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Uptake and use of electronic information services: trends in UK higher education from the JUSTEIS project

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Abstract

The aim of the JUSTEIS project over the first three cycles (1999-2002) was to examine the uptake and use of electronic information services in higher education in the UK, so that planning of JISC services could be informed by trends in usage and evidence of specific needs. The objectives were to: 1) examine what services were used by students and academic staff, and how senior library staff planned services to purchase content and support its use; and 2) examine how library and information services promoted services through their Web pages. Results over the three years explained the growing popularity of electronic journal services, the acceptance of the search engine model for information retrieval and the important role academic staff play in the promotion of electronic information services for student learning. Conclusions and recommendations concern the need for library and information staff to make their approach to integration of information skills into the curriculum appropriate for the discipline, the type of institution, and its strategy for implementation of any virtual or managed learning environment software

Introduction

The JUSTEIS (JISC User Surveys: Trends in Electronic Information Services) project was funded by the Joint Information Systems Committee of the Higher Education Funding Councils (JISC) in the UK to meet the following monitoring and evaluation objectives

Strand A: To undertake a periodic survey of electronic information services (EIS) uptake and use, investigating the quantity and quality of take-up, with a view to bridging the gap between the perceptions and the reality of user behaviour.

Strand C: To undertake a survey of resource access provided by individual higher education institutions (HEIs) in the UK, together with purchasing intentions.

The first cycle of activity was undertaken in 1999/2000, and the third in 2001/2002. One aspect of Strand B (concerned with transaction logging) was undertaken in 2000/2001. The fourth strand of the monitoring and evaluation, Strand D, a longitudinal, and in-depth view of EIS uptake and use, was undertaken by a team based at the University of Northumbria, UK (JUBILEE project, Banwell et al. 2000, 2001, 2002). In 2001/2002, the monitoring framework was extended fully to the further education sector. Work in the further education sector in the third cycle included an action research element and the JUBILEE and JUSTEIS teams produced a joint report for the action research studies.

The article discusses progress made in developing the monitoring framework and the main trends observed over the three cycles for the higher education sector, updating earlier papers on cycle one (Armstrong et al. 2001a, Armstrong et al. 2001b). The monitoring framework for further education is at an earlier stage of development, with pilot study in 2000/2001 and the baseline study in 2001/2002.

The term student refers to both undergraduate and postgraduate: where there are differences in the results reported between those two groups of students, the term undergraduate or postgraduate is used.

Background

The literature review conducted at the beginning of cycle one confirmed that there is a substantial gap in the evidence surrounding student user behaviour concerning electronic information services. Areas that have been investigated have often focused on one or two aspects of user behaviour in small pilot projects or considered changes or information behaviour at one institution only (e.g. Lubans, 1998). Methodological approaches vary, depending on the philosophical stance taken and the particular emphasis of the project. The JUSTEIS project design took account of research which indicates that information retrieval can be considered as a process of successive information seeking episodes (Spink, 1999), that the context is important (Solomon, 1999), and while we did not assess attitudes, personality and learning styles, we were aware that these can affect learning and

information behaviour (Dalglish and Hall, 2000) (Heinstrom, 2000), and that motivation is important (Brown, 1999). New methods of teaching and learning may also have an effect on information behaviour of students (Eskola, 1999). Some of these studies may have been conducted at more than one institution to help validate the methodology (and the findings obtained) but it was rare for more than three institutions to be involved. For the JUSTEIS project, therefore, there were few studies which yielded clues on the ideal methodology for a study across 20-25 institutions (and around 40 departments) in any one cycle.

Methods

Survey techniques to assess information behaviour

There are various methods of assessing information needs and information seeking behaviour indirectly. In JUSTEIS two methods, critical incident technique, and critical success factors, were combined in the interview schedule. The critical incident technique encourages the respondent to tell the story of a recent information-seeking incident in their terms, and can be used to explore the antecedents, the purposes of the search, the processes involved and the outcomes. The critical success factors technique (Rockart, 1979) was originally developed for managerial roles but can be adapted to determine the priorities an individual has, and the areas where information will contribute to the goals of the individual. The critical incident technique has been used in many studies of information behaviour, e.g. to examine information needs and information use by doctors (Lindberg et al. 1993) (Urquhart and Hepworth, 1995).

The categories for purposes of information, used for the interview schedule, were based on those derived in a study of the value of information use in research libraries (in university settings) (Saracevic and Kantor, 1997), and the design of the schedule was also informed by previous research done in the Department. Refinements were made in successive cycles (Urquhart et al. 2003) with a vignette information problem introduced to the interview schedule in cycle three, to help assess routine information seeking strategies (and set the use of EIS in context). A taxonomy of electronic information services was devised, to help link the findings with the survey of Web site provision (Strand C)

The interviews were transcribed and the transcripts were entered into a QSR qualitative data analysis software package (NUD*IST, using version N4 in cycle 2, and N6 in cycle 3). SPSS was used for the questionnaire data in cycles two and three, as Excel (used in cycle one) did not provide sufficient flexibility.

