

Researchers of Tomorrow:

A three year (BL/JISC) study tracking the research behaviour of 'Generation Y' doctoral students

Annual Report

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Coordination	Julie Carpenter, Education for Change Ltd
Contributing Authors	Julie Carpenter, EfC Louise Wetheridge, EfC Nick Smith, The Research Partnership Further contributions from: Meg Goodman, EfC Oscar Struijvé, EfC
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1 Executive summary

About the research

This annual report of the first year of the three-year Researchers of Tomorrow study is based upon quantitative and qualitative data gathered between July 2009 and February 2010.

The Researchers of Tomorrow study focuses on evidence-gathering from three groups of doctoral students in the UK:

- a cohort of 60 Generation Y doctoral students from 36 UK HEIs recruited into the project's 2½ year qualitative longitudinal study;
- responses to a national context-setting survey returned by over 2000 Generation Y doctoral students;
- responses to the same national context-setting survey returned by over 3000 older doctoral students.

Findings and conclusions

The research results of this first year show that, in broad approaches to information-seeking and use of research resources, there are no marked differences between Generation Y doctoral students and those in older age groups. Nor are there marked differences in these behaviours between doctoral students of any age in different years of their study. The most significant

differences revealed in the data are between subject disciplines of study irrespective of age or year of study.

The context within which doctoral students work has become increasingly homogenised as institutions and individuals respond to policy and funding pressures, and information technology has an increasing impact upon the research environment. It is no surprise therefore that doctoral students' overall experiences, priorities and broad research behaviour would be similarly homogenised.

The research indicates, however, potentially interesting and important divergences between Generation Y and older doctoral students; for example, where students turn for help, advice and support; and attitudes to their research environment.

Similarities and differences revealed in the national context setting survey between Generation Y and older doctoral students are summarised in Table 1 below.

We began this research with some implicit assumptions about Generation Y doctoral students, which we sought to test in the survey and through our longitudinal study cohort of only Generation Y students. These assumptions included:

- **Generation Y students would have and demonstrate good critical information literacy skills, commensurate with growing up in a non-web world.**

The research seems to confirm this: Generation Y students are sophisticated information-seekers and users of

information networks but they are not dazzled by the technology.

- **Generation Y students would be less inclined to make use of printed materials and always favour the electronic versions if they could get them.**

The research so far does not support this: e-journal articles certainly dominate as first choice in the Gen Y survey sample. However, that sample is 65% science students and their responses are generally consistent with those from science students in the wider survey sample. Moreover, the experience of reading in hard copy is preferred by many of the Gen Y cohort, including science students, and the notions of quality and authority still cling to print editions of journals.

- **Generation Y students would be highly competent users of information and communications technology.**

This certainly appears to be true, but it is also apparently true of older doctoral students too – the impact of technology on learning and research has evidently been so dramatic that ‘we are all the Google generation now’.

- **Generation Y would be early adopters and keen users of the latest technology applications and tools in their research.**

This research has not supported this assumption. On the contrary, it would appear that Generation Y doctoral students, in common with others, are quite risk averse and

‘behind the curve’ in using digital technology, not at the forefront; and this despite the fact that the majority of Generation Y students answering the survey and in the cohort appear to be keen users of the latest technology applications in their personal lives.

- **Generation Y doctoral students might take a different view of doing research than their older peers, having started their research career in the midst of an information explosion, with web-based access to hugely increased and increasing research resources.**

They might, for instance, take the pragmatic, ‘good enough’ view to achieving information-seeking and research results, rather than risk information overload; they might be more ready to share research because of the ‘web world’ they inhabit.

The research indicates, on the contrary, that Generation Y doctoral students are rigorous in their continuous search for, and absorption of, relevant research resources and set high standards for their comprehensive coverage of their fields, heavily influenced by their supervisors. They are generally unwilling to share their research findings at this stage in their research career.

Table 1: Summary of similarities and differences between Generation Y and older doctoral students

Broad areas of research	Similarities between Generation Y and older students	Where Generation Y students may be different
Constraints on research	Generation Y and older students concur on the severity of time pressures as a constraint on their research (ranked 3.78 and 3.85 respectively in the two samples, on a scale of 1 – 5 where 1 is no constraint and 5 is a severe constraint): this was ranked the highest constraint in both samples.	There are differences in views between Generation Y and older students in the samples relating to: <ul style="list-style-type: none"> • lack of money or need to raise funds (2.95 and 3.11 respectively); • family pressures (2.00 and 2.70); • the need to work to support research (2.17 and 2.95 respectively): only 5% of the Generation Y sample are part-time students compared to 34% of older students; only 18% of Generation Y students in the survey are entirely or partly self-funded compared to 44% of the older students.
Ways of searching for research information	Around 30% of both Generation Y and older students tend to initiate their research enquiries with a Google application.	More Generation Y students than older students (20% and 11% of the two survey samples respectively) used citation databases as their main starting place; but more Gen Y (65%) than older students (36%) study pure and applied sciences.
Research resources used	Both Generation Y and older students in the survey samples share a heavy reliance on text-based and secondary (published) resources, irrespective of year of study. 77% of Generation Y students cited e-journals, in comparison with 67% of older students; this probably reflects the pure and applied science study of 65% of the Generation Y sample. Both Generation Y and older students in the survey cite 'licensing restrictions imposed by e-journal and other e-information services', and 'difficulties in getting hold of	More Generation Y than older students cited e-journals (77% and 67% of the two samples respectively); the difference is likely to reflect the science study focus of the Generation Y sample.

Broad areas of research	Similarities between Generation Y and older students	Where Generation Y students may be different
	<p>relevant research resources' as constraints on their research (both overall 2.6 on a ranking scale of 1 – 5 where 5 is a severe constraint).</p>	
Using library collections and services	<p>The library collections in the students' own institutions (both collections of electronic resources and physical book, journal and archival collections) are used heavily by all doctoral students, though many (particularly in the sciences) may rarely visit the library</p>	<p>36% of Generation Y students in the sample have never used inter-library loan services, compared to 25% of older students.</p> <p>15% more older students than Generation Y students surveyed have used or regularly use subject specialist librarians; the majority (57%) of Generation Y students has never used advice and help from subject specialist library staff, compared to 42% of older students.</p>
Using technology in research	<p>Generation Y students are no more likely to use technology tools in their research than are older doctoral students: both survey samples show low levels (no more than 30% in any case) of take-up of tools such as alerting tools and RSS, text and data mining tools, 3D technology, social book marking.</p> <p>Evidence from the Generation Y cohort research suggests that the lack of take-up of specialist and Web 2.0 tools by Generation Y students in their research is not a question of lack of skills; it is more likely to be because the students do not see the immediate utility of the technology within their research and their preferred ways of working.</p>	
Training and support to research.	<p>Overall around 50% of Generation Y and older doctoral student survey samples had received some kind of useful formal training in areas related to information-seeking and</p>	<p>33% of Generation Y students in the sample said they have never used library staff support in finding difficult to get hold</p>

Broad areas of research	Similarities between Generation Y and older students	Where Generation Y students may be different
	research resource use	<p>of research resources compared to 21% of older students.</p> <p>Generation Y students are more likely to turn regularly to their supervisors for recommendations on research resources (60% and 49% respectively).</p> <p>More Generation Y students than older doctoral students (31% and 23% respectively) get help and support from their supervisors in using specialist technology tools.</p> <p>Generation Y students are more likely than older doctoral students to rely on their peers for support using technology (45% and 32% respectively).</p>

2 Emerging findings

Introduction

This section summarises where the quantitative survey data show similarities and emerging differences between Generation Y and older students in six broad areas:

- constraints on research;
- ways of searching for research information;
- research resources used;
- using library collections and services;
- using technology in research;
- training and support to research.

This is followed by a summary of findings from the qualitative data from Generation Y students in our longitudinal study cohort, with whom we have investigated some of the emerging differences indicated in the survey. These results relate to four areas of research experience:

- the networked research environment;
- using open access and open source;
- using technology applications and tools;
- finding help and support in research.

Finally, we summarise what among these findings will be followed up in the coming year with more nuanced and focused questions in the annual survey and with the Generation Y cohort.

Survey research findings

Constraints on research

Generation Y and older students concur on the severity of time pressures as a constraint on their research (ranked 3.78 and 3.85 respectively in the two samples, on a scale of 1 – 5 where 1 is no constraint and 5 is a severe constraint): this was ranked the highest constraint in both samples.

There are differences in views between Generation Y and older students in the samples relating to other constraints on research:

- lack of money or the need to raise funds (2.95 and 3.11 respectively)
- family pressures (2.00 and 2.70), which probably reflect the different family circumstances of older students; and
- the need to work to support research (2.17 and 2.95 respectively): only 5% of the Generation Y sample are part-time students, compared to 34% of older students, and only 18% of the Generation Y students in the survey are entirely or partly self-funded compared to 44% of older students.

Searching for research information

Generation Y students show the same overall preference as older students for starting out their research enquiries with Google applications (30% and 31% of the two survey samples respectively).

A higher percentage of Generation Y students than older students (20% and 11% of the two survey samples respectively) used citation databases as their main starting place. This almost certainly reflects the significantly higher proportion of the Generation Y survey sample (65%) studying physical, biological, engineering and health sciences in comparison to the older students (36%).

Research resources used

Both Generation Y and older students in the samples show a heavy reliance on text-based and secondary (published) sources, irrespective of whether the students are in the early or later years of their study.

In both samples the e-journal article is dominant as the main source of research information used: 77% of the Generation Y students cited e-journals, in comparison with 67% of the older students; the difference probably reflects the pure and applied science focus of study for the majority of the Generation Y sample.

Data for arts and humanities students in both samples show a 'long tail' of different research resources used by small percentages of students, whereas the science students overwhelmingly use just full-text e-journal articles and abstracts.

Both Generation Y and older students cite licensing restrictions imposed by e-journal and other e-information services, and difficulties in getting hold of relevant research resources as constraints on their research (ranked 2.73 and 2.69 respectively on a ranking scale of 1 – 5 where 5 is a severe constraint).

Using library collections and services

As one would expect, the library collections in the students' own institutions (both collections of electronic resources and physical book, journal and archival collections) are used heavily by all doctoral students, though many (particularly in the sciences) may rarely visit the library. In the survey we asked more specifically about two services typically offered by higher education institution (HEI) libraries: inter-library lending and document supply services and the advice and input from subject specialist library staff.

Slightly more older doctoral students surveyed make regular use of inter-library loan services (30% in comparison to 25% of the Generation Y students) and 36% of Generation Y students have never used them (compared to 25% of the older students). Regular use of inter-library loans is higher among arts and humanities students: for instance, in the Generation Y survey sample, 42% of arts and humanities students use these services regularly in comparison to 13% of physical science students.

15% more older students than the Generation Y students surveyed have used or regularly use subject specialist librarians; the majority (57%) of Generation Y students has never used advice and help from subject specialist library staff, compared to 42% of the older students.

Using technology in research

All doctoral students rely heavily on computers and the networked information environment in their research. The majority of both Generation Y and older students surveyed identify themselves as 'elite technology users', meaning they "have the most information technology, are heavy and frequent users of the internet and cell phones and, to varying degrees, are engaged with user-generated content. Members of these groups have generally high levels of satisfaction about the role of ICTs in their lives, but the groups differ on whether the extra availability is a good thing or not." (Horrigan, 2007, page ii).

We asked in particular about the use of specialist and emerging technology tools and applications in doctoral research.

Generation Y students are no more likely to use technology tools in their research than are older doctoral students. The data from the survey indicate low levels of take-up of tools (no more than 30% in any case in both samples), such as alerting tools and RSS, text and data mining tools, 3D technology, social book marking, etc., with the exception of wikis (including Wikipedia). Given the self-reported confidence of the majority of the students in the survey in using information technology it seems unlikely that this low level of take-up and use can be due only to a lack of adequate skills.

There are some minor and predictable differences in both survey samples between subject disciplines. For instance, text and data-mining tools are used and valued by 23% of Generation Y biomedical students compared to 6% of arts and humanities Generation Y students.

Training and support for research

Training

Overall about 50% of all doctoral students surveyed had received some kind of useful formal training in areas related to information-seeking and research resource use.

Among both Generation Y and older students, the kinds of training that most students favoured is not related to learning how to use technology as such, but to finding and accessing research resources (e.g. using their institutional portals, finding subject-based resources, finding resources outside their own institution) and managing references.

Support

Generation Y students are less likely than older students to use library staff support in finding difficult-to-get-hold-of research resources: 33% of the Generation Y students surveyed say they have never used this kind of library staff support compared to 21% of the older students.

Generation Y students are more likely, in comparison to older doctoral students, to turn regularly to their supervisors for recommendations on research resources (60% and 49% of the two samples respectively).

More Generation Y students than older doctoral students (31% and 23% of the two samples respectively) also get help and support from their supervisors in using specialist technology tools in their

research; and the Generation Y students are more likely than older doctoral students to rely on their fellow students and peers for support in using technology (45% and 32% of the two samples respectively).

The survey found that Generation Y students are more likely than older students to use an institutional base (office or laboratory) as their main place of work (52% and 32% of the two samples respectively). This choice of main work place appears to have an impact upon how doctoral students are supported in their research. For instance, in the Generation Y survey sample more institution-based than home-based students call on help from their peers in using technology tools in their research (49% and 31% respectively), and from their supervisors (34% and 22% respectively); and more home-based Generation Y students say they get no help with technology tools at all (33% compared to 22% of students working from their institutions).

Generation Y cohort findings

More complex pictures of student behaviour in information-seeking and research resource use have emerged through exploring some of these broad issues in qualitative research with the Generation Y cohort. These pictures, whilst not necessarily unique to Generation Y students, challenge a number of assumptions and give rise to a range of further questions to be explored in subsequent years of this study.

The networked research environment

Students in the Generation Y cohort have a relationship to research and academic networks and ways of working in the wider web-based information environment that speak strongly in favour of sector-wide shared services, seamless resource discovery and access, and resource sharing between academic libraries.

The students have a sophisticated awareness of the networked information environment, perhaps born out of their development as scholars in parallel with the increasing power and ubiquity of the internet for research and information-seeking. When searching for e-journal articles they are rarely aware of the precise publisher or e-information source itself; this may be because they usually use their institutional library's own e-resource interface or a Google application to locate and access resources, and the brand identity of the final source is less relevant than its authenticated quality.

Many among the cohort make assumptions about the 'joined-upness', or cohesion, of the academic library network and services across the sector that can leave them vulnerable to disappointment. For example, restricted access to research resources on account of the limitations of institutional licences is a particular and constant source of irritation, exasperation and mystification. Almost all the students in the cohort (with the exception of one or two in Russell Group institutions) encounter difficulties in accessing specific journal articles through their own institution.

