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ARTICLE

An investigation of differences in undergraduates' academic use of the internet

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ABSTRACT Based on survey data from 1222 undergraduate students studying at UK higher education institutions, this article addresses students' engagement with the internet as a source of academic information for their studies. In particular the article explores how academic use of the internet is patterned by a range of potential influences such as students' wider internet use, access and expertise, their year of study, gender, age, ethnic and educational background. Analysis of these data suggests that students' academic internet use is most strongly patterned along the lines of gender and subject-specialism rather than other individual characteristics or differences in technology access or expertise. The article therefore considers how these differences can be addressed by those seeking to encourage ICT-based learning across all sectors of the undergraduate population.

KEYWORDS: *gender differences, ICT, information searching, internet, subject differences, undergraduate*

Introduction

There has been growing enthusiasm over the past decade for the integral role the internet can play within higher education – not least as a means of providing students with ready access to educational opportunities (Murphy et al., 2001; Ryan et al., 2000). In particular, universities have positioned the internet as a ready means of delivering subject content and providing students with access to the information required for their studies (Eynon, 2005). Higher education institutions continue to devote substantial resources to providing students with access to internet-based information via e-journals, virtual learning environments (VLEs) and other

forms of 'e-learning' provision. Most universities now boast high-spec internet connectivity in classrooms, libraries, student accommodation and other public campus areas. Similarly, most degree programmes contain an information literacy component where students are trained to effectively search and critically evaluate internet-based information.

All of these efforts are predicated upon an assumption that university students – as young, well-educated and well-resourced individuals – are inherently inclined towards using the internet as a source of information within their day-to-day lives and, it follows, disposed towards academic use of the internet. Indeed, present cohorts of undergraduate students are seen to be drawn from the first generation of 'digital natives' who grew up with the internet (Prensky, 2005) and, therefore, are completely comfortable with (and perhaps sometimes overly-reliant on) using online sources to meet their information needs (Jones, 2002; McMillan and Morrison, 2006; Weiler, 2005).

Yet whilst the use of new technologies is an increasingly prominent element of many young people's lives, there is a growing sense amongst some academics that this re-orientation of higher education has perhaps been predicated on little more than assumptions about the likely 'educational effectiveness' of the internet and its supposed universal appeal to students. As Broad et al. (2004: 137) observe, much of the motivation behind the integration of the internet into higher education over the past decade has been driven by 'internal political pressures' on universities and academic departments rather than by sound educational rationales. From this background, it could be argued that there is a need to gain more detailed understandings of the *realities* of internet use in university teaching and learning in order to more successfully integrate the internet into university education (Selwyn, 2007).

Literature review

As with all areas of education and technology, there is a burgeoning literature on higher education and the use of information and communications technology (ICT). As befits the forward-looking nature of the field of education technology, most of this literature tends to be concerned with the *potential* of the worldwide web and other internet applications to accelerate university students' learning and knowledge-building, enhance and democratize access to educational resources and support interactivity, interaction and collaboration. Small-scale case studies and evaluations of best-practice encompass the use of ICT across all stages of university education, from students' use of online induction programmes for incoming students to online question banks, and the use of online chat forums (for example, Johnston and Huczynski, 2006; Kirkpatrick, 2005; Laing et al., 2005).

Yet beyond these evaluations of good practice, empirical studies of university students' actual *in situ* uses of the internet as a source of academic information are surprisingly few (in contrast to the well-mapped internet use of students in compulsory school settings). Most of the studies that have been conducted over the past decade into students' everyday use of ICT at university have tended to be subject specific, as evinced in recent studies into ICT use amongst students studying subjects such as dental education, accounting and business studies and computer science (Marriott et al., 2004; Usun, 2003; Walmsley et al., 2003). Although limited in their scope, these studies have reported, for example, that whilst all students and staff have university-based access to computers and internet, students' academic use of the internet is heavily entwined with leisure uses, and tends to be curtailed by issues of cost and time, as well as relevance to specific curricular and course assessment requirements.

Studies by Breen et al. (2001) and Brotcorne (2005) have looked at students' computer and internet adoption from a university-wide perspective. Both of these studies found computer use to be a major element of the student's working day, but Breen et al. (2001) reported that students were sometimes discouraged from using ICT when in university due to access limitations and the cost of personal ownership of equipment. Brotcorne's (2005) qualitative study of Belgian undergraduates found internet use to often clash with (rather than complement) students' progress through the rigid systems of assessment, grading and academic conventions which constitute university life. This led Brotcorne (2005) to conclude that students' use or non-use of the internet for their studies was not always due to a disadvantage *per se* but 'more due to matters of "digital choice" rather than "digital divide"'.