Sampling for user behaviour study

In each of the three cycles a stratified sampling approach was used, combined with a cluster sampling approach (Coolican, 1999, p. 37) to ensure that the sample included small, medium and large institutions (as assessed by student numbers), as well as different types of institution (established universities, research-intensive universities, new universities, and colleges of higher education, offering undergraduate degree programmes) (Table 1 illustrates the cycle three framework). Departments were then selected randomly from each institution, but

ensuring that the 40-50 departments selected were fairly equally distributed among five disciplinary clusters (Clinical Medicine, Humanities and Arts, Maths and Engineering, Pure and Applied Sciences, Pure and Applied Social Sciences) used to categorise departments. The original intention was to randomly sample students from the selected departments within the target institutions, but data protection limitations on access to student names and email addresses meant that a variety of approaches had to be offered to institutions. In addition, questionnaires, based on a cut-down version of the interview schedule, were devised to supplement response at most institutions. In the later part of cycle one and in both cycles after that, approaches to sampling generally involved academic staff at the institutions helping to arrange interviews and distribute questionnaires. This involved some negotiation, to provide useful data for JUSTEIS, but by a process that fits in with departmental procedures. Time constraints, and the need to maximise the number of student interviews (although keeping within the sampling frame) meant that fewer institutions were visited in cycle two, compared to cycle one, and in cycle three the baseline study for further education, conducted at the same time, meant that fewer departments could be included (Table 2). Much time in any cycle was spent finalising the departments to be visited, as only around 75% of the departments originally selected agree to participate, requiring a second round of sampling to find suitable substitutes. In cycle three, of the 50 departments approached, 4 pure and applied sciences, 5 maths and engineering, 4 pure and applied social sciences, 8 humanities and arts, and 8 clinical medicine departments ultimately participated (29 in total). Reasons for non-participation include organisational restructuring, or involvement in internal quality audit activities. Some departments give no reasons for refusal and with others it proved impossible to arrange a visit at a mutually convenient time.

Size (UG student numbers)/Type	Research intensive (Russell group)	Established universities	New universities	Colleges of Higher Education
Large (>18,000 students)	2	2	3	0
Medium (>6,000,<18,000 students)	1	3	2	2
Small (<6,000 students)	0	2	0	3

Table 1: Sampling frame for cycle three (2001/2002)

	No. participating HEIs	No. participating depts	No. student interviews	No. student questionnaires	No. academic staff interviews	No. academic staff questionnaires	LIS staff interviews
Cycle 1	26	37	121	518	30	57	37
Cycle 2	22	35	221	465	22	0	10
Cycle 3	18	29	200	353	26	28	9

Table 2: Sample details for JUSTEIS cycles

One major difficulty in cycle one was the widely different rates of response from individual institutions (and departments). For example, two of the 26 sites in cycle

one provided just under 50% of the student questionnaires. In later cycles, a more even response was achieved. A target figure of ten student interviews per department was requested by the JUSTEIS team, and academic staff contacts found this manageable. Some departments only provided interviews, some larger departments both interviews and questionnaires and some only questionnaires. The ideal figure of ten interviews allows for some “no-shows” on the date, and in practice a figure of 7-8 interviews per department is deemed acceptable. When a mutually convenient time for a visit could not be arranged, arrangements for questionnaires can be made, but this is a second-best option. In cycle three, the average number of student interviews obtained per participating department providing interviews was 7.7 (and 6.9 overall, for all participating departments, including those which only provided questionnaires). Ideally, sampling of students would be random, but the methods used seem an acceptable compromise between the ideal, and the practicalities of ensuring that interviewers are not steered towards selected ‘good’ students. Students are offered a place in a prize draw for a shop token as a small incentive to participate.

Survey of purchasing intentions

In each cycle ten sites were randomly sampled within the institutions selected and senior library and information services staff invited to participate in a telephone interview concerning their purchasing intentions for EIS. In total, over the three cycles, interviews were conducted with 28 senior librarians from 27 HEIs, (7 research-intensive, 7 old universities, 8 new universities and 5 colleges of higher education).

The questions covered general perceptions of benefits to users of EIS, current concerns affecting ability to plan for EIS, special arrangements for remote users, management and staffing issues, Web site development and maintenance, licensing and collaboration issues, budgeting and collection development, service evaluation and emerging patterns.

LIS web site survey methods

Various methods were used to make the counting of links and resources more reliable, as HEI Web sites vary greatly in the way EIS are presented to the user. By cycle three a more sophisticated, ‘mechanical’ means of removing duplicates had been developed and everything (other than individual e-journal titles) on every page was counted.

LIS web site survey sample

For the Strand C LIS Web site survey, the institutions included in the Strand A sample are supplemented by a random selection of other HEIs, not already assessed in previous cycles. In total, the number of HEI Web sites assessed were 44 (cycle one), 48 (cycle two) and 29 (cycle three).