They make much use of other academic libraries, both online and offline. They appear to rely on this access to other university libraries for one of two main reasons:

- to overcome inadequacies or gaps in the collections of their own institutions;
- because they work or live somewhere else and other university libraries are more convenient.

Using open access and open source

The cohort research reveals a complex picture of student reactions to using open access¹ research resources, both in their research and as places to publish their own research findings.

The principles behind open access publishing and self-archiving speak to the students' desire for an all-embracing, seamlessly accessible research information network in which restrictions on access do not constrain them. Similarly, many of the students favour open source technology applications (e.g. Linux, Mozilla) to support the way they want to work and organise their research, and are critical of the lack of technical support to open source applications in their own institutions.

However, it is clear that most of the Generation Y cohort students do not completely understand what open access means and this

¹ In this study, open access is defined as a) free online access to scholarly works through the removal of price barriers and most permission barriers, and b) self-archiving, where works are deposited in open access repositories, made available on personal and/or institutional websites, or through listservs, blogs and wikis.

negatively affects their use of open access research resources. They recognise the positive impact that open access scholarly publishing could have on the availability of networked research resources and the vexed question of reliable access to e-journals through their own institutions. At the same time, they are concerned that articles published through open access may not have been subjected to rigorous quality standards and peer review, on which they rely.

Peer-reviewed publishing of their own research outputs (generally meaning, for the cohort students, publishing in one or more of the top, priced e-journals in their field) is their goal, as it carries with it the validation and authentication of their work that they feel they require at this crucial early stage in their research career. They recognise, however, the difficulties they face in getting published in these highly competitive journals.

The research reveals some wider concerns about sharing research data and findings lying behind the students' views on publishing in open access, or self-archiving their research results, which include credibility and ranking (the 'impact factor' which figures highly in Generation Y cohort's concerns), confidentiality of data and modes of working, and concerns that outside researchers might not understand their data in the 'right way'.

Using technology applications and tools

The Generation Y cohort vividly illustrates how heavily doctoral students rely on information and communications technology, from simple dependence on having all their work stored on their laptop and almost continuous checking and rechecking for new research

resources through their favoured online applications, to a general readiness to experiment with new tools and applications to help them organise and record their research (e.g. Endnote, BibTeX).

Evidence from the cohort suggests that the lack of take-up of specialist and Web 2.0 tools by Generation Y students in their research is not a question of lack of skills. It is more likely to be because the students do not see the immediate utility of the technology within their research and their preferred ways of working.

The Generation Y cohort is fairly conservative and traditional in its approach to research. The students are heavily influenced by their supervisors and very aware of the need for authority and authenticity in the research resources they select. They are sceptical about the inherent merits of information technology in itself –they do not equate ease of access with quality of research resource.

Technology tools are readily taken up if they complement and enhance the students' existing research practices and behaviour, and if they can be relatively easily understood and absorbed into existing work practices. The students' supervisors play a critical role in their choice and take-up of technology applications.

Finding help and support in research

The Generation Y cohort reveals several problems with the sort of training sessions they have attended:

- training was more suited to Masters or undergraduate students and not pitched at a sufficiently advanced or detailed level;
- it is not available 'on-demand', making it much less useful to doctoral students;
- training courses tend to be generic, not tailored to individual students or groups of students in specific fields.

Generation Y students rely much more than older students on the support of their supervisors, their fellow students and peers in navigating their way through their research journey, in getting recommendations and instruction in how to use research resources and technology tools. Peer-to-peer training and support have the advantages of being *ad hoc*, desk-based and needs-driven. However, it is not yet clear how effective peer support is; whether, for instance, it results in significantly greater adoption and use of innovative technology tools to support doctoral research overall, and whether this implies a disadvantage to working mainly from home.

Those students in the cohort who work mainly from home rather than from an institutional base appear to be less likely to build these kinds of support networks, and less likely to avail themselves of other kinds of informal research support, such as from other academic staff and library staff.

Areas for further research

On the basis of these emerging findings, we intend to focus in year two on the following key areas:

The role of supervisors

What precisely is the role of supervisors in relation to Generation Y students' information-seeking and research behaviour?

What kinds of demands do students make of their supervisors in these areas, and what are their reactions?

How do supervisors influence students' use of technology in research, and how far does this extend into using emergent technologies?

Using the academic library network

What more can we learn about why doctoral students choose to visit and study in academic libraries other than their own? What kinds of constraints and barriers do Generation Y students encounter when they use other academic library collections and services, and how do they react?

To what extent are the current collaborative arrangements clear to doctoral students and how might these be improved to meet needs?

Effective research support

What are Generation Y students' attitudes towards using mediated research resources and content and intermediaries in research support (e.g. subject specialist portals and gateways, specialist library services)? Why do so few Generation Y students appear regularly to use the advice and help of library staff in identifying and getting hold of research resources?

What models and types of training and support would best serve students' needs and how effective is the current informal support provided by supervisors and peers (especially in technology use)? Why do Generation Y students prefer to turn to their peers?

Open access

How do Generation Y students understand and make judgements about research resources in general and open access in particular, and the development of alternative routes in scholarly publishing (both as users of research resources and authors of research content)?

Main work base

What underpins the doctoral student's choice of where their principal place of study will be? What lies behind the apparent difference between subject disciplines in this choice?

What impact, if any, does the students' main place of working have on the range and effectiveness of their information-seeking and use of research resources, and their use of institutional support?

3 About this research

Introduction

In 2007 the British Library (BL) and the JISC funded *The Google Generation Information Behaviour of the Researcher of the Future* research (CIBER, 2008), which focused on how researchers of the future, 'digital natives' born after 1993, are likely to access and interact with digital resources in five to ten years' time. The research reported overall that the information literacy of young people has not improved with wider access to technology.

To complement the findings of the *Google Generation* research, the BL and the JISC commissioned this three-year research study *Researchers of Tomorrow* focusing on the information-seeking and research behaviour of doctoral students born between 1982 – 1994, dubbed 'Generation Y'.

Generation Y, the children of the Baby Boomers, are defined in this study as born between 1982 and 1994. Generation Y students are not 'digital natives': unlike the Google Generation. They were educated, at least up to their senior secondary years, in schools with limited access to computers and the internet. In a largely technology-free environment, it is assumed that Generation Y acquired information-seeking and enquiry skills without learning

"to 'get by' with Google" (CIBER, 2008) and that the nature of this early start may have had an impact on their research behaviour and information-seeking skills as doctoral students.

The Researchers of Tomorrow study will establish a benchmark for research behaviour against which subsequent generations of scholars can be measured; it will ultimately provide guidance to the community of libraries and information specialists on how best to meet the research needs of Generation Y scholars and their immediate successors. The main focus areas of the study are

- mapping emerging research behaviour trends across the main subject disciplines;
- investigating how doctoral scholars, in particular those from Generation Y, seek information both on and offline;
- measuring the relative use of digital resources and physical resources (including research spaces);
- understanding how Generation Y students search for and use digital content for research, and
- if and how they use emergent technologies to do so.

The first year of the study has concentrated on gathering data and evidence around these broad areas. This has provided us with good indications of where differences in behaviour and attitudes may emerge, confirmed many of the observed trends in behaviour within the wider research community and challenged some assumptions. More nuanced enquiry in years two and three of the study will build on these results.

The research participants

This first annual report is based upon quantitative and qualitative data gathered between July 2009 and February 2010. Researchers of Tomorrow focuses on evidence-gathering from three groups of doctoral students in the UK:

Generation Y cohort

At the heart of Researchers of Tomorrow are the attitudes and behaviours of a cohort of 60 Generation Y doctoral students (the 'Gen Y cohort') from 36 UK HEIs recruited into the project's 2½ year longitudinal study. This cohort will keep us informed about the research and information-seeking challenges and patterns in their doctoral journeys, so that we may understand from their experiences and use their feedback to shape new questions that we cannot anticipate at this early stage of the study. The cohort is providing contributions in blog entries, discussion forums, one-to-one interviews and face-to-face meetings. Their contributions between September 2009 and February 2010 inform this Annual Report.

The quotations (in italics) and pen portraits (in plain text) in boxes are all from the Gen Y cohort. The Gen Y cohort is described in Section 4.

National context-setting survey

In a national context-setting survey run in July 2009, which allows us to compare the attitudes and behaviour of the Gen Y cohort with

the wider community of Generation Y and other doctoral scholars, 5,410 completed returns were received from doctoral students of all ages. The survey methodology, and profile of the respondents in terms of institutions, location, subject discipline etc., is described in Annex 1.

From this national, annual survey (to be repeated in July 2010) we have derived data on two samples:

Generation Y survey sample

A total of **2,063** completed questionnaires were returned by Generation Y doctoral students (the 'Gen Y survey sample').

The charts in this report are based on the Gen Y survey sample. A profile of the Gen Y survey sample is provided in Section 4.

Wider survey sample

Completed questionnaires were returned from **3,347** older doctoral students in the 2009 survey. Using this wider doctoral student sample (the 'wider survey sample') we can compare the attitudes and behaviour of the Gen Y survey sample with those of older, UK-based, doctoral students.

Results from the wider survey sample have been included in the charts where there are significant or interesting variations between that sample and the Gen Y survey sample.

4 The HE policy and research context

Policy context

Compared to the undergraduate sector, postgraduate provision has received relatively little attention from policy makers, according to the recent review published by the UK Department of Business, Innovation and Skills. The review endeavours to address this and provides an update on the current nature of doctoral research in the UK (BIS, 2010, page 4).

In 2007, the Higher Education Academy (HEA) collaborated with a number of organisations to launch a national debate about the doctorate in the UK and its fitness for purpose. A briefing paper to support the debate (Park, 2007) outlined the perspectives of different stakeholder groups, the main drivers for change and how the UK HE sector has responded, and posed a series of key questions for discussion. Since then, key drivers for doctoral research change in the UK continue to include an emphasis on skills and training, submission rates, quality of supervision and national benchmarking. There also remain “widely articulated tensions between product (producing a thesis of adequate

quality) and process (developing the researcher), and between timely completion and high quality research” (Park, 2007, page 6)

The OECD study of education trends worldwide (*Education at a Glance*, 2009) found that the UK’s doctoral graduation rate ranked relatively high compared to other countries – coming sixth in countries that provided data (although it also showed that the UK had one of the highest proportions of PhD graduates from overseas).

Funding and financing

The most common sources of sponsorship for full-time students are the UK Research Councils, which fund about one-third of full-time students (HEFCE, 2007, page 30). Funding from the Research Councils supports programmes of up to four years. “In 2008-09, the Research Councils funded just over 19,000 postgraduate researchers, at a cost of £376m” (BIS, 2010, page 12).

Recently, some higher education bodies have argued for normalising a four-year PhD (rather than three or 3½ years). The Council for Science and Technology, for example, reasoned that a four-year PhD provides time for students to acquire wider skills in communication, problem solving, entrepreneurship and management (Council for Science and Technology, 2010, page 4). The Wellcome Trust has also developed a flagship four-year programme.

The efficiency and cost-effectiveness of funding doctoral research are of increasing concern, particularly to the research councils, and are reflected “in the increasingly tightly-defined expectations of research councils relating to submission rates (the percentage of doctoral students who submit within a specified period of time, usually four years), and the growing interest of the funding councils (such as HEFCE) in completion or qualification rates (the percentage of doctoral students who complete within a specified time, usually seven years). All research councils now have clearly-defined thresholds for submission rates, often set at 70% submission within four years [...] and many threaten to impose serious financial sanctions (including withholding postgraduate funding for a two-year period) on institutions whose performance falls below threshold” (Park, 2007, page 15).

These thresholds and sanctions are strongly felt by higher education institutions (HEIs) and supervisors, who are under pressure to propel doctoral students towards timely completion. In turn, students are under pressure, for funding reasons, to complete their research within the defined deadline. Some HEIs have ‘progress boards’ to keep students moving forward.

Training

In 2001, the UK research councils, in collaboration with the UK GRAD Programme, developed the Joint Statement of Skills Training Requirements of Research Postgraduates, setting out the skills that postgraduate researchers funded by the Research Councils would be expected to develop during their research training. It was expected that different mechanisms would be used to support

learning as appropriate, including self-direction, supervisor support and mentoring, departmental support, workshops, conferences, elective training courses, formally assessed courses and informal opportunities.

The Roberts Agenda, prompted by the ‘SET for success’ report (Roberts, 2002) recommendation that all PhD students and postdoctoral researchers should undertake a minimum of two weeks’ training per year in transferable and generic skills, was subsequently backed by funds provided to the research councils to pay for this additional training (‘the Roberts money’).

Universities have interpreted the Joint Skills Statement and the Roberts Agenda in varying ways, often with a core of mandatory modules and a range of elective training courses (some online) and sessions. However, many doctoral research training needs appear not to be adequately or consistently addressed under this agenda, including information-seeking skills gaps among researchers.

Focus groups with PhD students in science, technology and medicine found that “training provided by the universities [...] was not held in high regard and a number of the students were unhappy with the requirement to undertake a specified amount of training. The poor reputation stemmed from a perception of its unsuitability for individuals” (People Science & Policy, 2009, page 5).

“Research Councils are increasingly targeting funding [to postgraduate researchers] in the form of block grants to Doctoral Training Centres (DTCs). This approach gives HEIs greater flexibility to fund provision that responds to emerging needs. DTCs often

bring together several research groups and facilitate working across disciplinary boundaries” (BIS, 2010, page 12). The expansion of DTCs together with emerging new models of doctoral research (for example, the New Route PhD) that prepare researchers for careers not only within but outside higher education, have implications for HEIs, which are under increasing demand to respond effectively to students’ training needs and to the broader issues of appropriate training.

The Researchers of Tomorrow study is concerned specifically with research and information-seeking skills - a subset of those competencies packaged by research councils’ skills modules. A study commissioned by the Research Information Network (RIN) on information-handling training for researchers found that “the range of skills defined by the Research Councils..... includes several which would fall within definitions of ‘information literacy’ used by librarians and information specialists (as well as most interpretations of ‘research information methodologies and tools’)... But important dimensions of research information skills and competencies such as engaging with and understanding the scholarly information system are not included.” (RIN, 2008, page 6).

The report also describes a number of features in the existing institutional offer to researchers, such as:

- few signs of strategic thinking about the place of information training within the wider training provision; or of attempts to align library, information and training strategies with broader research strategies, the Roberts Agenda and the research councils’ Joint Statement on Skills;
- central units responsible for developing and delivering training for researchers tend to emphasise generic skills (accessing and interpreting information; searching and systematic appraisal), while library and information specialists emphasise a different set of skills and competences, based on the concept of “information literacy”.

