Academic Use of Digital Resources: Disciplinary Differences and the Issue of Progression

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ABSTRACT

This paper examines the use of digital resources by academics in UK Higher education. The explosive growth of the Internet and in particular the Web has led to a growth in speculation about networked and e-learning (Steeples and Jones 2003, Brown and Duguid 2000). Increasingly researchers have become aware of the ways the university resists such changes and provides a 'resourceful constraint' to the changes surrounding the introduction of networked learning (Brown and Duguid 2000, Cornford 2002). The take-up and use of digital resources by academic staff will be a critical factor in the success of attempts to integrate networked technologies into university teaching. There has been little research work to date that investigates the ways in which academic practice varies in relation to digital resources although there is a significant tradition of research concerned more broadly with disciplinary differences amongst academics. Two key issues are identified, different discipline and subject areas show significant divergence in the types and uses of digital resources and progression seems to affect the use of resources within the different disciplines. The research supports the view that disciplinary and subject differences reported in other contexts have a significant influence in relation to the use of digital resources.

Keywords
Digital resources, disciplinary differences, teaching and learning, distributed learning environments.

INTRODUCTION

Networked learning is an educational form that is closely associated with the development and deployment of computer networks and the rise of a networked society (Steeples and Jones 2002). The growth of the Internet and more recently the Web have made it conceivable that education can take place in a learning environment that is based on instant communication and the ability to search a vast array of resources. Despite these rapid social changes the university resists transformation and provides what has been called a resourceful constraint to activities (Brown and Duguid 2000, Cornford and Pollock 2002). Cornford and Pollock note that despite the development of networked technologies that hold out the prospect of distributed learning the campus refuses to disappear. They claim that the idea of a virtual university rests on the idea that learning simply relies on the timely distribution of texts, sounds and images, in short information. By way of a contrast they note that the campus provides a number of resources as well as constraints and the persistence of the campus illustrates the need to take the resources afforded by place seriously and not be seduced by an apparently simple translation of education to the virtual and an informational view of learning.

The vision of a virtual or e-university as the future form of education has been taken up by government and is now embedded in national and European policy initiatives (Hodgson 2002). The Minerva action of the European Commission's Socrates programme focuses on Open and Distance Learning. At the European level policy places a stress on digital literacy, lifelong learning and developing the skills required for what is described as the information society. The UK government since the Dearing Report in 1997 has informed its policy initiatives with a 20 year vision for higher education that includes the promotion of networked technologies. While the exact outline of government policy in the UK is unclear it is highly influenced by a technological determinist view of social and educational change (Jones 2002). The simple advent of new information and communication technologies and the Web cannot guarantee a successful integration of technological changes into new forms of education, even when supported by government policy. It is well known that technology doesn't simply translate into new social practices and that the simple provision of access to materials will not be sufficient to ensure that they are taken up (Goodyear and Jones 2003). Even though online models of open and distance learning have moved away from what have been called transmissive models towards more socio-cultural or constructivist models of education these approaches still rely on specified

resources and content. The interactive and communicative aspects of the new technologies displace but do not replace the need for quality assured resources.

The research reported here was conducted in the context of a broad formative evaluation of the JISC-DNER (Distributed National Electronic Resource). The JISC-DNER is:

> a managed environment for accessing quality assured information resources on the Internet which are available from many sources. These resources include scholarly journals, monographs, textbooks, abstracts, manuscripts, maps, music scores, still images, geospatial images and other kinds of vector and numeric data, as well as moving picture and sound collections (JISC 1999 paragraph 5).

It is funded by the JISC – the Joint Information Systems Committee of the four UK funding councils for higher education, with an investment to date of over 30 million pounds. The JISC-DNER is aimed at users in tertiary education in the UK, not just for learning and teaching but also for research and scholarship. The term JISC-DNER is used throughout this paper but it should be noted that the initiative has undergone a re-visioning and the current term used to describe the JISC-DNER is the Information Environment (IE) (JISC 2001). The original proposal formulated by JISC for additional government funding captures some of the core intention:

> Although this data has been primarily used for research purposes, it is beginning to find a use in learning and teaching. However, this work has been slow and some additional funding would enable the JISC services to be used in totally different ways than originally envisaged. There is a strong requirement to improve the interaction between the people who are involved in the development of new learning environments and the national information systems and services being developed by the JISC. It is therefore proposed that an initiative be funded to integrate learning environments with the wider information landscape aimed at increasing the use of on-line electronic information and research datasets in the learning and teaching process. (JISC 1999, paragraph 9).