Limitations

To disentangle some of the factors involved, the need for sufficient quantitative and qualitative data has to be balanced against the practical difficulties of the survey work. There are several possible alternative approaches to the identification of trends in information behaviour. One is by use of transaction logging, and that, provided the software could provide the required degree of granularity, is one way forward, but this is not feasible at present. The second is to do in-depth discrete studies in one or two institutions, which may be easier to organise, but runs up against the problem of credibility for other institutions (the 'not invented here' syndrome).

The JUSTEIS approach, is a 'skimming and dipping' approach. Experience gained by the research team confirms that it is essential to undertake this 'skimming' exercise of a broadly based cross-sectional survey with a considerable amount of 'dipping', in the form of interviews. The qualitative data provided through interviews with students are essential, given the difficulties of professional terminology (e.g. ATHENS may mean authentication to librarians, but to many students it only means a place in Greece). Interviews helped to indicate possible problems in the reliability of interpretation of the data obtained from some sections of the questionnaires. From the 'dipping' in the interviews, the research team could suggest hypotheses which might be explored using the quantitative data. Interviews also provided a far better indication of new trends in information behaviour than could be obtained from questionnaire data.

Results

Some of the main themes from the cumulative findings are presented in the following sections. Extracts from the qualitative data illustrate recurring themes. In some cases some intermediate text has been omitted from the quotations, to save on space, but the meaning, and 'authentic voice' have been preserved. The full reports provide more examples of interview extracts. The tables in the results sections are limited to the interview data, where the interviews have provided the more reliable data.

Students' reasons for using electronic resources

From the perspective of those funding networked services, the questions concern the purposes of use of electronic resources, and network planning. Are students just spending taxpayers' money on frivolous use of the Internet which is not directly related to their academic studies, although they may be learning how to use the Web in the process? How many workstations should be provided on campus if, given the growing problem of student debt, many full-time students are effectively part-time at the university, mature students often need to spend as much time at home as possible, and more students are likely to need access off-campus?.

Undergraduate students in all three cycles answered that they were using electronic resources primarily for coursework, which could be background research, preparing presentations, or making lecture notes, but the effect of modularisation was apparent in the dominance of the use of electronic resources to help in preparing assignments. In interviews, assignments dominated as the main

reason for EIS use (38% cycle one, 48% cycle two, .48% cycle three). From the evidence of the cycle two and three reports, around 80% of the information seeking incidents reported by students concerned coursework and academic purposes, 20% were for personal reasons. Postgraduates divided into two groups: the PhD students who were (unsurprisingly) seeking information for their thesis and the taught Masters students who were seeking information for coursework, and the latter group generally resembled undergraduates in their information seeking patterns.

Of the cycle three searches discussed by the participants (mostly students, and a small number of staff) around 30% were conducted at home, and 70% at the HEI. Comparing that with the pattern of purposes, suggests students are more likely to use their own ISP connections and home facilities for academic purposes, rather than using HEI facilities for leisure purposes. Students are unlikely, of course, to choose a subversive 'critical information seeking incident' to describe to an interviewer, or detail on a questionnaire, and the JUSTEIS findings may therefore paint a rather generous picture of the need for remote access for academic purposes.

Students and staff use the Internet to obtain pictures and images, but there is no apparent increase in this usage. Music downloading is mentioned by some students in interviews. Science students in particular appreciate interactive sites which provide solutions, answers (put in the data collected, obtain the answer), and of course this type of interaction underpins the DNA database matching services. VLEs provide similar question and answer services, for formative assessment and students, though the evidence from the cycles is limited, appear to like this, and the VLE software may make such support easier to provide.

'I went into (name) and I was looking at the, about the next assignment that we've got coming up and I actually did the...(pause) there's a programme on these that takes you through some of...(pause) you had to question and answer...and I was quite pleased with myself because I did quite well and I was quite chuffed.' [undergraduate student 104120, cycle three]

'...there's a wonderful thing I found at the end of last term, one of the lecturers had put on in a lovely format so that you fit on three floppy discs, a version for a PostScript viewer so that you can see Maths solutions, that was lovely. Quite a few people are putting their solutions online now so that's good' [undergraduate student 34101, cycle one]

Electronic resources used

Search engines are consistently the most popular EIS for finding information in all three cycles. In cycle one, Yahoo was the most popular search engine, and of the nine interviewees (out of 188 in total) who mentioned Google, three were librarians. Of the students who mentioned it one made the comment *'this Google and it's incredible'*. By cycle three, Google was mentioned in 44% (103/235) of interviews, and normally as one of the interviewee's preferred search engines.

Metasearch engines, mentioned by a few interviewees (ten at most) in cycle two, hardly rated at all in cycle three.

Cycle one found that the majority of students preferred search engines to many of the bibliographic database (and similar) services provided through JISC agreements with publishers. Search engines are often used as a means to an end, and cycle two indicated that the social sciences students (in particular) used search engines to locate organisational Web pages, for information concerning the organisation itself, publications or products and further links where the organisation's Web page provided a gateway to other resources. This type of searching appeared common among all the disciplinary clusters in cycle three and is increasing as more material is published on the Web (Table 3).