Subjects of study and interdisciplinary trends

The Higher Education Policy Institute, in a joint review with the British Library, reports on trends across the 2006 – 2008 biennium that show “at research postgraduate level, science subjects dominate, especially engineering and technology, biosciences and physical sciences, whilst social sciences top the non-STEM subjects. Amongst subjects with more than 1000 assumed FTE students in at least one year, growth has been particularly strong in mathematics, computer science and medicine and dentistry....This continuing strong showing for STEM subjects very likely reflects the balance of Research Council and other support available.” (HEPI, 2009, page 38)

RIN research in 2006-2007 noted “for some years now it has been clear that the boundaries between traditional research disciplines are increasingly blurred” and their research indicated that 38% [of academic researchers] are working in interdisciplinary areas.... For libraries this presents new challenges. Interdisciplinary teams have new needs..... the researchers themselves often find it difficult to say accurately *what they themselves* need to see and use. Defining

a suitable set of journals that will contain everything a researcher working in an interdisciplinary field may need is impossible..... interdisciplinary researchers often find serendipity in play in locating information relevant to their research.” (RIN, 2007, page 40)

Supervision

Supervision must now be more transparent and more accountable, and aligned with the precepts of the QAA Code of Practice (2004), which, among other elements, expects institutions to have clearly defined roles and responsibilities for both supervisors and research students. Supervisors are under pressure to turn around their students’ doctoral research in under four years even when they see a risk that this short timescale may make research formulaic. They feel required to support ever larger numbers of doctoral researchers in order to maximise efficiencies and funding for the HEI while still maintaining rigorous quality standards.

Data sharing and scholarly communication

“Researchers communicate their findings – new knowledge, new methodologies and tools – primarily through conference proceedings and journal articles. These public activities have strong institutional and professional incentives in building reputations, securing promotion and so on. Incentives for other kinds of communication and sharing are weaker and indirect.” (RIN, 2009, page 7)

Most research councils have policies requiring researchers to set up formal mechanisms to manage created data, including provision

for access and re-use. A broad sweep of the literature on data sharing among researchers reveals that forms of research data exchange are diverse, across multiple electronic platforms and media, and that there is a widespread tension perceived by researchers between the advantages and disadvantages of sharing their data: researchers feel relatively more the negative incurrence of extra time, costs and intangible benefits. There are distinct data-sharing attitudes and practices between disciplines, with those in the sciences being more accustomed, and willing, to share research data than those in the arts and humanities.

Recent studies on researchers' information-seeking behaviour

The literature review of relevant and new research will be ongoing throughout the Researchers of Tomorrow study. This report covers literature and research reports published and unpublished from 2000 to February 2010.

While numerous research studies during the decade have focused on the information needs and information-seeking behaviour of undergraduate students and academic researchers, we have found only one or two to date that address these issues among doctoral researchers and none that specifically considers Generation Y in this context.

A changing academic library landscape

The Google Generation report (CIBER 2008) concluded that “enormous changes are taking place in the information landscape that are transforming scholarly communication and the role of ‘traditional’ research library services. Many of these changes have been brought about by technology and the explosion of electronic ‘content’ made possible by electronic publishing, mass digitisation projects, and the internet. library users have rapidly become information consumers who can switch instantly between commercial search engines, social networking sites, wikis, bookmarked resources and electronic services provided by their library to satisfy their information needs.”

The what? and where? of research and information-seeking behaviour

This changing landscape has been powerfully influencing scholarly research behaviour for more than a decade. Across a number of research studies and reports, conclusions have been drawn about scholarly researchers in general, though not necessarily about doctoral students in particular, and never specifically about Generation Y students. These conclusions can be broadly summarised as follows:

- Almost all age groups of researchers across subject disciplines are competent and confident with ICT to the degree that they can and do prefer to do at least a proportion of their research using online sources and tools;
- The majority of researchers (irrespective of age group or subject) prefer generic online search engines (Google) over any mediated subject gateway (e.g. Intute) when initiating a search; the reasons for this include more immediate and comprehensive results, fewer clicks, and a tendency among academics not to want others to mediate their searches.
- Over the last decade (with the growth in volume, accessibility and improved quality of online resources), use of physical research resources (e.g. printed journals and books) and physical library collections has declined dramatically among scientists, steadily among social scientists and more slowly in the arts and humanities.
- For all sorts of reasons, the majority of academic researchers, particularly in the sciences, do not like having

to leave their desk to do their desk research and, at the very least, are reluctant to leave their institution. Even arts and humanities' researchers who may need to look at primary resources are unwilling to travel far to find things. There is pressure to digitise everything so that all researchers can work almost exclusively online.

- There are well-documented differences between subject disciplines in, for example, the kinds of research resources favoured (on and offline), the resource discovery tools and methods used, the nature of research (e.g. whether collaborative, interdisciplinary), and use of available support services.
- Finding research resources online (specifically e-journal articles) is less of a problem than accessing them; this comes down to whether or not the researcher's institution subscribes to the e-journal in question.

Using information and 'emergent technology'

Researchers (CIBER, 2007, page 7) have made a distinction between 'transformative' and 'general purpose' innovations: "a transformation occurs when a new technology enters the market that is unlike anything that has gone before and requires that users must discover what it is used for and how best to apply it. Alternatively, there is a range of general purpose technologies with which many or most people may be familiar that continually undergo change. In these cases, new models may be produced that represent enhancements of earlier versions."

The key issue is whether there are any information and communications technologies or so-called emergent technologies that fall into the category of 'transformative' change, particularly in the context of research. Several studies have suggested that Web 2.0 applications are changing, or have the potential to change, the way students learn. Recent work in life sciences suggests that although "some researchers are aware of the potential of Web 2.0 and social networking tools ... they do not use them intensively. The reasons given include lack of time to invest in the learning curve of using the tools, the sheer number of tools and services, and the lack of a critical mass of people using them...There are also organisational or institutional restrictions on the use of 'cloud' computing and Web 2.0 tools and facilities, which are considered security risks to both systems and data." (RIN, 2009, page 42)

5 Setting the Scene

Profile of the Gen Y cohort

The 60 students who make up the Gen Y cohort at the heart of this study are a diverse group geographically, institutionally, by subject of study, funding and a range of other features.

Researchers of Tomorrow Gen Y cohort consists of 25 male and 35 female doctoral students. They are all between 23 and 28 years old (born after 1982). They are not 'digital natives' – they did not grow up with Google and most went through UK compulsory education without the internet and, for the most part, without computers in school up to junior or senior secondary level.

The cohort comes from 36 HEIs across the UK, including three in Scotland, one in Wales and seven in London. All are studying full time. All three broad subject disciplines contain nearly equal proportions of male and female participants.

- Twenty-one Gen Y cohort students are in the arts and humanities. Catherine, for example, is studying history of art, focusing on visual portrayals of Stuart princes; and Donald is a film studies student, who aims to acknowledge the work of a little-known Soviet documentary filmmaker.

- Twenty-one students are from the social sciences, including Grace, whose research explores the psycho-social impact of breast cancer among ethnic minority women to inform guidelines for healthcare professionals; and Wesley who is studying Public Policy Development, exploring the use of well-being powers by local authorities in England.
- Eighteen students are in science, technology and medicine. Bradley is studying inorganic chemistry; Valerie is researching malarial transmission in Laos.

Some Gen Y cohort students' research implicitly involves looking across disciplinary boundaries to search for information, for example across psychology, sociology and healthcare. One participant of the cohort is explicitly an inter-disciplinary researcher – Jane is studying the experiences of people living near road and rail networks (acoustic science with psychology).

Although the entire cohort is studying full time, many take on extra activities and responsibilities such as undergraduate teaching or working directly with their external funders. Of those for whom we have data, nine are self-funded (predominantly arts and humanities students, some with institutional fee waivers); 19 are fully or partly funded by a research council (the AHRC, ESRC, EPSRC or BBSRC); 18 have a university studentship/bursary; seven are fully or partly funded by a public or third sector organisation; and six are fully or partly funded by a private corporation.

Students in the cohort also share other similarities; they are all in the first 18 months of their doctorate; none will complete before June 2011. Several passed upgrades from MPhil studies to doctoral status between June 2009 and March 2010.

Surveyed at the beginning of the study, more than half said that they are doing a doctorate primarily because they want to pursue a career in academia; the rest were motivated by their subject and love of learning.

They are at the start of their careers. Being around their mid-twenties, the majority have gone through education without a break; several of those currently sponsored by corporations, public or third sector organisations or a university department feel the first year of their study as akin to their first job. However, besides being encouraged to take on teaching responsibilities within the institution, conferences and external publishing, these students are not involved in other employment.

Typical of Generation Y students, the majority of the cohort students are 'elite' users of ICT (as are the large majority of all the doctoral students who responded to our national context setting survey). They enjoy using technology, think the internet is very useful and use it frequently for work and socialising. In their personal lives, most are enthusiastic users of social networking sites (Facebook) and media sharing tools (Flickr, YouTube).

Research behaviour typology

We plan to develop a set of typology groups from the data emerging from this study based on the research and information-seeking behavioural characteristics of the Gen Y cohort, which will be tested in the wider Generation Y doctoral student community through the national survey.

We can see four different research behaviour groups emerging from our initial data about the Gen Y cohort's experiences and the way they work. These typologies partly correlate with subject disciplines, with the nature of the research methods and with the main place of work of the student. They are not mutually exclusive: many Gen Y cohort students display more than one of the characteristics summarised here. They are very likely to shift and alter over the next years of the study. However, eventually we hope to define patterns of working, information and resource use within different typology groups, to help HEIs identify different types of researcher within a doctoral student population and to shape their services accordingly.

These emerging typologies are described briefly below and illustrated by some quotes from the Gen Y cohort blogs.

Multi-taskers

Multi-taskers are involved with several research activities simultaneously and often volunteer themselves for extra academic roles such as tutoring, chairing research groups, or organising events. They enjoy and embrace the non-linearity of their

research and work best wearing several research 'hats' at the same time. They are also the most likely to complain about lack of time!

So, its now 2010 and nearly halfway through my PhD - at present I don't feel I am anywhere near halfway towards finishing a PhD thesis. This term is extremely busy, more than any I have experienced to date. I am at the data collection stage but I am also teaching tutorials this semester, alongside trying to write some working briefs, conference presentations, book reviews, attending various training events as well as adding to existing pieces of work I have to be included in my thesis. (Social science student)

[In] my own experience of research [...] all the processes ... (gathering, sorting, synthesizing, evaluating etc.) go on all the time, not one after another. Perhaps I might spend three minutes 'gathering', one minute 'synthesizing' and one minute 'evaluating', but I would certainly not spend a whole week or a month on one process alone. (Arts and humanities student)

Uni-taskers

Uni-taskers are focused and determined in their more linear approach to their research. They move resolutely towards their end goal without many unnecessary distractions or diversions. They do one or a very few activities at a time and are most likely to progress through stages of their research in a thorough, orderly and timely fashion.

In the last couple of months I've went off on a little bit of a tangent to the rest of my first year work (but hopefully it will come full circle

an link back up). This means that I essentially have two small projects on the go at once and multi tasking isn't easy so my original project has sat on the back burner for a bit. Its time to go back to it I think and give the other project a rest. (Science, technology, medicine student)

Challenges seem to be mainly to get enough time free to sit down and concentrate on writing. It seems like the university can't keep itself from throwing things in the way, seminars, meetings, forms and surprise research design courses. (Social science student)

Support-seekers

Support-seekers depend on their research peers and people within and outside their institution for support. They are likely to be working collaboratively, either formally or informally, or to be constantly seeking collaborations and developing people-based networks. They attend conferences and events in order to build relationships that they use to sustain and inspire their research. They are among the most likely to be found regularly in their institution.

The atmosphere in the PhD centre is very supportive, although the issues being dealt with here are less academic and are usually orientated around the day-to-day business of conducting my research. Without the support of my fellow researchers, I feel it would be a much more stressful experience. For example, comments from researchers further into their research helped me

*when dealing with the University Reprographics department.
(Social science student)*

Go-it-aloners

Go-it-aloners do not often reach out to others for support in their research. They are content and confident in their own approach and methods for doing research and seeking information; they have built up a pool of known and trusted resources and if they decide to try out a new application or approach they self-teach. They are solitary researchers, among the most likely to spend as much time as possible working from home or from a quiet, private space in their institution.

At the moment, I am busy collecting data through face-to-face interviews and so spend most of my time working alone. I receive minimal support from my supervisors, although they are able to give feedback on any issues I raise during monthly supervision meetings. In terms of searching for information and literature, again, this is something I largely take care of myself. (Social science student)

But as far as the main body of research goes, I'm pretty well aware that it's just down to me. By this stage, I know my field, the requirements of my discipline and how to go about the research process: I just need to put that into action over a long timeframe. (Arts and humanities student)

The Gen Y survey sample

Of the 2,063 Generation Y students who responded to the national context-setting survey, 95% were studying full-time in 2009. The data show that 43% have some funding from the research councils, 51% from other external funding sources and 17% are self-funded.

Year of study

Figure 1 shows the sample split between years of study: the majority of respondents were in their first or second year.

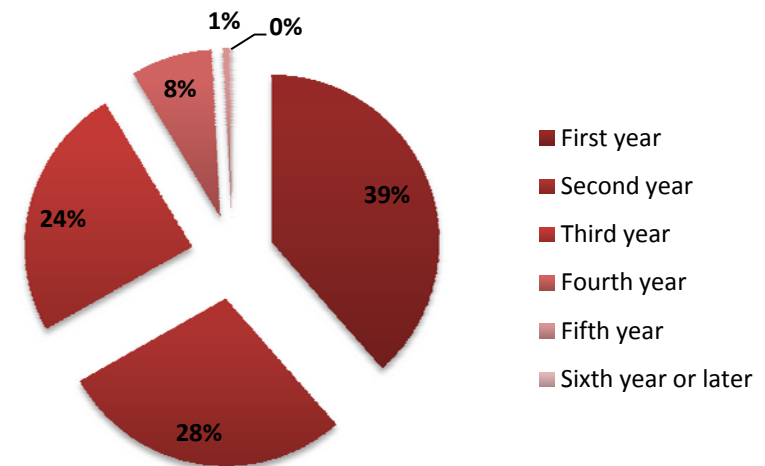


Figure 1: Gen Y survey sample percentage by year of study

Subject disciplines

The Gen Y survey sample is quite evenly spread across disciplines (Figure 2).