The aim of the JISC-DNER is to influence the use of networked digital resources in teaching and learning. This paper attempts to locate that aim by examining the way this initiative interacts with current practice within universities.

DISCIPLINARY DIFFERENCES

Research in Higher Education has debated the role that academic disciplines have in organizing recognizable groups within universities (Becher 1990, 1994, Neumann 2001, Becher and Trowler 2001). This research has identified disciplinary differences as significant influences on the ways in which academic work is organized. Disciplines have been shown to influence the relationship of academics to knowledge, the relationship of students at undergraduate and post-graduate levels to teaching staff and the type of knowledge that students are expected to gain about their subject or discipline area. The relational tradition of research has also taken account of disciplinary and subject differences in research examining both teaching and learning in universities. This research tradition assumes that disciplines are a contextual influence affecting teaching and learning (for a summary of this research see Prosser and Trigwell 1999).

Within this research tradition there has been some limited research concerning the use of electronic information resources at undergraduate level (McDowell 2002). This research whilst collected from staff from a variety of discipline and subject areas did not specifically comment on any differences found between the different subject and disciplinary areas. Macdonald, Heap and Mason (2001) show how student's use of information resources may relate to their level of development within the discipline rather than a general lack of IT skills or motivation. This study also found that post-graduate students showed greater capacity to learn independently from extensive information resources than undergraduates. This research suggests a link between subject and disciplinary differences and student progression. The issue of subject difference in the use of IT more generally has been identified as an under-researched issue in schools and colleges (Selwyn 1999). Examining students aged between 16-19 the research found huge variations in computer use. It concluded that:

> for many students (and teachers) computer use is inherently at odds with their conception of what it is to be a learner within their chosen subject areas. (Selwyn 1999 p43).

Research investigating disciplinary differences has not been fully developed to explore whether such disciplinary and subject differences affect the ways in which digital resources are conceptualized and used, or whether disciplinary differences combine with student progression to affect staff and student use of digital resources.

The research related to disciplines divides academic life up into a variety of clusters or groupings. Becher for example uses a four-fold taxonomy.

Table 1. Knowledge and Disciplinary Groups (adapted from Becher 1994)	
Disciplinary Groupings	Nature of knowledge
Pure Sciences (e.g. Physics) "Hard Pure"	Cumulative; atomistic (crystalline/tree-like) concerned with universals, quantities, simplification; resulting I discovery/explanation
Humanities (e.g. history) and pure social sciences (e.g. anthropology) "Soft Pure"	Reiterative; holistic (organic/river like); concerned with particulars, qualities, complication; resulting in understanding/interpretation.
Technologies (e.g. mechanical engineering) "Hard Applied"	Purposive, pragmatic, (know-how via hard knowledge); concerned with mastery of physical environment; resulting in products/techniques.
Applied social sciences (e.g. education); "Soft Applied"	Functional; utilitarian (know-how via soft knowledge); concerned with enhancement of [semi] professional practice; resulting in protocols procedures.

For practical and policy purposes subjects and disciplines have been divided up in a more fine grained way. The Learning and Teaching Support Network in the UK has subject centers that cover 24 different subject/discipline areas. The detail of these divisions does not concern us here but the significance of the divergences in defining subjects and disciplines show that even a finer grain of analysis still provides no exact fit. Becher noted (1990 p333) that disciplines themselves were composed of a "constantly changing kaleidoscope of smaller components". The research reported in this paper reflects the current organization of subject and discipline boundaries. Questions concerning the match between these organizational boundaries and current disciplinary practices have not been addressed.