Indeed, upon closer inspection many of these previous studies actually convey a sense that not *all* students are as inclined to integrate internet use into their studies as might be assumed. As is usually the case in educational debate, blame for this disparity has been most frequently attributed to deficits of skills, motivation and know-how on the part of students, faculty and/or the educational institutions themselves. For example, some researchers have reasoned that university students' (non)engagement with the internet is influenced by perceptions of usefulness, ease-of-use and other psychological attitudes towards both technology and learning (for example, Cheung and Huang, 2005; Hong et al., 2003; Joiner et al., 2006). Following on from Breen's observation, differences in the quality of internet access have also been identified as a likely divide among students, most notably in terms of differences between 'public' and 'private' locations of use (Hassania, 2006). Similarly, institutional and faculty support and resourcing have also been raised as potentially inhibiting or facilitating factors (Eynon, 2005).

Whilst useful, this body of literature has been less concerned with any potential wider social patterning of internet (non)use. This short-coming in the present research base contrasts with suggestions from recent North American work which suggests that social as well as technical issues merit serious consideration in the context of university students' (non)engagement with online academic information (Cotton and Jelenewicz, 2006). Here, it is suggested that even within a population of college students, divisions may well be found in students' internet along the lines of gender, race, educational background and/or technological experience.

Thus at present, whilst there is much enthusiasm being directed towards the integration of internet-based information in UK higher education there is little empirical mapping of students' use (and indeed non-use) of the internet – in particular how internet use may be patterned across different groups of students. In considering the potential factors which may correspond with differences in use, further confirmation is therefore required of the role of variables such as subject discipline and educational background, as well as individual factors such as gender, age and ethnic group, as well as issues of technological access and know-how. In short, research needs to provide a more holistic view of students' *actual* use of the internet in their studies, as opposed to what they could or should be doing.

With this in the mind the remainder of this article examines recent data from undergraduate students studying in UK higher education institutions and briefly considers the following questions:

- how does undergraduates' engagement with the internet for academic information correspond with their wider use of the internet?
- how does the level and nature of internet use for academic information compare between different groups of undergraduates?
- what do these patterns suggest for the encouragement of students' further academic use of the internet?

Research methods

These research questions are addressed through analysis of self-report questionnaire data collected from a stratified sample of undergraduate students at UK universities during the 2006/7 academic year. A brief two-page questionnaire was developed to include questions on respondents' general use of the internet for a range of domestic, leisure and educational purposes as well as their demographic and education backgrounds. Questionnaires were administered to 1222 respondents who were all full-time undergraduate students at higher education institutions in the UK. The majority of students were studying at a large 'old' civic university in

the UK (Cardiff University, n = 1080), with a sub-sample of students from 24 'old' and 'new' UK higher education institutions included for purposes of establishing generalizability (n = 142). Analysis of data revealed no statistically significant differences between the Cardiff and non-Cardiff sub-samples, leading them being analysed together throughout this article.

In terms of sample characteristics, 57 per cent (n = 690) of the sample were female, 89 per cent (n = 1079) classed themselves as 'white British' and 99 per cent (n = 1207) were classified 'home' (as opposed to EU or international) students. Ages of respondents ranged from 17 to 50 years (mean age 19.0 years, SD = 1.8 years) and in terms of pre-university educational background respondents' A-level scores (where applicable) ranged between AAA to E (median score ABB). Respondents were studying a range of subject disciplines which were categorized as follows: 30 per cent studying social studies; humanities (for example, mass communications and documentation, languages, historical and philosophical studies) 20 per cent; business and administrative studies 11 per cent; medicine (for example, medicine and dentistry/veterinary science/subjects allied to medicine) 10 per cent; law 9 per cent; natural sciences (for example, biological sciences/physical sciences) 8 per cent; computer sciences/mathematical sciences 4 per cent; engineering and technology 4 per cent; architecture, building and planning 3 per cent; and creative arts and design being studied by 2 per cent of the sample. The sample should therefore be seen as skewed towards students with strong educational backgrounds, and those studying social studies and humanities subjects. That said, the sample can be considered to be generally representative of the overall UK student population in terms of gender and ethnic background when compared to recent data from the Higher Education Statistical Agency (HESA, 2006).