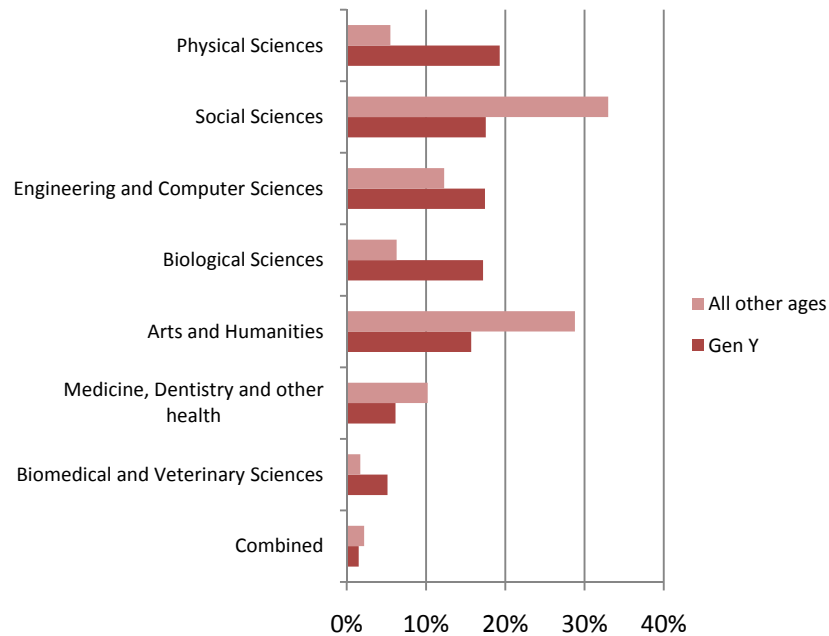


Figure 2: Gen Y and wider survey samples by subject discipline

The wider survey sample has a significantly different subject profile to the Gen Y survey sample; among the older doctoral students over 50% of the sample studies arts and humanities and social sciences, in contrast to Gen Y students among whom 65% of the sample studies sciences – in particular physical and biological sciences, and engineering and computer sciences. This is

consistent with the national trend since 2006 identified by HEPI and the British Library towards strong representation of science, technology and medicine subjects in doctoral research (HEPI, 2009, page 38).

Cross-disciplinary information-seeking

About 40% of the Gen Y survey sample are always or very often required to seek information outside their core discipline (Figure 3). More arts and humanities and social science students than science students say that their research 'always' or 'very often' entails crossing core subject discipline boundaries.

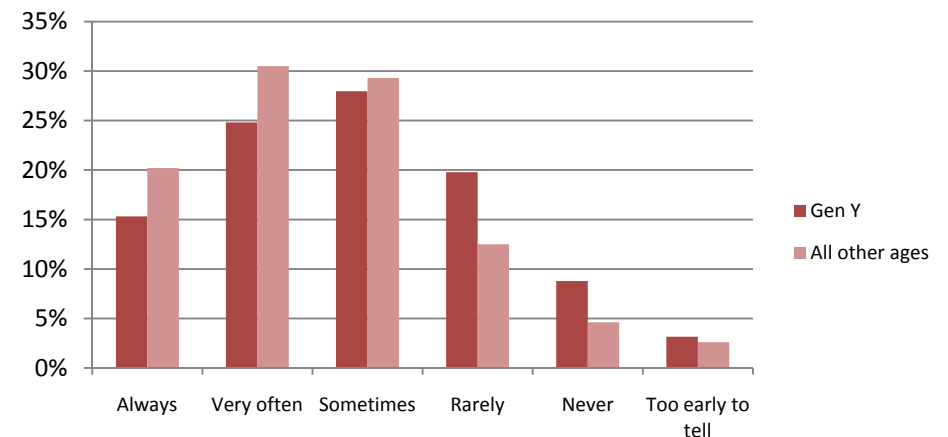


Figure 3: Gen Y and wider survey samples: frequency of information-seeking outside core discipline:

The data show more students in the wider survey sample working this way, which is consistent with the higher proportion studying arts and humanities and social sciences in the wider survey sample.

Constraints on research progress

The Gen Y and wider survey samples concur on the severity of time pressures (3.78 and 3.85 respectively), ranked the highest constraint in both samples (Figure 4).

The Gen Y survey sample and the wider survey sample differ in their ranking of constraints:

- lack of money or the need to raise funds (2.95 and 3.11 respectively)
- family pressures (2.00 and 2.70), which probably reflect the different family circumstances of older students; and
- the need to work to support research (2.17 and 2.95 respectively): only 5% of the Gen Y survey sample are part-time students, in comparison to 34% of the older students, and only 18% are entirely or partly self-funded compared to 44% of the wider survey sample.

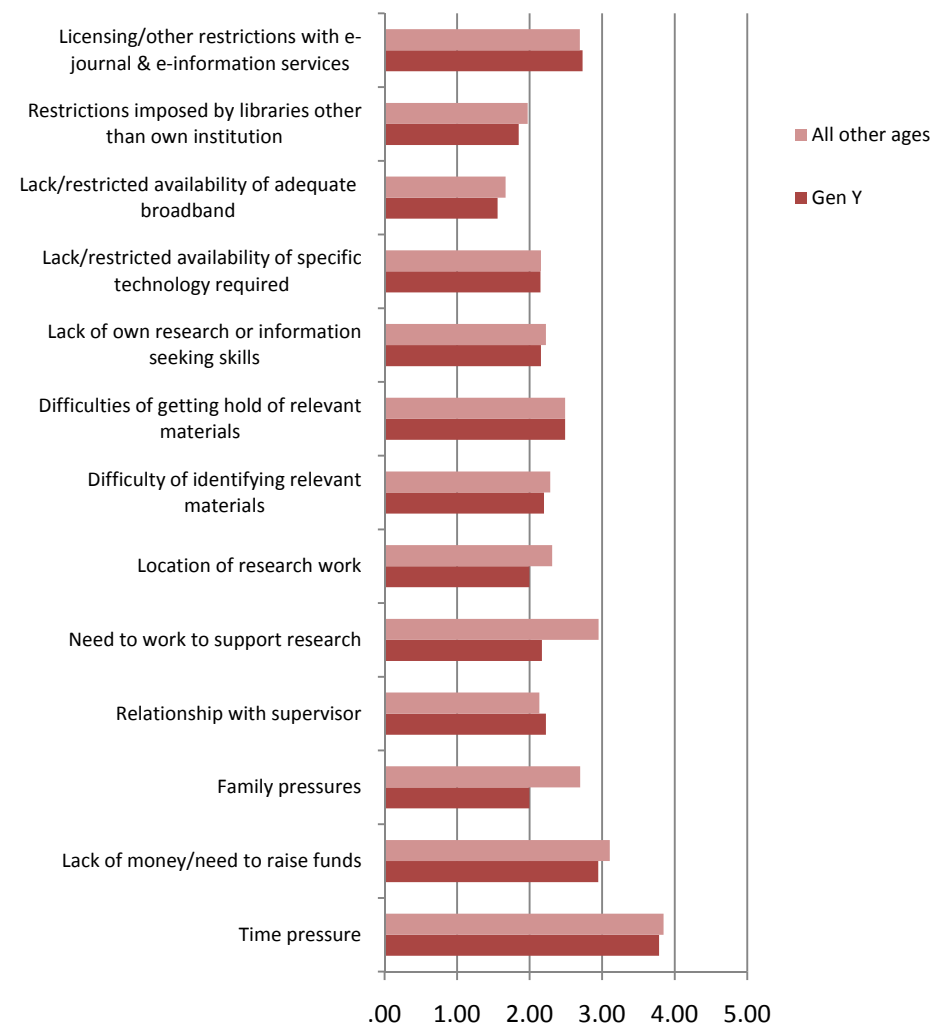


Figure 4: Gen Y and wider survey samples: ranked constraints on research progress:

Attitudes towards information technology

The majority of both the Gen Y survey sample and the wider survey sample self-identified themselves as being in the category of ‘elite technology users’ (Figure 5)²: they have “the most information technology, are heavy and frequent users of the internet and cell phones and, to varying degrees, are engaged with user-generated content. Members of these groups have generally high levels of satisfaction about the role of ICTs in their lives, but the groups differ on whether the extra availability is a good thing or not.” (Horrigan, 2007).

Of the Gen Y and wider survey samples, about 39% take a pragmatic approach, ‘not spending much time thinking about technology’. Rather more of the wider survey sample regard information technology as primarily tools for work not social purposes (42% and 36% respectively).

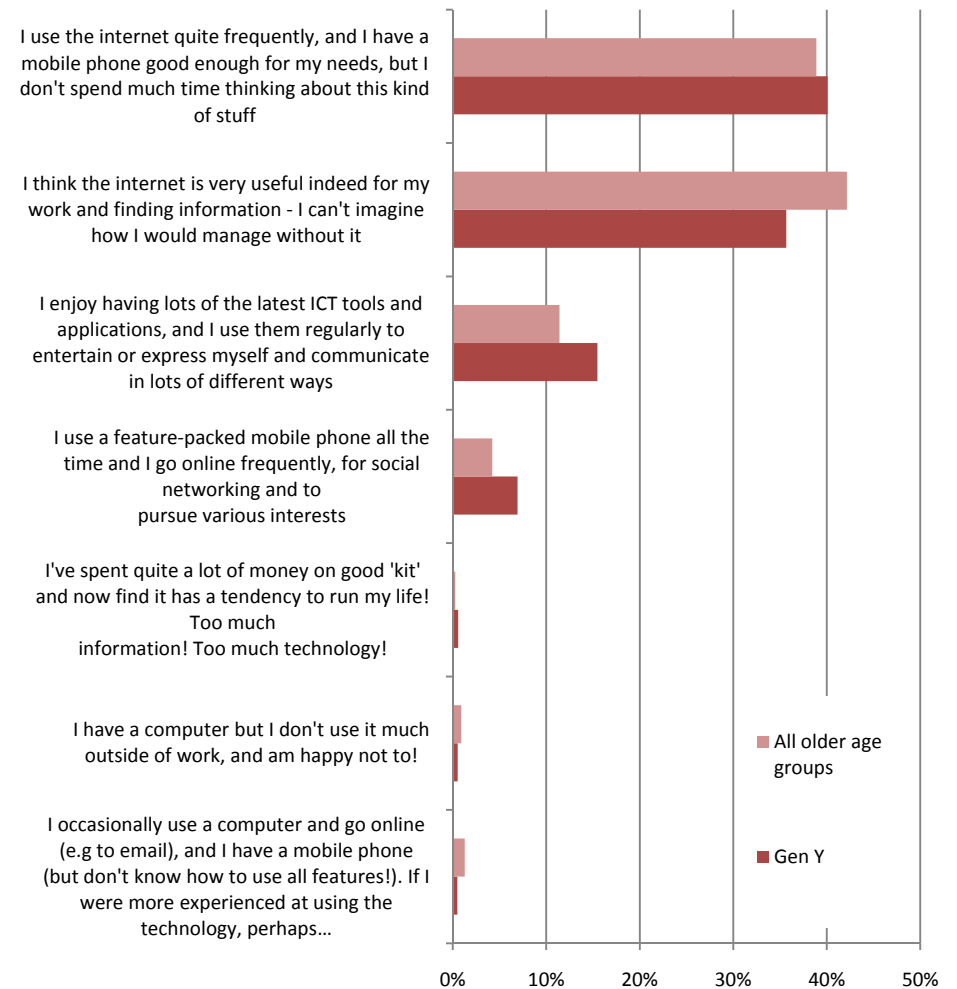


Figure 5: Gen Y and wider survey samples: information technology users by age groups

² See Horrigan (2007) A typology of information and communication technology users (see Annex 2). The Pew research distinguishes between ‘elite users’ of ICTs, ‘middle-of-the-road users’ and individuals with ‘few technology assets’.

6 Research results

During its first year, Researchers of Tomorrow has concentrated on gathering ‘ground-clearing’ data and evidence.

In the national survey, we focused on how Generation Y and other doctoral students search for and use research information, the kinds of resources they use, what training and support in information-seeking and using resources they have received and what kinds of technology tools they use in their research.

The Gen Y cohort has been asked to tell us about who they are, why they are doing a doctorate, what they are researching, where they work and what they think about their research environment, where they turn for support and what training they have received so far.

We present below a summary of the main findings about Generation Y students from this first year, focusing on the following broad areas:

- Ways of searching for research information
- Types of research resources most used
- Using library services
- Using technology in research
- Training and support in research
- The main place of work for doctoral students

The charts and tables show the results for the Gen Y survey sample, unless the research has indicated interesting variations between these students and older doctoral students, in which case we also present the data relating to the wider survey sample.

Direct quotes (shown in italics) from the Gen Y cohort blogs and discussion forums and pen portraits (in plain text) of some of the cohort students (all names changed) are presented in boxes to illustrate findings.

Ways of searching for research information

Google applications are heavily and constantly in use by the students in the **Gen Y cohort**. However, Google is by no means the only or most important source of information: students in the cohort are experienced information-seekers and most use a wide range of online sources.

Jessica, an archaeologist, uses Google Books a lot – “it’s brilliant! Good for tracking down books.” She’s been going through references recently and if it’s not in the library then she goes straight to Google Books.

David (early animated film) commented on how very rewarding it can be (as well as frustrating) to find a reference to something buried in some old book and then be able to track it down eventually through internet and library resources. He uses the internet to pick up and follow leads and hints and not to have things 'handed to him on a plate'

Some arts and humanities students in the cohort find that enquiries using Google can generate an unhelpful overload of research resources; those researching in science disciplines (STM) tend to use more specialised databases.

The **Gen Y cohort** appears to have a sophisticated awareness of the networked information environment in which they work. They source their information and research resources through external as well as their own institutional portals, and from wider generic

internet sites. They are well aware of the potential of using other institutional library resources, both online and offline.

Many among the cohort, however, make assumptions about the ‘joined-upness’, or cohesion, of the academic library network and services across the sector, which can leave them vulnerable to disappointment.

I find the library useful; although I tend to do everything online, so often don't need to go to the library. I often search for journals using the University's online free access to journals, however I find it frustrating when they do not have the paper I am looking for free. I found Athens at my old University much easier than the system I am using now. (Science, technology, medicine student)

I'd have to admit to being office bound when I'm gathering resources. I mostly use the internet to find electronic versions of text (e-books and journals). If I am going to another institution to access resources there, then I'll check online before leaving the warmth of my office (laziness, I know). (Social sciences student)

As well as the labwork, I do of course read around my subject area to both give me ideas and to find out if what I plan to do has already been done. The main tools I use for this are the Cambridge Structural Database (through the ConQuest interface) and the Beilstein and Gmelin databases (through Mimas's CrossFire Commander software). (Science, technology, medicine student)

When asked to think about one critical incident of information-seeking, almost a third (30%) of the **Gen Y survey sample** overall used Google or Google Scholar as their main source to find information, as did just over 30% of the older doctoral students in the **wider survey sample**. However, variation between the two survey samples emerges in the use of one other main source of information: 20% of the **Gen Y survey sample** overall selected citation databases in comparison with only 11% of the wider survey sample: this reflects the greater dominance of arts and humanities and social science studies among the older students in the wider survey sample (see Figure 2).