THE RESEARCH

The research was conducted as part of a large-scale formative evaluation EDNER at two universities in the North West of England. One university was a regional research and teaching institution part of the traditional university sector (pre-1992 University) the other was a large city center institution, more vocationally oriented, and came from the UK polytechnic tradition (Post-1992 university). In the pre-1992 university 19 academics were interviewed across a range of disciplines. These interviews were complemented by interviews with all 9 subject librarians in the same institution. In the post-1992 university the research was conducted in two phases. In phase one face-to-face interviews took place with 7 members of staff and a further 8 members of staff completed an email questionnaire. In phase two a further 4 lecturing staff, five research students and 10 undergraduates were interviewed. The interviews do not attempt to be representative of current academic practice, but to illuminate the issues that might have a bearing on how academics currently approach the use of digital resources.

USE OF DIGITAL RESOURCES

Disciplinary and subject approaches

The use of digital resources, though highly individualized, was significantly related to subject and discipline area. The different disciplines could be grouped into three main types of use.

Physics, Engineering and Mathematics

The use of digital resources was closely related to the use of specialist software. These subjects were interested in providing access for students to specialized software, databases, simulations and potentially to networked experiments. The use of digital resources seemed in this way to be related to workshop or laboratory work. The purpose of bringing these sources into the educational environment was not so much to make available primary information sources, rather it was to develop skills in handling information that were thought likely to be

required in further study or in the workplace. The staff in these subjects also expressed an interest in the use of images, including moving and 3D images and simulations, this was also so in the case of Biological Sciences.

> "So for instance [course name] is a lab class that works on SolidWorks and in that there is a SolidWorks part so if we want to do assembly file the common place for them to find the information and the actual parts is from the intranet and then they can download it onto each PC where they are working and then configure it" (Engineering tutor)

> " Oh they are basically, the students are being introduced to these as beginner users as it were, they are not student teaching packages, students are taught how to do basic things on them…………… So we don't actually use any Mathematics teaching package it all tends to be professionals' software that we use in an introductory context." (Mathematics lecturer)

The mathematics and science subject areas also did not direct students toward journal use of any kind until the final stages of an undergraduate programme whereas social science and arts students were more likely to make use of journals and e-journals throughout their degree.

Social sciences including Politics, Languages, Education and Applied Social Sciences

This group of staff was most interested in the use of particular types of Web based materials. These subjects needed access to current and in some cases very up-to-date material often from Government or specific agency sites. This group of subjects also showed an interest in developing a type of information literacy by using Web sites to access potentially biased or dangerous materials. The purpose the academic staff had was to develop students' skills in reading materials with a view to assessing their provenance, reliability and validity. Languages were also interested in access to news media such as local language newspapers.

> We are encouraging students to look at, to look in detail at what is going on in contemporary conflicts …. if it was the Kosovan conflict we would encourage them to look at what the Foreign Office's view is, what the Russians' view is, what the American view is and you often can't do that from resources in the Library because they are bound to be several years out of date (Politics lecturer)

> The other thing I encourage students to look at which I think that the web becomes particularly useful for is websites that have been put up by people who are wanting to write their personal experience of illness because then they are getting perspectives that are different to what would be presented in the sort of academic press or just general news and that, I mean that was when I mentioned anorexia last year, there was quite a wide range of sites which were called, which came under a heading of "PRO-ANA" and these were sites put up by people with anorexia advising other anorexics on how to diet. (Applied Social Science lecturer)

> I mean there are two issues, one is actually to do with language which is the fact that a lot of Spanish websites, if they are done by a private individual, they are not very fussy about putting things like accents on words and so you need to tell them 'look, you know, you may come across a page which has half of the accents missing, in which case you are obviously not going to take that as good linguistic model'. The other thing is content …. to take an extreme example, Spain still has a fairly restrictive Abortion Law so if they are doing a project on Spanish Abortion Law then they would come across obviously extremist groups, they come across Catholic groups, they come across Government web pages, so it is just, I suppose, teaching them to identify or making it clear that they have to identify the source of the information and from that to actually say 'ok well this is a Catholic group, the Catholic obviously have, they have this particular stand point on abortion, therefore the information I am getting is liable to be biased in that particular way' (Language lecturer)

History and Law

These subjects stood out in the way that they emphasized using digital searches for materials that could be accessed either digitally or using traditional methods. In part this may relate to issues of copyright and the public availability of materials. In Music the reverse was the case. The use of digital resources, in this particular area, though technically simple was hindered by the strict rules applying to copyright.