'I wanted to go into the Department of, well the Government Web page. So I clicked on to the internet and typed in the address because I knew it. And then used their search to define what I was looking for.....Open.gov... I was looking for some statistical information on trends and things.' [student 104116, cycle three]

EIS used in critical incident search	Cycle one undergraduate interviews n=86 %	Cycle two undergraduate interviews n=191 %	Cycle three undergraduate interviews n=160 %
Search engines	64.0	59.2	60.0
Organisational Web sites	11.6	19.4	24.4
Bibliographic databases	9.3	6.9	16.3
OPAC	8.1	6.8	7.5
Own HEI Web site	12.8	8.9	5.0
Email, newsgroups	11.6	4.2	4.4
E-journals, and services	11.6	7.9	13.7
Gateways (JISC)	2.3	2.6	0.0

Table 3: Types of electronic resources used by students for a recent search

Cycle three found that even those students and staff who use the Web of Science regularly were relating their search routines to the search engine model and Internet searching..

'...So I used the search engine then, the journal search engines on the internet. [Interviewer: On the internet?]'...Yeah. [Interviewer: What search engine did you use?]'...Medline.' [undergraduate student 97112, cycle three]

Use of subject gateways such as SOSIG and OMNI, was very low. An apparent increase was indicated in the cycle three questionnaire data but this was not confirmed in the interview data. Only one interviewee (staff and students) indicated use of SOSIG, for example, in cycle three. Students, particularly postgraduates possibly, appreciate 'gateways', though not necessarily the JISC-funded gateways. Cycle one, for example, found that some sports sites suited the needs of the students doing one of the burgeoning sports science courses. Cycle three found that some students in performing arts, and media area used certain sites which were effectively gateways. For students in the health sector, there is

increasing emphasis on evidence-based health and evidence-based practice. Resources such as RDN, and gateways are found within the NeLH (National electronic Library for Health) portal, effectively providing portals within portals. Within the period of the last cycle access was negotiated for higher education staff and students in England for access to some of the licensed databases within NeLH. The NeLH is not just a collection of resources, however, and that perhaps is a key point.

Electronic resources and services used regularly were e-mail, OPAC and search engines. Use of local CD-ROM services has declined (Table 4), but use of bibliographic databases has increased, as has awareness of electronic journals. The complementary questionnaire data shows a similar trend, with e-journals ranked third in cycle three after e-mail and search engines, but not in the first seven in cycle one or two. The shift in use of bibliographic databases can be partly attributed to the sample composition in cycle three, and also partly to the more inclusive definition used, as in cycle one more emphasis was on services negotiated through JISC. In cycle three students were asked whether they were using lecturers' home pages (often departmental pages), VLEs, or library subject trees (Table 4).

Regularly used EIS	Cycle one undergraduate interviews n=86	Cycle two undergraduate interviews n=191	Cycle three undergraduate interviews n=160
E-mail	1st	1st	1 st (88.1%)
Search engines	3 rd	2nd	2 nd (81.8%)
OPAC (own)	2nd	4th	3 rd (74.8 %)
Own HEI Web site	5th	3rd	4 th =Lecturers' home pages (51.1 %) VLE (35.7%) Own library subject tree (21.7%)
E-journals	7th	**	4 th =(51.1%)
Bibliographic databases	**	**	6 th (44.1%)
Local EIS (CD-ROM)	4th	7th	7 th (37.8%)

Table 4 Electronic information services regularly used by undergraduates

It is difficult, beyond the ubiquitous e-mail and search engines, to find out what students may be using. Branding of EIS seems to be a problem, and this example of a conversation between interviewer and student sums up the general state of awareness of more specialised services among many students, and how difficult it is to find out just what they do use.

[Interviewer: Have you ever used any bibliographic databases, if I said BIDS or Web of Science, would that mean anything to you?]...No.

[Interviewer: Gateways or portals, does that mean anything to you?

You've never heard of anything like the Resource Discovery

Network?]...No *[Interviewer: SOSIG?]*...No *[Interviewer: Are there any Internet sites that you use regularly, that can be newspaper, shopping*

anything?]...Genie. [Interviewer: You've got a mobile phone?]...Yeah. [Interviewer: Is it a WAP phone?]...Yeah, but I don't use that service. Genie and Hotmail are really the only thing. [Interviewer: Do you do a lot of texting?]...Yes. [Interviewer: Okay, anything else?]...The BEI (Business Education Initiative) Web site, I do spend a lot of time on it . [undergraduate student 94102, cycle three]

Resource provision

Library and information services have been quick to adapt to changes in the deals negotiated through JISC. Over 70% of LIS Web sites provided links to Web of Science in cycle two (2000/2001), while over 50% provided links to its parent service, MIMAS. In cycle three, there was a notable increase (over cycle two) in the availability of links to vendors such as Cambridge Scientific Abstracts (CSA), LEXIS-NEXIS, Silver Platter and OVID.