From a subject discipline perspective on choice of main sources of information, Figure 6 shows an interesting picture of differences in the **Gen Y survey sample**. The majority of science students addressed their information needs through Google and two other big categories of external online sources, while the majority of arts and humanities students sourced their information from a wider spread or 'long tail' of online and offline sources.

Only Google commands a similarly important role as an information source for arts and humanities and social science students alike.



Figure 6: Gen Y survey sample: main source used to find information by subject discipline

Research resources most used

Text-based and secondary sources

In our survey we asked students to think about what kind of information they were looking for in the last critical incident of information-seeking activity they had undertaken. The **Gen Y survey sample** shows the predominance of text-based and secondary research sources in their doctoral research across all subject disciplines.

Figure 7 shows that the majority of the **Gen Y survey sample**, irrespective of their subject of study, were looking for bibliographical information or other published, text-based sources.

The interest in data sources shown by social science researchers is also evident in these results.

We expected to find some variations in the use of text-based and secondary sources between students in different years of study, especially among science students, given that the early years of doctoral research usually focus on literature review. However, the data in both the **Gen Y survey sample** and the **wider survey sample** show no significant variations from year to year, suggesting a continuous need among doctoral students to find secondary and published research materials.

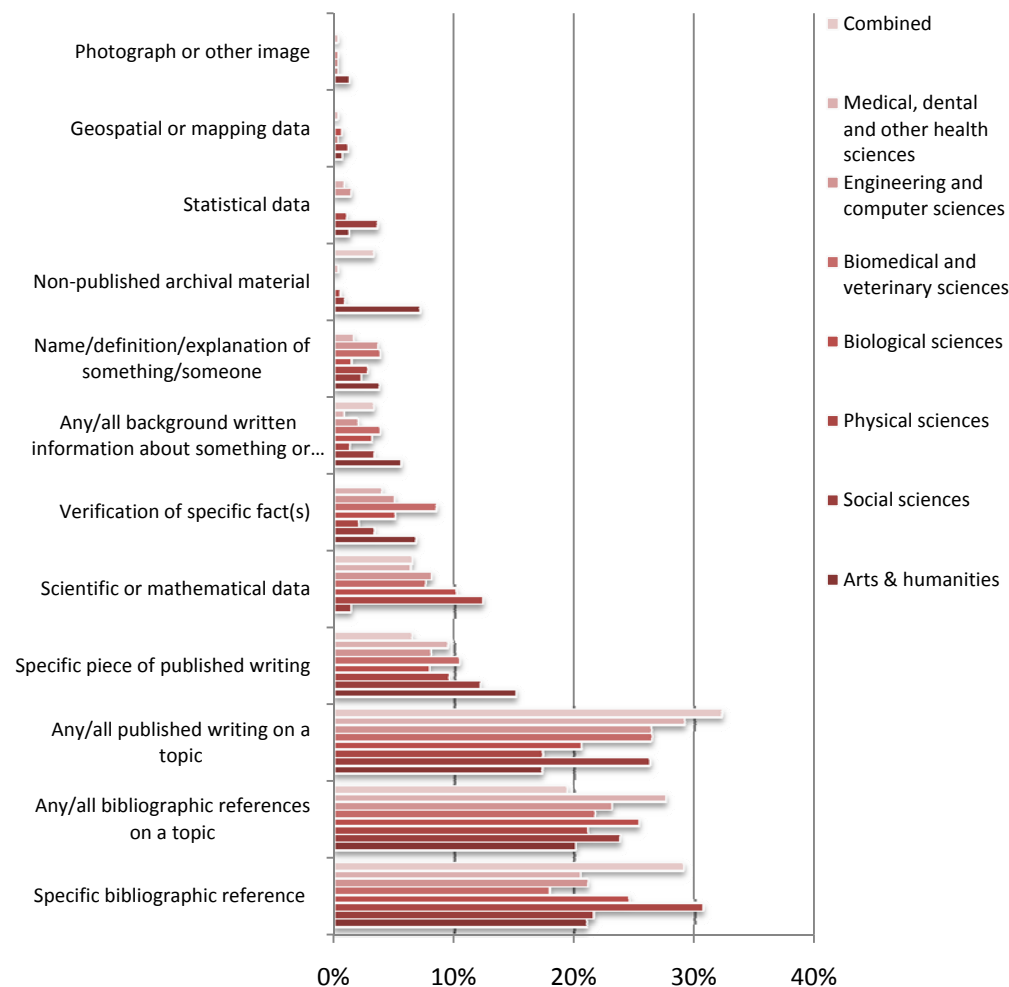


Figure 7: Gen Y survey sample: kinds of research information sought by subject discipline

While the **Gen Y cohort** confirms this continuing reliance on text-based and secondary, published information, throughout all the different stages of their research journey, variations appear according to subject of study.

An early heavy reliance on published and text-based information is indicated across all subjects as the students do the 'ground-clearing' work of their literature review, position themselves as researchers and clarify their ideas during the first months and year of their doctorate.

For many students, the next research 'stage', after the literature review, is to conduct their own original data-gathering through qualitative research or experimentation, or close textual and primary source material analysis. At this point, the science students seem to move to a 'keeping up-to-date' mode:

Brian's research is all primary laboratory work doing experiments and generating his own raw data. He never uses anyone else's data and rarely uses any published material except to keep up to date. His university offers subscriptions to Web of Knowledge and SCOPUS which are all he ever needs

Lucy (a social scientist) started out doing intensive searching of lots of databases but has now learnt much more about her sources and moved on in her research, and has narrowed down to a few e-journals that she consults regularly to keep up-to-date.

The process of seeking and reviewing relevant published works appears to be a more continual one for the arts and humanities and social science students in the **Gen Y cohort**, irrespective of the stage reached in his or her research.

[At the moment I am doing] background work (e.g. locating source materials) - not as much, but I always raid the footnotes and bibliography of any text I'm reading to see if it might hold texts which might be of use to me, and then I add them to an ongoing 'still to read' list. Each library trip, I choose ten books from my 'still to read' list, and get them out! (Arts and humanities student)

My thesis is not a single neat process, but rather an accumulation of materials and ideas which interact with and modify each other, and which are also modified by other people's thoughts, by chance encounters in my reading and by my attempts to improve my facility for expression. (Arts and humanities student)

The dominance of e-journals

Most of the **Gen Y survey sample** told us that they found the research information they were looking for in more than one research resource, but e-journals predominated.

As Figure 8 shows, fewer, though still a substantial proportion of arts and humanities students in the Gen Y survey sample, used e-journal resources. This may be related to the relatively fewer arts and humanities journals published electronically. Equally, the continued importance of the printed book for arts and humanities doctoral students is indicated in these results.

The **Gen Y survey sample** overall varies from the **wider survey sample** in two respects, reflecting the predominance of science students in the Gen Y survey sample and the greater number of arts and humanities students in the wider sample:

- 20% of the Gen Y survey sample found what they were looking for in printed books, in comparison to 26% of the wider sample;
- 77% of the Gen Y survey sample ended up with full-text e-journal articles in comparison to 68% of the wider survey sample.

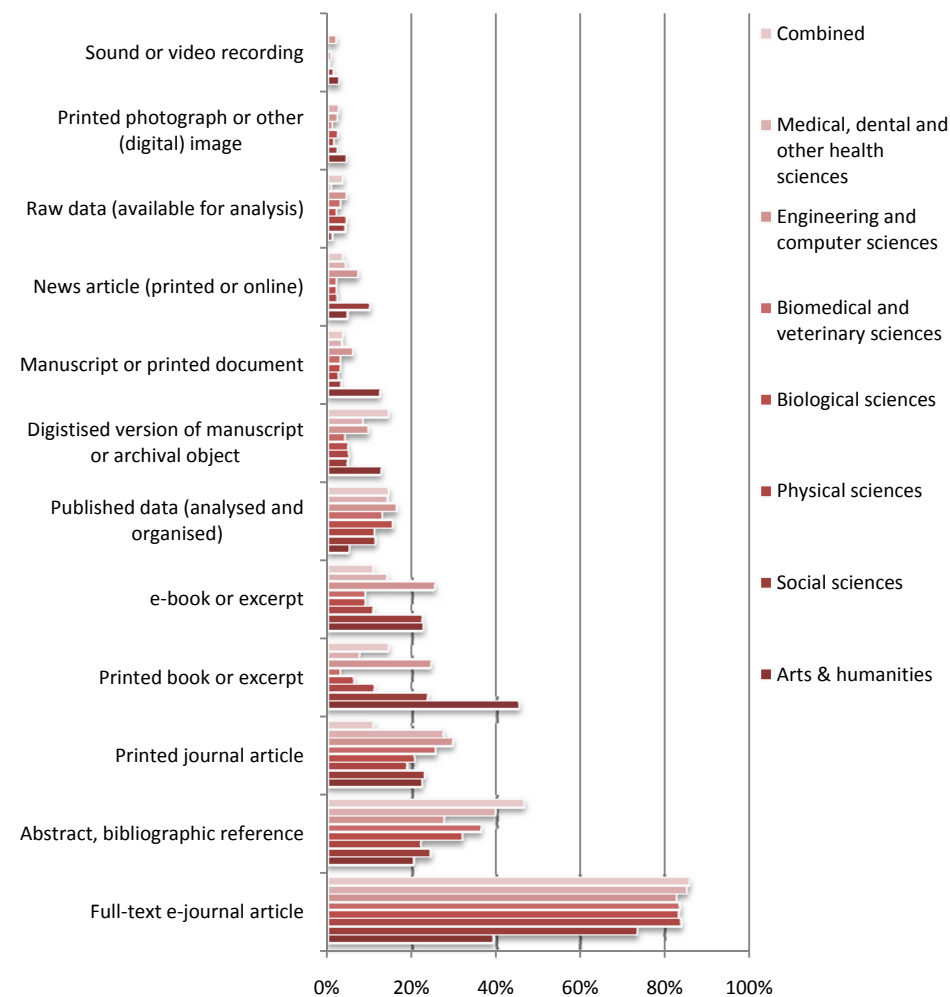


Figure 8: Gen Y survey sample: kinds of research resource used by subject discipline

All the students in the **Gen Y cohort** access e-journal articles at one time or another. Among arts and humanities students there is also a heavy reliance on book and hard-copy journal collections.

The **Gen Y cohort** seems rarely to be aware of the publisher or e-information source itself when searching for e-journal articles: this may be because they usually use their library's own e-resource interface or a Google application to locate and access resources.

Despite the prevalence of e-journals for research, several students in the cohort express ambivalence towards them in terms of their usability and quality of experience.

As someone who uses online journals regularly, their easy accessibility makes research a lot less painful. However, as a postgraduate student who would like to publish at some point, the allure of the tangible, printed volume is far more satisfying than a virtual edition. (Arts and humanities student)

Physical books and journals vary a bit. More and more, the physical subscriptions to journals are being dropped to allow the funds to be used for books/electronic materials. I personally find this disappointing; I find I read more broadly if I'm sat in front of a paper journal. (Science, technology, medicine student)

Access to e-journals

The **Gen Y cohort** indicates strongly that restricted institutional e-journal licences are a constant source of irritation, exasperation and mystification. Depending upon their institution and the subject area of their research (and whether or not this subject area is well-supported by institutional resources), almost all the students encounter difficulties in accessing specific journal articles through their own institution.

Our print journals are ...not very much accessed (although I think this is as much due to students not knowing they are there), and our e-journal facility is quite poor (i.e. only some years are available for some journals). The range of journals is fit for purpose up until MSc level I think, but I would find it difficult if I only had access to my institution's library. (Social sciences student)

I think the institution needs to increase its Athens access - it is one worst I have come across. If it wants to be seen as a research university the students need resources. Getting to a page and clicking pdf but not having access is a constant annoyance and now [we are compiling] a chart as to who had most problems in our office! (Science, technology, medicine student)

With regard to the library at my own institution I am constantly restricted in what is made available in hard copy and electronically. The number of subscriptions to journals made available electronically is limited and while the hard copies I need can be

supplemented through the SCONUL system, additional electronic resources are inaccessible. This is a problem faced by students at all levels at my institution but obviously made worse at PhD level when research is so specialised and in my case requires continual access to contemporary literature. (Social sciences student)

The students adopt several different methods to overcome these constraints: visiting other university and research libraries; calling their friends in other universities to ask them to access the resource on their behalf; putting out pleas on social networking sites, etc.

[It] would be great if [there were a] place where postgrads had [a] forum to tell people what they need and if peoples' Athens could get it they could send a pdf. It's all about sharing and contacts and this [would] be a good way to network diff universities. (Science, technology, medicine student)

Similarly the **Gen Y survey sample** reveals the extent of access problems: Figure 9 shows that 'licensing and other restrictions imposed by e-journals and e-information services', closely allied to 'difficulties in getting hold of relevant research materials', emerge as constraining factors³ across all subjects, especially within the sciences and social sciences.