> One of the main digital resources in Law, and this is generally the case and not just on my courses, is the online databases of reported cases and unreported cases. (Law lecturer)

> If you have got say a student who wants to do something on Liverpool, you can put in key words and you can see whether anything has been written on it. I use this as a sort of way of finding out what you can find as electronic resources elsewhere possibly and also what you find in some printed sources or as slides. (History lecturer)

OK the big issue in our area is about copyright because there's a huge quantity of already digitized material and CD recordings which could be used quite widely. …………… but copyright means I can't simply rip a bit off a CD …. because it would be breaking the law. (Music lecturer)

Library view

The librarians' relationships with academics varied though in general, there was a noticeable gap between library and academic staff. Within the pre-1992 university each department had a member of staff responsible for library liaison but communication with the department, other than for subscription services, often relies upon the development of personal relationships rather than a formal link. A department with a notably close relationship to the library was Law where the subject librarian attended staff meetings regularly and was trusted to buy new digital resources. The use of digital resources within different departments did not necessarily depend on the relations between academic staff and the corresponding librarian. The use of digital resources was reported by librarians to vary markedly within subjects and disciplines.

   a)   Departments identified with low use of digital resources:

Languages, Politics, Arts, Philosophy and Religious Studies.

   b)   Departments identified with moderate use of digital resources:

Linguistics, American Studies, and Psychology, Educational Research, Geography, Biology and Environmental Science.

   c)   Departments identified with a notably high use of digital resources:

Management School, Law.

Librarians reported that they considered the variation to be influenced by the history of each department in the use of digital resources and by the external demand that exists for the use of digital resources within the subject area and professions relevant to that discipline area.

Progression

All academic staff in all subject areas reported some degree of progression in the use of networked digital resources. The involvement of the staff interviewed in teaching at first year undergraduate level varied but all interviewees reported some student use of digital resources from the first year. Even when all students were introduced to digital resources in their first year it was students in their final year or sometimes their penultimate year of study that made the most significant use of digital resources. Staff clearly differentiated between an introduction, that was often described in terms of basic information skills and sometimes left to librarians, and higher order research-like skills that were developed in the final undergraduate years or at postgraduate level. In some subject areas such as mathematics and sciences the use of journals and e-journals was largely reserved for final years students or postgraduates. In subject areas like marketing the concern was the highly specific nature of the resources required, especially when a problem based approach to teaching was adopted.

   a) Interviewer   So that is the historical abstract?

   History lecturer: Yes. So we use this a lot. Students are introduced to this in the first year but I don't think they need it at that stage but I use all of this in the third year.

   b) Interviewer: When you get further on, you have mentioned that e-journals and databases would be used more by post-graduates but is there a point the second or third year where students would begin to use those sorts of structures?

   Mathematics lecturer: If students are doing projects they start to use the Library more and in the third year they start to use catalogues much more…. but the actual electronic journals and electronic searching … I think they will be reading more beginning the post-graduate level.

   c) Interviewer: Would you direct students to e-journals?

   Engineering tutor: It would depend on the member of staff, we don't do a lot of teaching by e-journals, that is more when you get on to the fourth year teaching and research where we will propose further material.

The view of progression provided by academic staff may have been influenced by the structure of university programmes and individual preferences. In three departments two members of staff were interviewed and these interviews illustrated the differences in the ways individuals make use of and appreciate digital resources. The differences seemed to have a relationship to the main teaching load of the member of staff. Teaching staff with

more responsibility for first year students were more likely to mention skills training as an issue, whereas staff concentrating on final year students were less concerned with general skills but had an awareness of the students' need for highly specific resources. Within each of the three Departments the issue of progression was reflected in the different ways tutors oriented to the types of resources they considered most useful for the students.

These findings are consistent with research conducted in the Open University, in which students' at lower levels experienced difficulties due to skills deficits despite course guidance in information skills, whereas postgraduate students were reported to have more fully developed skills on entry (MacDonald *et al* 2001). McDowell also noted the effect of progression on student use of electronic resources in relation to academic library like resources (McDowell 2002 p259). The interviews show that the most notable change reported by academic staff in the use of electronic resources was often when students were undertaking projects and it was at this point in undergraduate programmes that they were also encouraged to make use of digital resources in particular e-journals and digital searching for additional materials.