Many subject gateways can be accessed from LIS Web sites, and the range includes those funded by JISC (e.g. BIOME collection) as well as those not (e.g. World Wide Virtual Library). Over the three cycles, there has been an increase in the number of sites linking to the Resource Discovery Network. Over 50% of sites in cycle three linked to the National electronic Library for Health.

COPAC and the BL OPAC remain the most popular remote OPACs. Links to e-journal collections are varied. IDEAL and Ingenta remain the main providers, with Emerald, Catchword (now part of Ingenta), SwetsNet and Science Direct in the second tier.

Preferences for electronic or printed resources

Despite the apparent predominance of the search engine and e-mail as part of information behaviour (Table 4), books are still considered a reliable, basic resource of information and cycle three's vignette study showed that many students still turn to books as well as the Internet for routine academic queries, with books used first more frequently than the Internet (Table 5). Often, both might be used to answer a query, with books used for orientation first, before doing an Internet search.

Strategy	Number of undergraduates using approach
Library and books, journals first	59
Internet first	32
Specialised databases, journals	26
Internet only	10
Ask someone	10 (5 first choice)
Organisations	6

Table 5: Strategies used by students for a vignette information problem

'I'd probably start with a textbook first...because it's quick, easy, gives me some basic information often to start with. It might help me too, if I want some research or something on the Internet getting into a book first gives me some ideas, keywords to put in. Then I'll probably go to the Internet

and have a look at research articles probably after that' [undergraduate student 97109, cycle three]

Disciplinary differences

The Web of Science databases, and CHEST deals such as NISS-BIOMED are used, and valued, by the clinical and biological sciences community (Table 6). In cycle one there were indications from the questionnaire data that humanities and arts undergraduates ranked search engines as their most frequently used EIS, and this was confirmed in the questionnaire data in cycle two, and cycle three.

EIS used by undergraduate students (from interviews and questionnaire n=469)	Pure and Applied Sciences n=78 %	Maths and Engineering n=90 %	Pure and Applied Social Sciences n=60 %	Humanities and Arts n=73 %	Clinical Medicine n=168 %
E-journals	37.1	30.0	26.6	9.6	39.9
OPAC	24.3	38.8	43.3	35.6	28.5
Bibliographic databases	16.6	13.3	26.7	4.1	28.0

Table 6 Use of EIS among undergraduates from different disciplines

The disciplinary differences in preferred EIS are hard to identify categorically when the subgroups among respondents are small, and HEI restructuring produces some departments in, say, Humanities and Arts that would be in Maths and Engineering or Social Sciences in other institutions. Not all students responded to this question on the questionnaire survey. However, the consistent message from the three cycles is that humanities and arts students use databases least among the disciplines, while clinical and science students make the most use of databases and electronic journals. Humanities and arts undergraduates are far more inclined to use the OPAC (to find books) but that is also, presumably, a reflection of the way knowledge is presented and published in the humanities and such differences may continue (Kling and McKim, 2000). What is more, there seems little shift over the three cycles among humanities and arts students.

As one postgraduate PhD student in the humanities noted:

'I've only ever found one thing I wanted in that format (e-journal) once and that was an American kind of archaeological, social science journal...But most of the stuff I want is not in that format as far as I'm aware, maybe I haven't looked hard enough.' [PhD student 71101 cycle three]

Cycles one to three found, fairly consistently, that the clinical and biological sciences students are usually introduced to the specialist databases by their second year. Unsurprisingly, the students in those disciplines are more likely than students in other disciplines to be using more advanced search strategies

Information literacy among students

The SCONUL Seven Pillars of Information Literacy envisages that information literacy can be viewed as a progression of skills, with undergraduates on the first set, postgraduates at the higher end (synthesis, creation of new knowledge):

- recognise information need
- distinguish ways of addressing gap
- construct strategies of locating
- locate and access
- compare and evaluate
- organise, apply and communicate
- synthesise and create. (Task Force on Information Skills, 1999)

There are other taxonomies, e.g. one produced by the Association of College and Research Libraries (2000) and most contain similar categories. Most taxonomies stress both the efficiency and effectiveness of information seeking, together with higher level skills of evaluation and critical appraisal.

In view of the interest in ‘information literacy’ (and the debate about what it comprises) the search strategies used by students, particularly undergraduates were examined in cycles two and three. What seems to be happening is that search engines offer a one-stop shop, effectively short-circuiting between the skills at the lower end, i.e. recognising information need, and the middle range i.e. locating and accessing information. ‘Comparing and evaluating’ can equally well apply to material found on the Internet as it does to material found from a variety of other resources, including printed sources, but the search engines offer a very fast, and very effective one-stop shop, providing information that is frequently hard to locate by other means, without much effort required in constructing conventional search strategies.