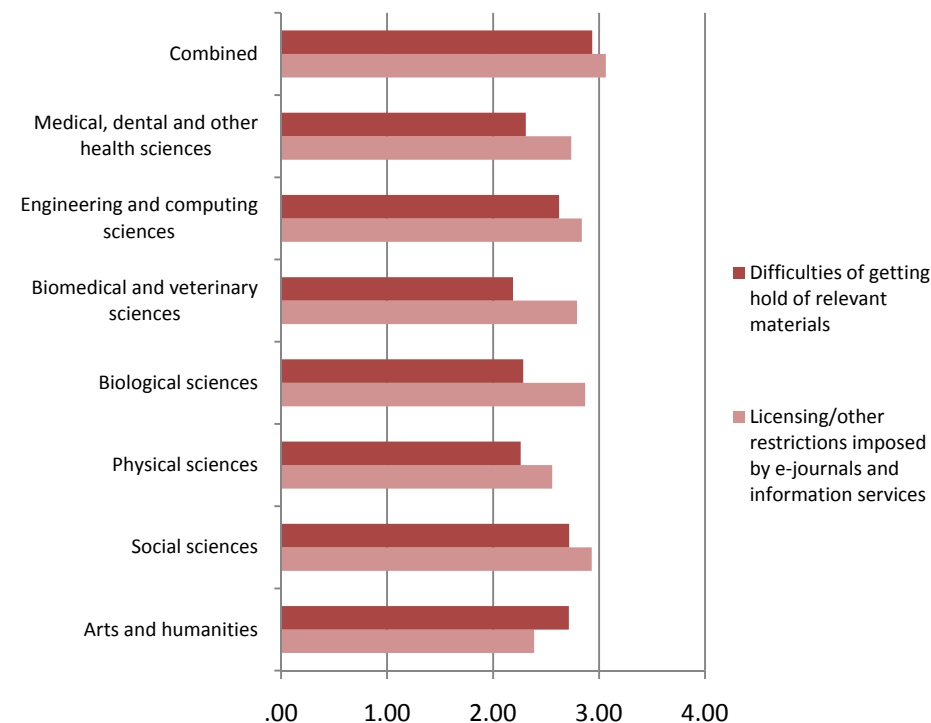


Figure 9: Gen Y survey sample: mean ranking for severity of two constraining factors on students in different subject disciplines

³ ranked from 1 – 5 with 1 being no constraint and 5 being severe constraint

Using open access

Open access in this study is defined as free online access to scholarly works through the removal of price barriers (e.g. subscription fees) and most permission barriers (e.g. copyright and licensing restrictions), making them available with minimal use restrictions (e.g. author attribution only). Open access usually refers to the two most common forms:

- open access publishing, where authors, their employers or funding organisations cover or contribute to the costs of publication in open access journals; and
- self-archiving, where authors deposit their work in open access institutional repositories and/or subject repositories, or make material available on personal and/or institutional websites, or through listservs, blogs and wikis.

Open access research resources

Overall, the **Gen Y cohort** is not aware of or does not completely understand what open access means. This significantly and negatively affects their use of open access research resources. They believe, for instance, that articles published through open access resources will not have been subjected to rigorous quality standards, on which they rely. Arts and humanities students are particularly sceptical about the availability of open access quality research resources. On the other hand, they recognise the impact that this mode of scholarly publishing could and potentially does have on institutional subscriptions and the vexed question of reliable access to e-journals through their own institutions.

Publishing their research outputs in open access

The majority of the **Gen Y survey sample** across all subject disciplines are producing or intend to produce peer-reviewed journal articles (Figure 10). Open access journal articles lag considerably behind in Gen Y doctoral students' output choices. However, the question phrasing did not differentiate between peer-reviewed priced journals and peer-reviewed open access journals, so we believe the situation regarding publishing research outputs may be more complex and will revisit this issue in subsequent surveys.

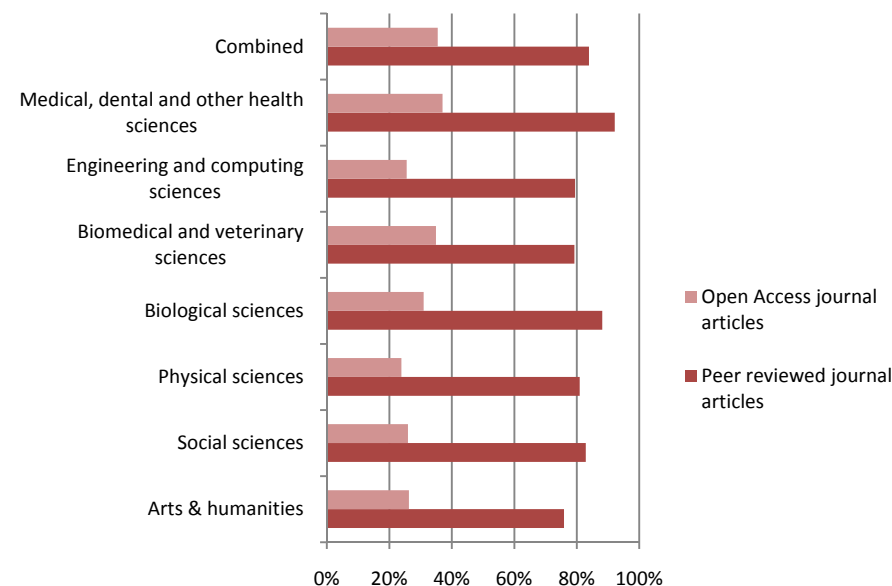


Figure 10: Gen Y survey sample: percentage within subject disciplines publishing or intending to publish in journals

Sharing research findings

These data about open access publishing relate to wider concerns expressed strongly by the **Gen Y cohort** about sharing their research findings and data at this early stage in their research career. The cohort, none of which is pursuing their doctorate as part of a collaborative research team, has expressed (in a discussion workshop) concerns that include credibility and ranking (the 'impact factor' figures highly in Gen Y cohort concerns); confidentiality of data and modes of working; and concerns that other researchers might not understand their data in the 'right way'.

In interviews with the Gen Y cohort one STM student suggested that there is a lack of sharing outside departments and students stick to their own subject groups, working independently. One other student said that her PhD feels more like a job than study because she does not spend time with other postgraduate students and doesn't share her findings or the things she learns.

Other research (see Section 3) has shown that these concerns about publishing through open access and sharing research data are not unique to Gen Y students. Indeed, comparison of **the Gen Y survey sample's** views on publishing their intermediate research results with those of **the wider survey sample** reveals very similar responses (Figure 11), with a slightly higher proportion of **the Gen Y survey sample** publishing or intending to publish in peer-reviewed journals.

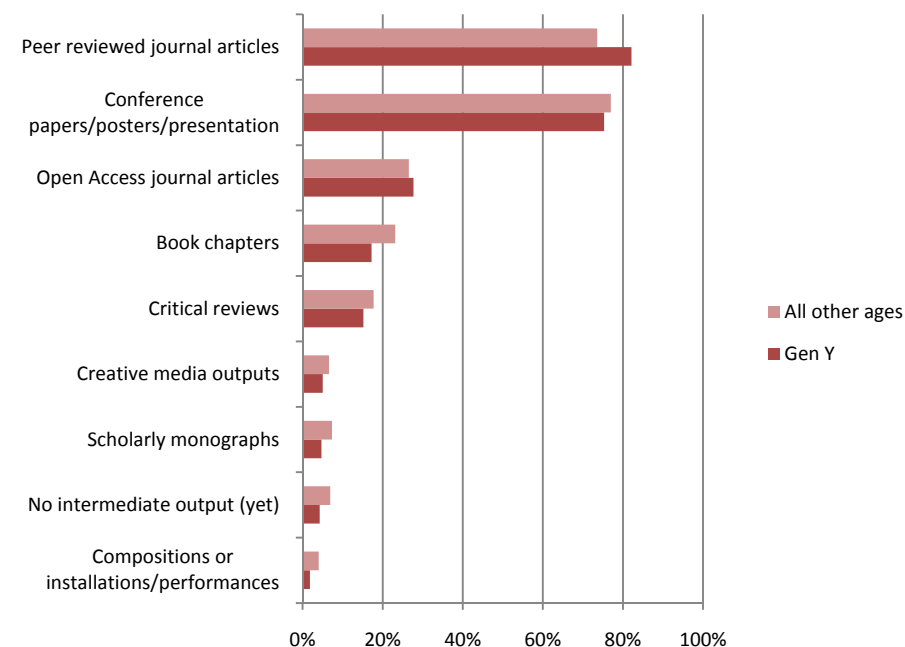


Figure 11: Gen Y and wider survey samples: percentage and intermediate research outputs

Using libraries

Use of students' own institutional library services

Most of the **Gen Y cohort** have a strong institutional focus; they have their main place of work in their institution, and make regular use of their institutional libraries, though not always the physical spaces or collections.

Using library collections

Among the arts and humanities students in the cohort there is a heavy reliance on hard copy book and/or journal collections in their institutional library, although the majority also regularly (and perhaps increasingly) access e-journals. In interviews with the cohort students, expressed levels of satisfaction with availability and accessibility of hard copy book and journal collections are variable, although generally positive.

I've borrowed a couple of books from the library during my PhD so far but mainly so I have a copy on hand if I need it. The library has just extended the number of renewals so that you can have a "long loan" book out for over a year if no one else requests it. This is very handy if it is a good generic text. (Social sciences student)

I use the internet to get articles - mainly through Google Scholar, when connected to the University Network, or through VPN. For hard copies of things, like books or offprints, I use the Departmental Library - to browse the books on the shelves or take some books home. (Social sciences student)

Interviews with science, technology and medicine students in the **Gen Y cohort** indicate that very few physically visit their institutional library with any regularity. However, they are aware of what it offers and think it is 'ok' or 'good', but are more likely to access the resources electronically from a remote PC.

Bob says his university library is very good for his area and general social science (though he rarely actually goes there) but less good on some of the very contemporary books and e-journal articles that he needs. Quite a lot of his source material is in more 'popular' areas, e.g. business, and the library doesn't stock them. He has never bothered to try inter-library loan. He uses the internet a lot - Google Scholar and Wikipedia. He tends to go straight to 5 or 6 e-journal databases to do searches before using Google Scholar to track down references and authors. He follows a lot of blogs, and he makes extensive use of RSS and alerts on databases when they exist, though he says some of them are very unsatisfactory because they are hard to set up and not specific enough.

Many students in the cohort (across all disciplines) prefer hard copies of documents and materials because they are considered easier to annotate and reference – therefore most will print out or photocopy and store them in hard copy.

Patsy (a scientist) says her institution's offering of resources is "amazing". She uses electronic resources and books and visits the library every 2-3 weeks. She gets extra time with books because of her dyslexia. The library has really good search facilities for books; you can reserve. She uses e-journals mostly: prints off articles and "highlights to death".

More and more, the physical subscriptions to journals are being dropped to allow the funds to be used for books/electronic materials. I personally find this disappointing, I find I read more broadly if I'm sat in front of a paper journal. (Science, technology, medicine student)

Using library services

The research focused on two services typically offered by HEI libraries: inter-library lending and document supply services and the advice and input from subject specialist library staff.

The majority of **Gen Y cohort** students across all disciplines make use of inter-library lending services at some time or other. This is supported by evidence from the **Gen Y survey sample**: Figure 12 shows that regular use is more common in arts and humanities but significant numbers of all subject disciplines have used inter-library lending services and only a very few students are not fully aware of the inter-library loan and document supply options offered, even if they have not used the services.

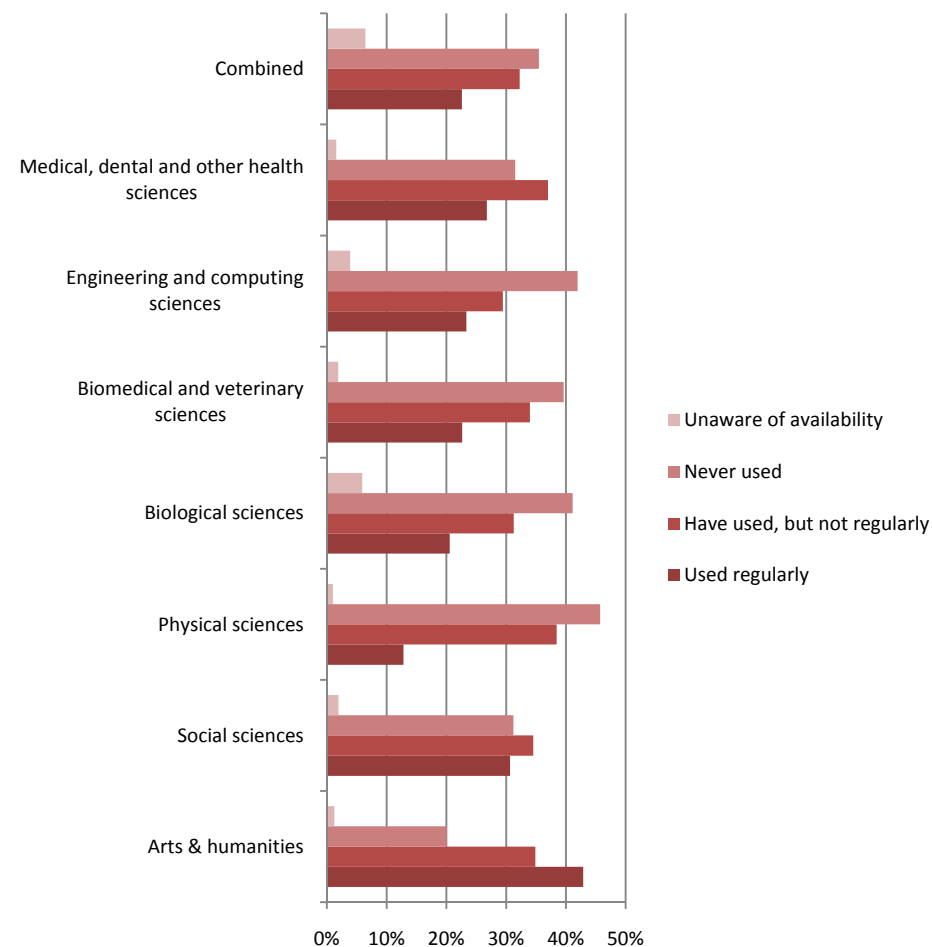


Figure 12: Gen Y survey sample: use of inter-library loan services by subject discipline

In relation to the use of subject specialist advice and services, however, the picture across subject disciplines from the **Gen Y survey sample** appears quite different: Figure 13 shows that a high proportion of the **Gen Y survey sample** has never used subject specialist library staff support, particularly in sciences.

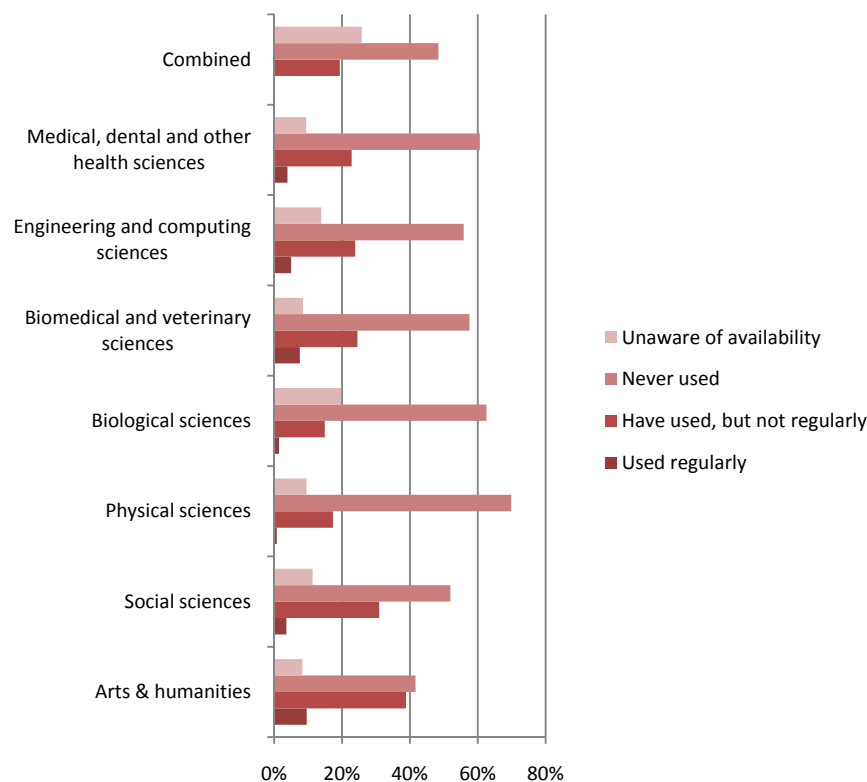


Figure 13: Gen Y survey sample: use of research support from subject specialist library staff by subject discipline

If we compare the **Gen Y survey sample** with the **wider survey sample** of older doctoral students (Figure 14), we see that 15% more of the **wider survey sample** have used or regularly used subject specialist librarians; the majority (57%) of the Generation Y students have never used advice and help from subject specialist library staff, compared to 42% of the older students.

