very slow to use; hard to know which sources are relevant/reliable as they are not refereed.

Effective learning
It is apparent that student's perception of the WWW as an effective learning tool altered substantially within the *Geohazards* cohort, but remained static within the *Volcanic Activity* cohort. This could be because students on the *Geohazards* course had a better understanding of the WWW as they used it in a more structured, integrated way and could see the benefits, rather than using it passively to collect pre-prepared bundles of lecture notes. See Table 3.

Question: How do you rate the WWW as an effective learning tool?		
	Volcanic Activity	Geohazards
Pre-module	71%	69%
Mid-module	71%	93%

Table 3. Mid-module questionnaire ratings of 4 (fairly confident) or 5 (very confident)

Reflections and conclusions

If the primary educational purpose of the WWW is to provide an information source to support students' learning, it is clear that the WWW pages supporting the *Geohazards* module were more successful than those supporting *Volcanic Activity*. A total of 93 per cent of students in *Geohazards* rated the WWW as an effective learning tool compared with 71 per cent in *Volcanic Activity*. In addition, students' confidence in using the WWW had clearly increased in *Geohazards*, although it had decreased for students in *Volcanic Activity*. The reasons for this may lie in the passive approach adopted in the *Volcanic Activity* module as opposed to the active use of resources encouraged in *Geohazards*.

In the *Volcanic Activity* module, where extremely detailed lecture notes were available and where assessment was very conventional, students were appreciative of the convenience offered by the WWW, but their motivation to attend lectures fell as they relied on lecture notes available on the WWW. In contrast, the WWW pages supporting *Geohazards* contained outline notes and reference to relevant WWW resources. Students were supported in their use of the WWW and were taught to construct Web pages. Consequently, they remained keen and motivated. Approximately 40 per cent of the

Geohazards project groups voluntarily produced Web pages to support their project (http://www.aber.ac.uk/~jpg/hazards/studenthazards), and one group of students opted to use Micrososft PowerPoint for their presentation, thus illustrating an increased confidence in using IT tools. It was generally noted that a great deal of visual material from the WWW appeared in student projects.

It is plain from this study carried out at the University of Wales Aberystwyth, that as in other teaching and learning exercises, it is not enough simply to use new technology with traditional teaching and learning methods. Passive learning is as unsuccessful when delivered by new technology as when it is delivered by chalk and blackboard.

Lecturer's reflections

The lecturer involved (and one of the authors of this paper), John Grattan, felt that using the WWW as a tool for teaching and learning had been successful in *Geohazards*. It had enabled students to explore the themes and issues in an active manner, and students were keen and motivated about creating Web pages. Unfortunately, the *Volcanic Activity* module had been less successful in that the passive delivery of reading material via electronic means appears to be essentially as ineffective as any other style of passive learning.

The future

Changes to the Web pages
It is intended that the style of the *Volcanic Activity* WWW pages will be changed so that students receive outline notes with direction to relevant resources. The existing detailed notes will still be available periodically for revision purposes, but students will not be able to rely on them throughout the semester. The pages will be constructed to encourage students to use them as exploratory tools rather than simply to provide dense information. Additional resources will also be provided in *Geohazards*.

Support
A recurring comment from students using the WWW was that they were often unsure of the validity and reliability of resources. Grattan plans to address this problem by giving a brief talk on the quality of information on the WWW. Although he currently only makes links to sites he feels are of academic value, these in turn have links to other sites which may have material of less academic value.

The Institute of Geography and Earth Sciences at the University of Wales Aberystwyth has now appointed a technician with the specific job description of supporting teaching and learning initiatives within the Institute. This will provide much needed assistance and encouragement to academic staff.

Assessment
Grattan plans to modify the assessment such that students can choose to submit either a written project or WWW pages. Both types of assessment will be marked using the same criteria, i.e. structure; depth of analysis, etc.

Evaluation
This paper represents the findings from the first year of an on-going study. The results of this initial study have identified some interesting trends which need to be investigated

further next year. In particular, future research will focus on what makes learning through the WWW effective, for example page design, types of links, support and training for students. Student responses will also be queried in greater depth to find out what they themselves mean by 'effective'?

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