‘Logged on to the internet on Internet Explorer in college...used the search engine Google to search for companies that manufacture pub till systems and then from their hyperlink on their website I contacted them through an email and asked them to send me some information.’ [undergraduate student 82107, cycle three]

One aspect of interest is the progression from undergraduate information skills to those which might be expected of a postgraduate. The sample size for both cycles is small and cycle three, for example, included just 30 interviews with PhD students. They are, as expected, more aware of the different sources of information, more inclined to use library catalogues to find books not held in their own institution and many of those interviewed are using skills at the upper end of the ladder, including those of application and communication.

‘Yes, I am a member of, there is a Web site for the project here, and we set up a FirstClass conferencing area, I am a member of that. It's not very well used but I am a member of that, and I think I am on the lists for a network related to what I am researching.’ [PhD student 74111 cycle three]

Influences on student use of electronic information services

Habit, shaped by previous experience is the main influence on undergraduates’ reasons for using particular electronic resources. The questionnaire data for cycles

two and three indicate also that academic staff, as well as peers play an important role in decisions to use particular resources (Table 7).

‘Probably for one of my assignments which was for a human resource module and the tutor recommended to use various academic journals and texts which are available online, they’re online journals. I used Emerald and I accessed three or four journals because we were give specific titles and then for the assignments they recommended using the online texts again.’ [undergraduate student 104104, cycle three]

‘I had no idea what to do, so I asked a friend...Um because in, in the library I don’t...there’s not really I mean it might just be me and the times I’ve gone but that wasn’t...really like staff around’ [undergraduate student 65110, cycle two]

Factors leading to EIS use	Cycle three undergraduates: questionnaires n = 321 %	Cycle three undergraduates interviews n=160 %	Cycle two undergraduates questionnaires n=412 %	Cycle two undergraduates interviews n=191 %
Own previous experience and results	67.6	41.3	67.5	25.2
Lecturer or tutor recommendation	23.1	9.4	23.3	11.5
Friend or colleague recommendation	16.8	10.0	19.7	7.9
Reading list	10.6	3.1	3.9	1.6
Course or session organized by LIS or IT services	8.1	6.3	5.3	0.5
LIS or IT services staff advice	7.2	1.9	3.6	0.5
Read about it	5.6	0.6	4.1	2.6
Course Website	5.3	0.0		
Other	1.6	5.6	1.7	5.3
No response/data	1.9	21.9	1.7	47.6

Table 7 Influences on undergraduates’ choice of resource in recent search

Library staff do not, apparently, play an important role in directing or advising students, but their role may not be apparent to students, as this interview with a senior librarian in cycle three explained.

*‘We encourage and I have to say the key teaching staff are taking us up on this, we encourage the teaching staff to book sessions within their teaching time. There are three ways that that can be done....
....there’s still quite a lot who send them off, they just tell the students they’ve got an hour and a half or an hour in the LRC and....they don’t liaise with us at all about what they want us to do with the students. The*

students come, they don't actually know why they're there, they just know that the session in the History block on that Friday is with the LRC. Very, very frustrating....

...Um, the second one is they talk to liaison in advance and suggest topics to search for etc. but don't come to the session. That's not too bad....

...But the third one and it's the one we're trying to get new teaching staff to do, is they talk to us in advance so that the workbooks that the student goes away with and that we use in the session are tailored for that particular module but also the member of staff stays...

...and we actually want to take that one step further, it's happened once, which is where the teaching staff has actually held the session and has asked a member of IMS to support and we don't think that's a step back, we think that's wonderful.' (Senior librarian, cycle three)

Implementing effective organisational models of information skills support

Cycle two data identified three types of models of ILT support among staff that were evident among the sites studied.

Model One: Follow my leader (Sole IT enthusiast, other colleagues of a wide range of ability)

This model is characterised by an enthusiast or champion of the use of ILT in the Department. Other staff look to the champion for advice and guidance, and are, to some extent, dependent on the champion. This model was less evident in cycle three, but there was some indication that the enthusiast would be marked out by development of Virtual Learning Environment use.

Model 2: Everyone for themselves (A free market, staff aware and 'doing their own thing'. Individuals – staff and students – responsible for their own learning about EIS)

In this model, most staff are aware of the possibilities of using EIS within teaching and learning but there is little evidence of central direction, and staff, to some extent, compete to provide EIS for learning and teaching. There is support for students but levels may vary among members of staff, and students are responsible for their own learning about EIS, by and large.

Model 3: Collective effort (Integration of information skills into the curriculum)

In this model there is more evidence of a strategic impetus behind integration of information skills into the curriculum, and more awareness among staff (and some students) of the way such embedding has been intended and achieved.

Conclusions of cycle two suggested that:

- Departments in research-intensive universities tend to Model 2, though disciplinary initiatives such as problem-based learning (currently popular in clinical sciences) may move individual departments closer to Model 3.
- Departments in established universities may be the best places to look for examples of Model 3, and some new universities may be moving in this direction.

- Departments in new universities and Colleges of Higher Education may belong to any of the three models.