Additional sources of information

The evaluation of the DNER used a variety of measures to assess academic use of digital resources. These included mapping of the institutional and departmental presentation of digital resources and a survey of staff and students, These other measures cannot be reported in full here but it is important to note that they confirm that use of digital resources was significantly related to subject and discipline area. The Institutional mapping showed a wide variation in the overall number of links from Departmental pages and more detailed analysis showed that this unevenness was retained when links to internal university pages were removed. From the survey data we were not able to assess the extent to which there were differences in the transmission of information (measured by level of awareness) between staff and students by discipline (due to the small staff sample size). Overall, we managed to interview a total of 58 staff in 20 universities, and asked them to distribute 10 printed questionnaires to their students. From this we obtained a student volunteer sample of 296 students. Importantly in terms of discipline 32% of the sample were studying humanities subjects, followed by 24% studying 'medical and allied subjects'. In contrast, only 3% of the sample were arts students, with this being the only discipline that had very poor representation within the sample obtained. We were able to establish that within the staff and student samples there were differences in levels of awareness by discipline area. Examining staff awareness by discipline (albeit low samples included for each discipline area), awareness was highest amongst Humanities (64%) and Sciences (57%) and lowest among Medicine and Allied (33%), Social Sciences (43%) and Mathematics/engineering (44%). Awareness of JISC specific services was also fairly high (62%), although once again there was great variation by discipline. The sample was small, but of those who responded, the highest level of awareness was found amongst Arts (100%), Social Sciences (71%) and Humanities (64%), with lowest awareness of discipline specific resources by Mathematics and Engineering (44%). These survey results across UK Higher education suggest the findings from the particular universities reported here illustrate a wider disciplinary pattern in the use of digital resources.

CONCLUSIONS

This paper confirms the view that discipline and subject area is a significant factor affecting teaching and learning in Higher Education. In particular there appear to exist disciplinary differences in the way that digital resources are being integrated into teaching and learning within the disciplines. A strategy for the development of digital resources will need to take account of these variations and the variation that also exists in terms of level of study. The evidence suggests that the factors affecting this variation may not be the same as in other areas of disciplinary difference. The grouping of disciplines into three areas does not fully conform to the type of taxonomy that has been used to discuss disciplines more generally. The divide between hard and soft disciplines does seem to remain. It is the hard subjects areas such as physics and engineering that display a distinctly different relationship to digital resources. The soft disciplines vary but arts, humanities and social sciences differ most notably from the hard sciences rather than with each other.

The division between pure and applied subjects is not so clearly in evidence in relation to digital resources. Library staff did mention professions as a reference group making use of digital resources more likely but in the staff interviews this was not a salient issue. On the other hand there were disciplinary issues specifically related to the character of the available digital resources. This was most apparent in relation to copyright issues. Subject and discipline areas that either had a large non-copyright source of materials were likely to use online databases to search for both digital and traditional sources. In areas that had strict compliance with copyright the use of digital resources was likely to be hindered even if simple technological solutions were available.

Issues of progression were evident in the use of digital resources in all discipline and subject areas. In the early years of study staff were interested in developing information skills. These differed by discipline and science subjects were particularly interested in students making use of particular kinds of software for their work. In social sciences and humanities the students were introduced to a variety of materials, some of which were intended to show weaknesses or view points not available in academic texts or validated resources. This use of resources that were not quality assured was to help students learn how to assess different sources of information. These progression related disciplinary differences touch upon the divergent ways different disciplines and subjects constitute knowledge. This was also evident in the students' use of electronic journals. Journal use of all types was not a central feature of undergraduate science subjects. In the arts, humanities and social sciences access to journals and e-journals in particular is being encouraged from the first year of undergraduate study.

Cornford and Pollock (2002) following Brown and Duguid (2000) describe the university as a resourceful constraint. This study of subject and disciplinary variation indicates that the university may be much more than the physical campus and relate to the organisation of knowledge in discipline and subject areas. The socio-cultural form of each subject or discipline has a history and a pattern of engagement with academic resources in teaching and learning. These ways of using resources carry over into the digital world. Issues arising beyond technology and the university also affect the use of digital resources and this is particularly apparent in the influence of copyright legislation.

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EDNER the evaluation of the JISC-DNER at: http://www.cerlim.ac.uk/edner/welcome.html