Given the non-probability nature of our sample and the relatively simple questions of patterning which we wished to derive from the data, it was our contention that the questionnaire data were best analysed in a relatively straightforward manner. Gorard (2001: xv) argues that one of the key methodological reasons underlying the recent high-profile challenging of the quality and relevance of educational research has been the 'over-use of statistical tests, inappropriate use of statistical tests, confusion between levels of measurement, confusion between design error and random variation'. With this in mind, for the purposes of this article the data have therefore been analysed in a relatively straightforward manner. Thus analysis of the questionnaire data is described in terms of frequencies, cross-tabulations and, where appropriate, bi-variate tests of statistical difference and association.

Results

All but two per cent of the sample reported having used the internet to look for information relating to their university studies/assignments during the past 12 months, with 50 per cent of students reporting having done so on a 'frequent' basis (that is, 'all the time'). In this respect, academic information was the highest ranked type of frequent information search that the internet was used for when compared to searching for information about consumer goods and services, news/current affairs or leisure/interests/hobbies. Moreover, using the internet for searching for academic-related information was a more prevalent use than online activities such as e-banking, e-gaming, e-shopping, downloading and participating in online courses or lessons. That said, using the internet for educational information was ranked lower than communicative and social software uses of the internet, with significantly higher proportions of students reporting frequent use of the internet for email, chat-room and social-software applications such as blogging, myspace and similar packages. In this respect, academic-related information searching was

Table 1 **Students' self-reported use of the internet**

	All the time	*Some times*	*Hardly ever*	*Never*
Send/read emails	80	17	2	1
Use internet newsgroups, chat rooms, instant messaging	64	22	8	6
Maintain a blog/space on bebo, facebook, myspace, etc.	55	23	8	14
Look for information about university studies/assignments	**50**	**40**	**8**	**2**
Browse/surf the web for no particular purpose	30	46	18	6
Look for news/current affairs information	28	39	30	9
Online banking/management of personal finance	27	28	18	27
Look for products/services/gathering product information	20	62	15	3
Look for information about leisure/interests/ hobbies	20	49	25	6
Buy goods/services online	16	55	22	7
Legally download software, film, images or music	14	32	29	26
Play games online	9	23	35	33
Participate in online educational courses/lessons	4	11	26	59

Data are percentage of all respondents (n = 1222)

a prominent, but not predominant, aspect of undergraduates' everyday engagement with the internet.

In terms of how academic information searching was patterned according to students' levels of general internet usage, some notable patterns were apparent between different groups of students (Table 2). For example, those students who rated themselves as 'expert', 'very competent' or 'fairly competent' internet users were more likely to report looking for information about university studies/assignments than the small number of their peers who rated themselves to be 'novices' – although this difference was not found to be statistically significant ($\chi^2 = 2.21$, df = 1, n/s). A significant difference was found in terms of the context of internet access – with those respondents enjoying 'private' access to their own computer more likely to report looking for information about university studies/assignments than the ten per cent of the student population who were restricted to accessing the internet in shared university settings such as computer rooms or libraries ($\chi^2 = 25.97$, df = 1, $p < 0.001$).

In terms of how academic information searching was patterned according to students' background characteristics, some notable differences between students were also apparent (see Table 3). For example, female students were significantly more likely than male students to report looking

Table 2 **Percentage of students self-reporting instances of academic information searching during the previous 12 months by internet use characteristics**

	Frequently look for information about university studies/ assignments
Perceived level of internet competence	
Expert	47
Very competent	50
Fairly competent	51
Novice	37
Nature of internet access	
Able to access the internet in a 'private' context (e.g. home, halls)	52*
Only able to access the internet in a university context (e.g. computer lab, library)	27

Data are percentage of all respondents (n = 1222)
* Significant difference at the $p < 0.001$ level using X^2 test

Table 3 **Percentage of students self-reporting instances of academic information searching during the previous 12 months by background characteristics**

	Frequently look for information about university studies/assignments
Gender	
Male	42*
Female	56
Ethnic background	
White British	50
Non 'white British'	51
Age	
18 years	50
19 years	49
20 years	52
21 years	49
22 years and over	51
Year of study	
First	50
Second	51
Third/Final	47
Educational background (A-level)	
ABB grade or above	51
BBB grade or below	48
Subject discipline	
Social studies	58*
Law	53
Business & administrative studies	52
Humanities	37
Medicine	59
Natural sciences	47
Computer sciences/mathematical sciences	49
Engineering & technology	50
Architecture, building & planning	37
Creative arts & design	25

Data are percentage of all respondents ($n = 1222$)
* Significant difference at the $p < 0.001$ level using X^2 test

for information about university studies/assignments ($\chi^2 = 25.27$, df = 1, $p < 0.001$). Conversely – and just as importantly – no significant differences were discernable in terms of students' ethnic background, age, year of study or educational background in terms of A-level grades. Perhaps the most notable differences were in terms of subject discipline. Here, there was a distinct pattern of students from medicine and social studies backgrounds being more likely than their counterparts in architecture/planning and creative arts to report looking for information about university studies/assignments ($\chi^2 = 38.77$, df = 1, $p < 0.001$).