In cycle three, interviews with academic staff and senior library staff suggested that there might be a strong disciplinary effect on the model exhibited, and the questionnaire data (with limited sample size) did not show significant differences between types of institution and the type of induction and information skills training adopted. Based on the evidence in cycles two and three, it seems that Model 3 is most likely to be found in a discipline (such as health, education, social sciences) where there is a strong drive for evidence-based policy-making at national level (and in the research arena). In other disciplines, the main factors affecting the model adopted may well be related more to the type of institution and its learning and teaching priorities.

Purchasing policies and problems

Purchasing intentions and planning over the three cycles have been beset by huge uncertainties for those interviewed. Problems stem from the basic budget infrastructure and year-on-year funding changes which impede long-term planning. Authentication problems (such as numerous passwords, on campus and off campus differences in access) are difficult but can be reduced. The more difficult problem for many institutions is that of service support, and the appropriate staff skill mix. Most services report a decline in inter-library loans and decline in physical library visits.

Discussion

Students quite naturally value convenience, and sufficiency for purpose. They appear less concerned about quality of information as defined by the JISC gateway services, a view which may reflect that of academic staff (Mackie and Burton, 1999). The ubiquitous solution to information seeking for electronic resources seems to be search engines, particularly Google, but that is related more to its pre-eminence as a hub, and success breeds success (Barabasi, 2002, p.93). Search engines, and electronic journals often provide access to full-text in a way that the traditional database services and gateways may not. Books, often their own textbooks are convenient to use, and may provide the answer faster than a search engine search. A survey commissioned by OCLC (2002) of 1050 US college students (undergraduate and postgraduate) who used the Internet for their academic assignments also indicates a strong reliance on search engines (42% use for every assignment, 37% for most assignments), but also a strong reliance on books (75% used printed library books, 70% used journals or periodicals, although only 57% used the library catalogue). Although the US students gave a rating (out of 10) of 6.2 for the accuracy of the information on the Web, only 4% thought the quality of the information they found and selected from the Web was not good enough for their assignments, which suggests that neither US nor UK students see major problems with the effectiveness of their searching. When asked whether they were satisfied with the results of their critical incident search, very few JUSTEIS respondents were dissatisfied with their search results.

The JUSTEIS findings indicate that academic staff play a key role in encouraging students to use electronic information resources effectively, and that peer influences are also important. Similarly, the OCLC (2002) study found that 61% of students would ask the nearest source (friend or classmate) for help on the Web, 36% asked academic staff and 21% asked librarians. It should be noted that the OCLC sample was self-selected, from a group already (presumably) conversant with Internet sources. JUSTEIS showed that disciplinary differences do matter, and that 'quality of information' may be defined in different ways by different disciplines. Academic staff working in clinical and related sciences have a strong disciplinary imperative to train students in critical appraisal and use of evidence-based resources. A user support model appropriate for this discipline is not likely to work well for other disciplinary areas. One institutional solution will not fit all.

For more specialist resources, LIS staff need to work more closely with academic staff to find out which resources students should learn to use. From cycle one the importance of lecturers' Web sites was highlighted, and by cycle three this has been transformed, partly, into use of VLEs. Perhaps the US college students make more use of course-specific Web sites than do UK students, as the OCLC study found that only 10% of students did not use these, whereas only around a third of the interviewees in cycle three claimed they used a VLE regularly, and just over a half claimed they used lecturers' Web sites regularly. For library and information service staff, JUSTEIS has confirmed that new ways of working are vital, and that learning support needs a different skill set to that traditionally offered by LIS staff, one that may include (Biddiscombe, 2002) pedagogic skills, computing skills or experience in VLE or MLE development.

Conclusions

The reports for each cycle provide a wealth of data about undergraduate, postgraduate and academic staff use of electronic information resources and services. This paper has highlighted some of the main trends over the cycles as well as indicating what has not changed over the cycles. Although the number of undergraduate interviews obtained is tiny compared to the size of the total undergraduate population in the UK, JUSTEIS has achieved an overview across all types of discipline and institution that has not been provided before, for the UK. The monitoring and evaluation framework reports (Department of Information Studies, 2000, 2001, 2002) provide more detail about aspects of the work that cannot be included in this paper. The emphasis has been placed on formative process evaluation, finding out what is going on, and then trying to explore, in a more summative manner to process evaluation, whether certain developments or problems are common enough to warrant further attention.

The main trend (apart from the rise in popularity of Google) appears to be the way that academic staff support for use of electronic information may increasingly be formalised through the VLE. Students want reliable, personal help – how can that best be provided when limited resources and calls for equitable provision require that much support has to be provided to all through a VLE? Interactive tutorial material seems more important than simple provision of a range of resources. LIS staff need to develop new skills, and work with academic staff, who themselves

may be unaware how important their role is in encouraging information skills for lifelong learning.