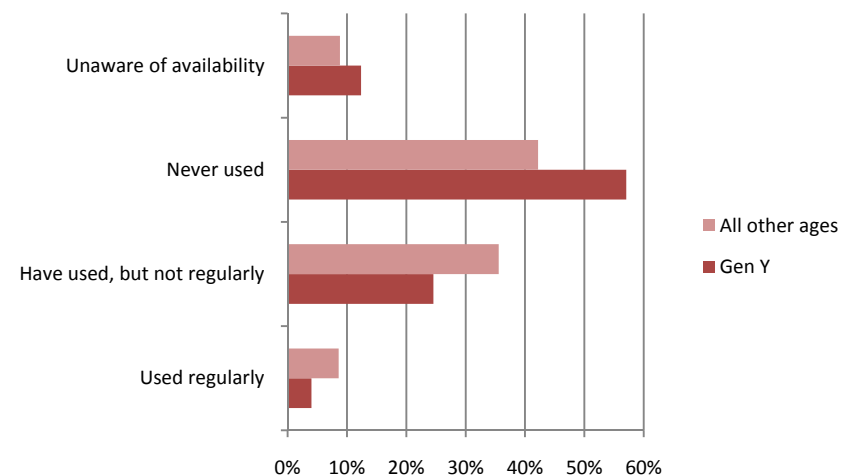


Figure 14: Gen Y and wider survey sample: use of research support from subject specialist library staff

Using other libraries

Academic libraries

Most of the **Gen Y cohort**, across the subject disciplines, use other academic libraries regularly, either accessing resources online or physically visiting them, or both. They appear to rely on this access to other university libraries for one of two main reasons:

- to overcome inadequacies or gaps in the collections of their own institutions;
- because they work or live somewhere else and other university libraries are more convenient.

I am rarely on the campus at this point in my studies as my research is carried out at a local hospital. This means I actually access online databases through a portal provided by another university. I find that I can access most of the journals I require, with very few not being available...Unfortunately I have found that when I am on campus I do not have access to some of the journals which are available at the hospital..... (Science, technology, medicine student)

I do use the libraries of other institutions in my local area to access books that my university's library doesn't have, which again is a regular occurrence. I also use these institution's libraries and public libraries as a workspace as the library at my home institution does not provide a work environment conducive to doing any substantive work. (Social sciences student)

I generally use the university library to access resources, however I live in Leeds so have, on occasion, used the Leeds/Leeds Met libraries - but perhaps not as much as I could have. I know the Leeds university library has many more resources in terms of books/journals but I'd only be able to use these for reference. I have SCONUL access to Leeds Met library which means I can borrow a few books and use computers which is really good. (Social sciences student)

Libraries external to HE

In the **Gen Y cohort**, at least half the arts and humanities students use primary resources, including archival sources (original published play texts, film archives, image archives) as the basis for their own analytical and original research. This almost always involves going physically to some other library or archive (even where many of the resources have been digitised).

Catherine is a History of Art student based in Scotland.... She does most of her research at the National Library, where it is quiet, there is always space and she has easy access to all texts – better than in her institution. She uses online databases of images and manuscript catalogues, downloading and storing resources onto a USB stick and photographing images stored in the library. She goes to a variety of places to seek resources – the BL, National Archives, and national museums and art galleries.

Using technology in research

The **Gen Y cohort** vividly illustrates how heavily doctoral students rely on information and communications technology, from simple dependence on having all their work stored on their laptop and almost continuous checking and rechecking for new research resources through their favoured online applications, to a general readiness to experiment with new tools and applications to help them organise and record their research (e.g. Endnote, BibTeX).

It seems important, however, that these new tools and applications do not 'transform' the way that the students work (and wish to work); for instance a social sciences student tells us:

My supervisor and I did have an exchange earlier in the week about the Times Higher Education report on this study -. We both found it slightly amusing that I was expected to be making use of "virtual-research environments, social bookmarking, data and text mining, wikis, blogs and RSS-feed alerts". I don't know what most of those things are, but I'm pretty sure none of them are reading articles, writing down my ideas, and discussing them with my supervisor, so I'm not going to panic about my development just yet! (Social science student)

However, he also reveals that he has:

used the Alceste software [textual data analysis] package for a first run at classifying the themes of the parliamentary discussion before the war, and expect to use it quite a bit more over the course of my work. (Social sciences student)

Technology tools that they do use in their research are readily taken up if they complement and enhance the students' existing research practices and behaviour and can be relatively easily understood and absorbed into existing work practices.

I've found that iTunes U can be quite useful to compliment reading. Not only do the methods vary (so my eyes don't phase out in the middle of a page), but I can use them at different times. I've loaded a couple of lectures onto my iPod and listen to them on my way into Uni. Some of the material on iTunes is quite general and some too specific, so I wouldn't rely solely on this method but together with reading and/or classes it makes a handy tool. (Social sciences student)

However, there are some indications from the **Gen Y cohort** that the students are discovering (by themselves) ways of using emergent technologies such as Web 2.0 – with which most of them are competent and familiar in their personal life – to good effect in their research.

Outside of university I find myself using resources like RRS feeds and Twitter quite a lot in order to keep up to date with events and sources of information of possible use to my PhD project. (Social sciences student)

Deborah is based at the interdisciplinary Centre for Medieval Studies networks widely outside the University too: during her first year she used Facebook to contact all her academic history contacts and included their Facebook contacts in her request for reading recommendations and it got her a terrific response.

Low levels of use of specialist and web 2.0 technologies are confirmed in the **Gen Y survey sample** and there are virtually no differences at all in responses when compared to the wider survey sample. We asked the survey respondents to tell us how much they used and valued a range of technology-based tools, including Web 2.0 applications, in their research.

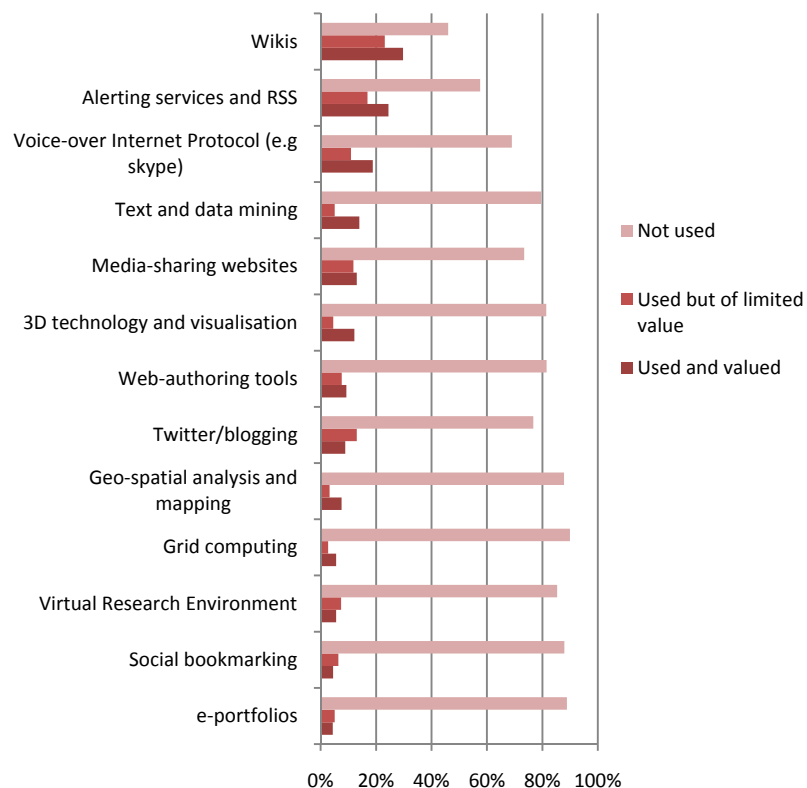


Figure 15 Gen Y survey sample: use / value of technology tools

Figure 15 shows that a relatively high proportion of the whole **Gen Y survey sample** has not used any of the listed technology tools for their research, even though they are, in general, highly competent information technology users.

The lack of take-up of specialist and Web 2.0 tools in their research is clearly not a question of lack of skills. Evidence from the **Gen Y cohort** suggests that it is more likely to be because the students do not see the immediate utility within their research and their preferred ways of working.

Despite the low overall take-up of technology tools, there are some interesting variations in use and value of tools in different subject disciplines: Figure 16 shows which of the technology tools are used and valued by the highest percentages of students in the Gen Y sample by subject discipline.

These data indicate, for instance, that more science students than arts and humanities or social science students in the **Gen Y survey sample** use and value alerting services and RSS (30% of biological science students in comparison to 19% of arts and humanities students, for example), and that, unsurprisingly, more science students use text and data mining tools (24% of biomedical students in comparison with 11% of social science students).

On the other hand, it appears that arts and humanities and social science students may be slightly more inclined to use social networking tools to support their research. Thirteen per cent of arts and humanities have used and value twitter and blogging in their research, in comparison to 5% of physical scientists.

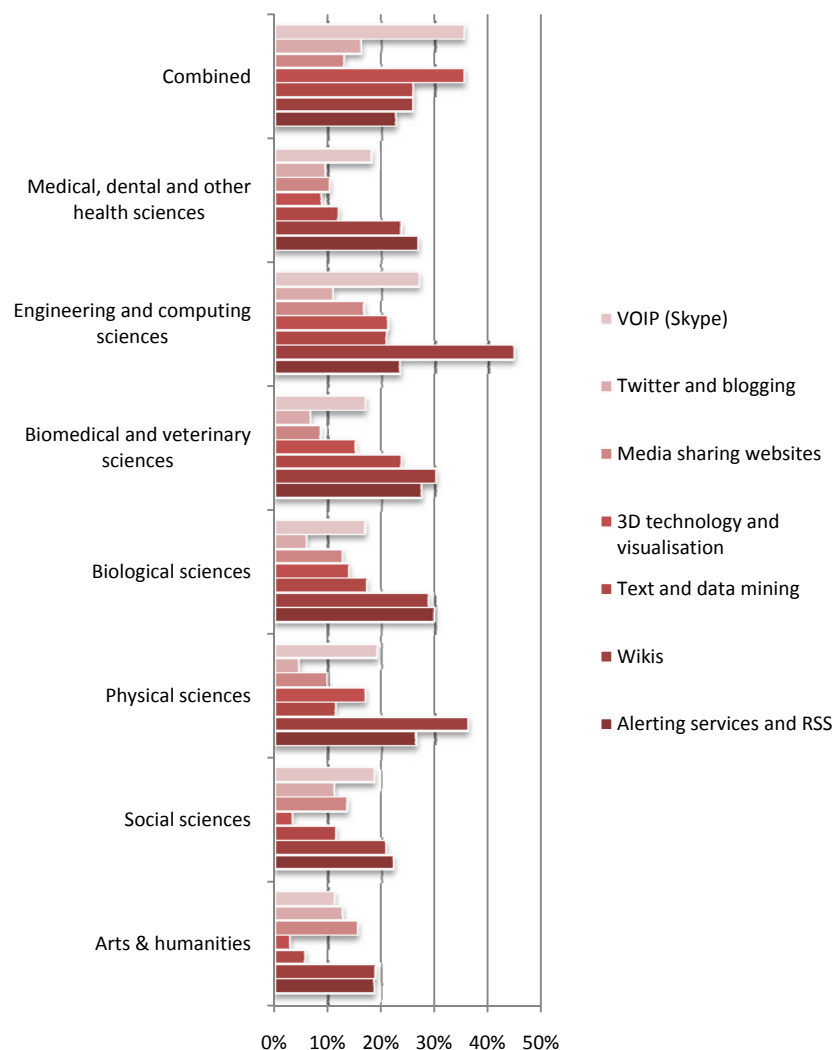


Figure 16: Gen Y survey sample: technology tools most used and valued by subject discipline

Choosing open source

Several of the **Gen Y cohort** students favour open source technology applications (e.g. Linux, Mozilla) to support the way they want to work and organise their research. They are critical of their own university's lack of technical support for open source applications. None of the cohort has singled out institutional IT staff as particularly supportive to them in using technology or learning about different applications.

The university's support and encouragement for Microsoft is really annoying - they've just created a new email / calendar / workspace thing (basically like the awesome Google suite) which only has full functionality in Internet Explorer. The computer service provides some support for Apple, but hardly any for Linux. But I think that the new undergrads with their netbooks are more likely to have Linux now than before, so maybe it might change. There is of course lots and lots of support for open source on the internet. (Science, technology, medicine student)

I like that the fact that I've so far been impressed by what I try [in open source] and I'm not paying out huge sums of money for applications I'm not that happy with. So, based on my successes with dabbling in open source applications, I definitely think I'll try out some more! (Arts and humanities student)

I am experimenting with ways of taking and organising notes on my laptop (currently in the form of OpenOffice documents, but this may change). As I use Ubuntu as the operating system on my laptop, I have created a new bibliographical database in the BibTeX format using JabRef (I have become very dissatisfied with RefWorks). I am also considering changing to a different word processor, which uses the LaTeX document markup language. So far my experimentation with different software has been quite a difficult process, but I hope to find an effective way of working at this early stage, so that I don't have to change it further down the line. (Social sciences student)

Training and support in research

Universities have interpreted the requirement to provide research skills training to doctoral students in varying ways, often with a core of mandatory modules and a range of elective training courses, some of which are online, and short seminars.