Discussion

Although these data are brief and leave many questions un-addressed about students' subsequent use of online information in their studies, they do suggest that the undergraduate body of students at UK higher education institutions is a generally internet-rich population, with academic information searching forming a prominent part of their general online engagement. As such the traditionally reported barriers to student internet use (that is, deficiencies in terms of access, skill and know-how) appear to be steadily diminishing. All students in this study reported having access and making regular use of the internet, with the vast majority happy to report themselves as being competent if not expert users of the internet.

That said, there were a minority of students whose academic use of the internet still appeared to be compromised either by their reliance on shared, public access points (ten per cent of respondents) or by a lack of competence and/or confidence (the one per cent of self-reported 'novices'). Both these groups were found to be substantially less likely to be making frequent use of the internet for academic information and, as such, still require specific attention and support from university authorities as a distinct minority group of requiring specific support and attention. Thus these students' needs should not be overlooked amidst future moves to cater for the majority of competent and confident internet-using students.

The needs of these students notwithstanding, the data presented in this article could be seen to reflect the maturing of internet use in higher education – both in terms of the 'mainstreaming' of students' use of the internet as a source of academic information, and in terms of the maturing of the issues and problems behind this widespread use. Indeed, it would appear that any 'barriers' still underlying differences in students' internet use run deeper than physical or technical issues of resourcing and skill. It is here that university authorities can therefore look to re-appraise their practice in terms of encouraging of students' further academic use of the internet. In particular, whilst no significant differences were apparent in

academic information searching by students' age, year of study, ethnic or educational background, consistent differences were apparent in terms of students' gender and subject of study. These would therefore appear to be two salient issues which require attention from university authorities and faculty in the near future.

With regard to gender differences, our data found *female* students to be significantly more likely to make use of the internet for academic information seeking than their *male* counterparts. This finding runs counter to much of the research literature during the 1980s and 1990s which highlighted men's dominance of education technology (for example, Sutton, 1991). Indeed, now it is assumed that gender differences in internet usage and engagement have all but disappeared (Mossberger et al., 2003), and that any differences which do remain are in terms of female reticence. Our data suggest otherwise, and point to the need for universities to begin to explore distinct ways of making online learning and internet-based information attractive to male students.

Similarly, another form of online divide which demands renewed attention are the differences in subject discipline reflected in our data – with students from medicine, social studies, law and business all reporting higher levels of educational internet use than their counterparts in creative arts, architecture/planning and the humanities. Therefore addressing these 'subject-based' barriers is likely to require a different set of responses from university authorities – based less around resourcing internet access and ensuring the development of internet skills amongst students, and more around developing students' understandings of how technology fits into the material they are studying and the nature of learning in general – regardless of subject specialism. In particular, subject departments and teaching associations could be encouraged to further consider how online information sources can be made to better 'fit' with the demands and nature of the different subject areas.

Future research

Of course, this brief article has been limited in its focus on the 'front-end' of students' use of the internet for education information. In focusing on the differences in students' levels of engagement with the internet for educational purposes, we have not examined the nature, quality or effectiveness of this engagement. Nor have we questioned how online resources and sources fit alongside students' offline information seeking. Therefore it is clear that students' actual uses and non-uses of the internet during their higher education studies merit a sustained and far-reaching programme of future research.

One of the key issues for any future research would be to explore what forms of information students obtain from the internet and, most importantly, how students use such information once they have retrieved it. In particular more in-depth qualitative research should be carried out with students to understand how ICTs and the internet 'fit' with the everyday 'student experience' and, in particular, how gendered and subject specific uses of the internet may develop (see McMillan and Morrison, 2006). Similarly, research should be conducted along more longitudinal lines than the 'snap-shot' nature of the present data set. Repeated collection of data from cohorts of students as they progress through their undergraduate studies would provide a rich and detailed picture of the factors underlying their take-up of ICT-based resources. We hope that the present study has been able to provide a starting point for such investigation.

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