Much of the information literacy debate tends to focus on the skills acquired in formal education. Around one in five of interviewees in JUSTEIS discussed personal Internet searching, often seeking information from organisations and interacting with those organisations. Skills and attitudes acquired in such searching may deserve more consideration than they have apparently been given

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References

- Armstrong, C. et al.(2001), "A study of the use of electronic information systems by higher education students in the UK", *Program*, Vol. 35, No. 3, pp. 241-262.
- Armstrong, C et al. (2001), "The JISC usage surveys: trends in electronic information services (JUSTEIS) project: supply and demand in higher education", *Library and Information Briefings*, No. 106/107, pp. 1-18.
- Armstrong, C et al. (2001). *JUSTEIS JISC Usage Surveys: Trends in Electronic Information Services. Strand A. Strand C. Final report 2002/2001 cycle (Cycle Two)*. Department of Information and Library Studies, University of Wales Aberystwyth.
- Association of College and Research Libraries (ACRL) (2000), *Information literacy competency standards for higher education*, American Library Association, Chicago. Available from <http://www.ala.org/acrl/ilcomstan.html>.
- Banwell, L et al (2000, 2001, 2002) *JUBILEE project reports*, IMRI, Northumbria University, Newcastle-upon-Tyne.
- Barabasi, A (2002), *Linked: The new science of networks*, Perseus Publishing, Cambridge, MA.
- Biddiscombe, R. (2002), "Learning support professionals: the changing role of subject specialist in UK academic libraries", *Program* Vol. 36, No. 4, pp.228-235.
- Brown, C.M. (1999), "Information literacy of physical science graduate students in the information age", *College and Research Libraries*, Vol. 60, No. 5, pp. 426-438.
- Coolican, H. (1999), *Research methods and statistics in psychology*, 3rd edition., Hodder & Stoughton, Abingdon, Oxford.

Dalgleish, A. and Hall, R (2000), "Uses and perceptions of the World Wide Web in an information-seeking environment", *Journal of Librarianship and Information Science*, .Vol. 32, No. 3, pp. 104-116.

Department of Information Studies, UWA (2000, 2001, 2002). *JUSTEIS annual reports*, Department of Information Studies, University of Wales Aberystwyth.

Eskola, E. (1999), "University students' information seeking behaviour in a changing learning environment. How are students' information needs, seeking and use affected by new teaching methods?", *Information Research*, Vol. 4, No. 3. Online. Available from <http://informationr.net/ir/4-2/isis/eeskola.html>.

Heinstrom, J. (2000), "The impact of personality and approaches to learning on information behaviour", *Information Research*, Vol. 5, No. 3. Online. Available from <http://informationr.net/ir/5-3/paper78.html>.

Kling R, and McKim G.W (2000), "Not just a matter of time: Field differences and the shaping of electronic media in supporting scientific communication", *JASIS* Vol. 51, No.14, pp. 1306-1320.

Lindberg, D.A.B. et al. (1993), "Use of MEDLINE by physicians for clinical problem solving", *JAMA (Journal of the American Medical Association)*, Vol. 269, No. 4, pp. 3124-3129.

Lubans, J. Jr (1998). Series of papers: "How first-year university students use and regard Internet resources; Key findings on Internet use among students; Students and the Internet; Study 4: Internet use among 3rd year students at Duke University", Online. Available from <http://www.lubans.org/docs/1styear/firstyear.html>.

Mackie, M. and Burton, P. F. (1999), "The use and effectiveness of the eLib subject gateways: a preliminary investigation", *Program*, Vol. 33, No. 4, pp. 327-337.

OCLC (2002), "White paper on the information habits of college students1: How academic librarians can influence students' Web-based information choices", <http://www2.oclc.org/oclc/pdf/printondemand/informationhabits.pdf>.

Rockart, J.F. (1979), "Chief executives define their own information needs", *Harvard Business Review*, Vol. 57, pp. 81-93.

Saracevic, T. and Kantor, P.B. (1997), "Studying the value of library and information services. Part II. Methodology and taxonomy", *Journal of the American Society for Information Science*, Vol. 48, No. 6, pp. 543-563.

Solomon, P. (1998), "Information mosaics: patterns of action that structure", In T. D Wilson and D. K. Allen (eds) *Exploring the contexts of information behaviour. Proceedings of the second international conference on research in information needs, seeking and use in different contexts*, Taylor Graham, London, pp. 150-175.

Spink, A. (1999), "Towards a theoretical framework for information retrieval in an information seeking context" In T. D Wilson and D. K. Allen (eds) *Exploring the contexts of information behaviour. Proceedings of the second international conference on research in information needs, seeking and use in different contexts*, Taylor Graham, London, pp. 21-34.

Task Force on Information Skills (SCONUL) (1999), *Information skills in higher education*, SCONUL, London.

Urquhart, C et al. (2003) Critical incident technique and explicitation interviewing in studies of information behavior. *Library and Information Science Research* (to appear in Vol.25, No. 1)

Urquhart, C.J. and Hepworth, J.B. (1995), "The value of information supplied to clinicians by health libraries: devising an outcomes based assessment of the contribution of libraries to clinical decision-making", *Health Libraries Review*, Vol. 12, No. 3, pp. 201-213.