Although Researchers of Tomorrow has asked questions specifically about research and information-seeking skills, **the Gen Y cohort** has responded with reactions covering wider research skills training than this sub-set. Though these reactions are interesting, the study will focus in the next year more particularly on the efficacy of training in information-seeking, using research resources and technology.

Within institutions, training appears to be provided through different units and departments, including the Doctoral Training Centres and the library services, depending upon the content and, sometimes, disciplines involved. From the students' perspective, it seems immaterial where the point of provision lies and whether or not the training intervention is part of a formal Research Skills Programme or more *ad hoc* and demand-led.

Formal training

Among the **Gen Y cohort**, about one third of the students have received formal research skills training since starting their doctorate; of these many do not have a high opinion of its quality or usefulness to their research. Some students are obliged to undertake formal research skills training in order to accumulate

credits for funding bodies. Problems with training sessions identified by the Gen Y cohort include:

- training was more suited to Masters or undergraduate students, and not pitched at a sufficiently advanced or detailed level;
- it is not available 'on-demand', making it much less useful to doctoral students; those who tried to seek out training (a small minority of the cohort) found it difficult and by the time they succeeded it was no longer timely;
- training courses tend to be generic, not tailored to individual students or groups of students in specific fields; this generic nature makes sessions on finding and using research resources of particularly limited value.

This term I have quite a few Research Skills Programme (RSP) Courses to do which I know from last year are time consuming and thus can be thesis-consuming too! After a term of a few days here and there taken out to do these courses, I felt about a month behind, and had to 'catch up' over the summer. Thus, ironically, courses which are supposed to help our research actually hinder it by detracting from the work in hand. (Arts and humanities student)

Asked about what more training they would like, most of the **Gen Y cohort** students said they either do not need any more or that they need more advanced training tailored to them as doctoral students, such as advanced IT or research methods training that builds on their existing knowledge.

Among students who have attended library-led training sessions (usually elective), the response has been generally more positive.

Sessions provided by the library are excellent, covering everything from basic IT skills to advice on finding research matter. And they are also great for meeting and learning from other PhD students. I actually learnt to use RefWorks following a library session on research skills, when a neighbour decided to take some time afterwards to show me (Science, technology, medicine student)

In the **Gen Y survey sample**, over half the sample had received some kind of useful training in information-seeking and research resource use. There are no significant variations between the Gen Y and **wider survey sample** in this area. Figure 17 shows that using their own institution's information portal and finding/using research resources, such as subject-based bibliographical and journal resources, are among those kinds of training received by the majority of respondents.

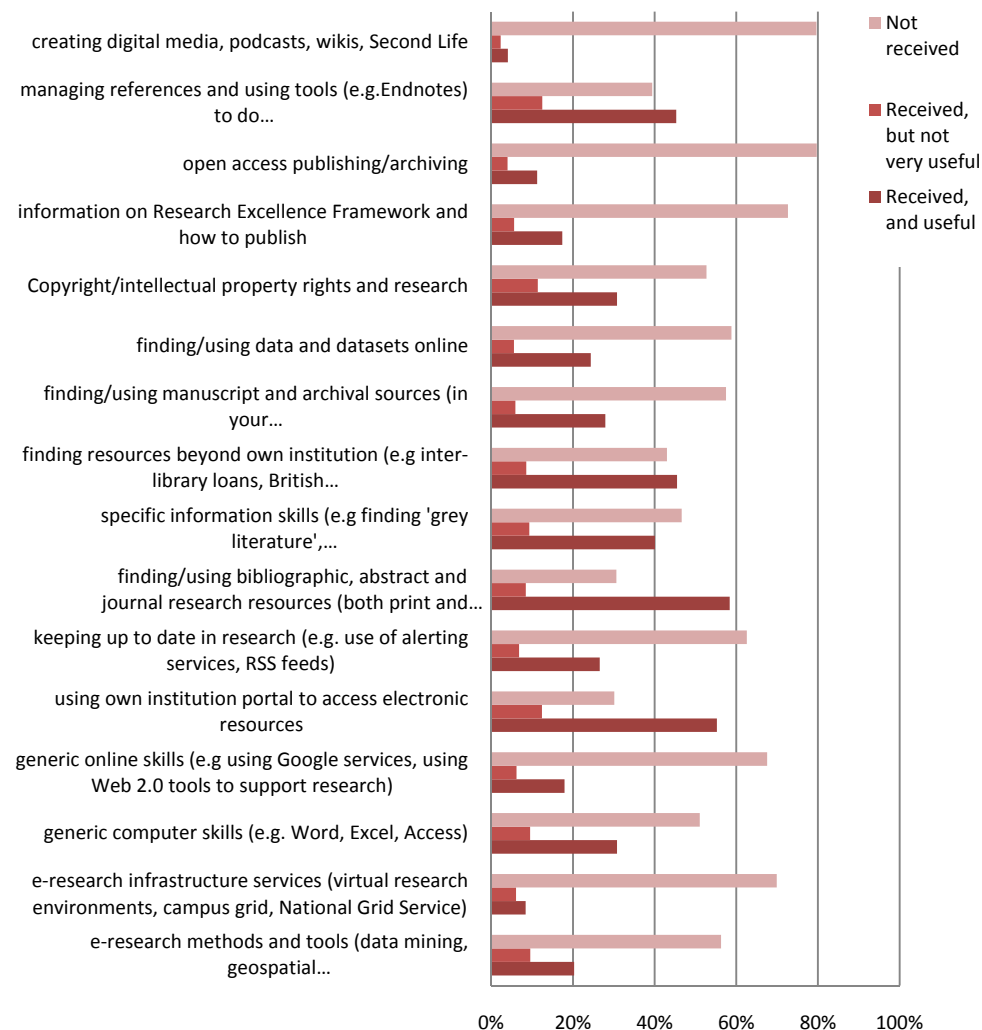


Figure 17: Gen Y survey sample: training received and usefulness

Many fewer students in the **Gen Y survey sample** had received any training in more advanced technology-based resources and tools, such as using e-research infrastructure and e-research methods or the use of Web 2.0 applications. This is consistent with both the keen focus amongst Gen Y doctoral students on using secondary and text-based research resources, which do not demand any particularly specialist or unusual technology applications, and their more general attitudes to the use of emergent technology in their research, as described in the preceding pages. As this kind of training tends to be demand-led and elective, the majority are currently unlikely to spend time acquiring skills in technologies that they do not need to use.

Informal support

Many of the **Gen Y cohort** students express a preference for reaching out for support and advice from their supervisors, other academic and library staff and their peers, rather than attending formal training sessions to address their skills and knowledge gaps. Generally, they feel that they know where to go for help if they need it.

This picture is borne out by the responses from the **Gen Y survey sample**: Figure 18 summarises the main kinds of research support used and valued by the sample. Value was assigned by the respondents whether or not they regularly made use of the support. Support from supervisors in identifying research resources is valued by the highest proportion of the sample, with inter-library lending services and assistance specifically from library staff coming joint second.

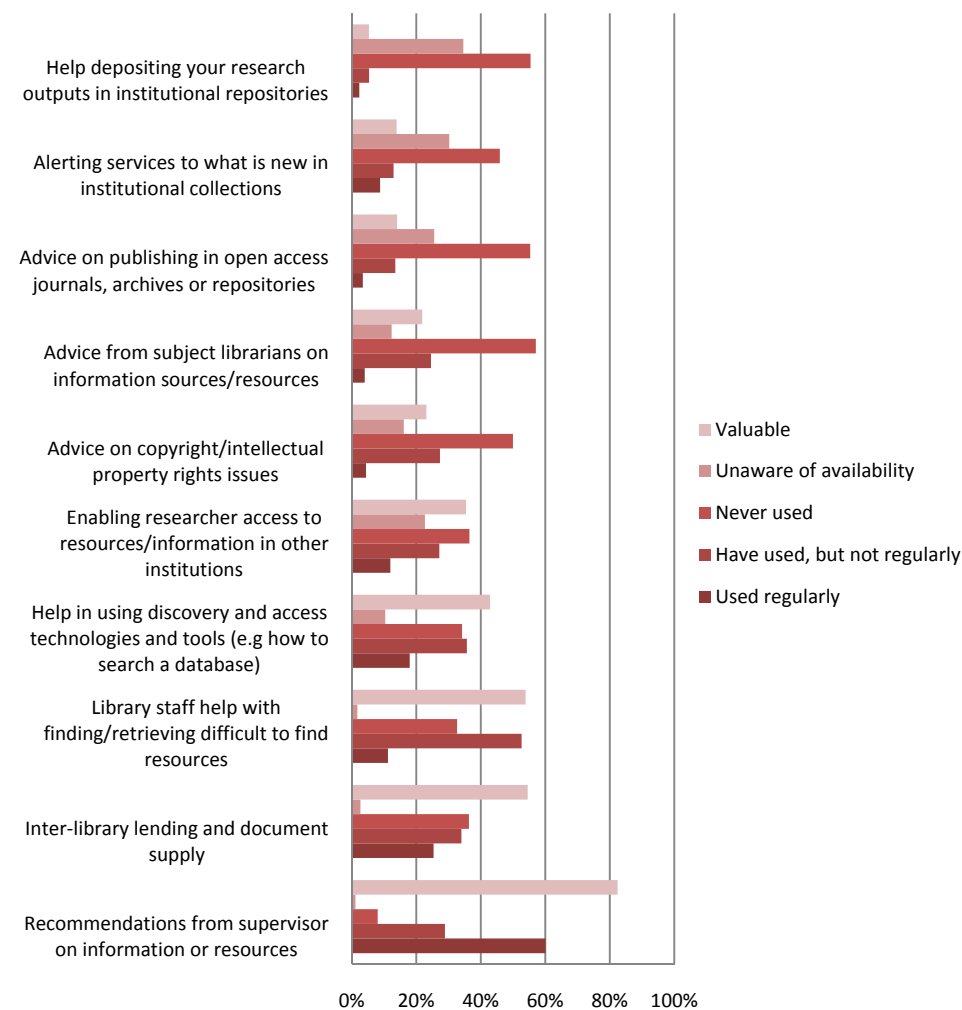


Figure 18: Gen Y survey sample: research support use and value

Library staff

In contrast to the use of subject specialist librarians' advice and support, which appears in the **Gen Y survey sample** to be used by very few students outside arts and humanities (see Figure 13 above), Gen Y students from all disciplines do use more general library staff support, whether or not this is through physical visits to the library itself.

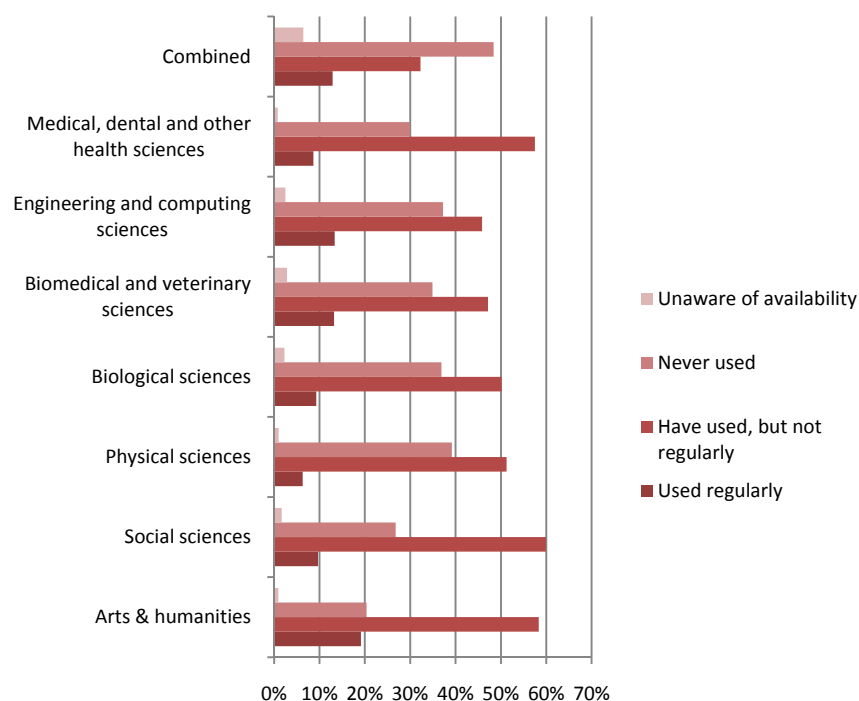


Figure 19: Gen Y survey sample: use of library staff help in finding and retrieving difficult to find resources by subject discipline

Figure 19 indicates that more or less half of all the **Gen Y survey sample**, across all disciplines, had made some use of library staff assistance in finding and getting hold of the more difficult to find research resources. However, 33% of the **Gen Y survey sample** have never used this kind of library staff support compared to 21% of the older students in the **wider survey sample**.

Within the **Gen Y cohort**, research help and support from library staff, not only in their own library but also in external library and archival services, is very important to arts and humanities and social science students, though less important to the students researching in the sciences.

Most of the students who use their support services value the knowledge, experience and helpfulness of the library staff to whom they turn for help.

[T]here's always someone friendly on the helpdesk to help out if there's a problem finding something. I even phoned our library from New York once to try to get hold of an article I couldn't access online, and the guy on the phone helped me to get it in about 5 minutes! (Social sciences student)

What I like most is that the librarians are quite possibly the most enthusiastic and helpful people ever, and I certainly recommend finding a librarian who knows their stuff, because I have had tremendous amounts of help with my research so far, just simply by asking my librarian the right question. In one month I have mastered RefWorks, know all the key Journals where my work

would be, improved my note taking skills, searching skills and finally cracked Metalib. (Science, technology, medicine student)

One resource that I have found extremely useful at the Library is the Information Retrieval Officers, who are available to help suggest data sources or alternative forms of data. Unfortunately, at the moment there is only one officer per school. (Social sciences student)

The librarian here in charge of PGRs has also been most helpful in teaching me about searching and assisting me in finalising the search terms I should be using. This in turn makes lit searching so much more efficient which is always a bonus! (Science, technology, medicine student)

Supervisors

Most of the students in the **Gen Y cohort** have two supervisors, although some have up to four. They rely heavily on their supervisors for broad support and guidance on the development and direction of their research, particularly in relation to research methodologies, ideas development and quality assurance.

In terms of seeking information, I pretty much just turn to my supervisor as he tends to be able to get hold of any papers that our library does not have access to. (Science, technology and medicine student)

My supervisors are certainly the people who have provided articles, useful references and potential methodologies for the project. At the start of the project their help in identifying sources of literature was fantastic, although at this stage in the project my information gathering and lit searching is now far more independent and down to me. (Science, technology and medicine student)

The **Gen Y survey sample** shows (Figure 18 above) how valuable students regard recommendations on research resources from their supervisors and that a high proportion of the sample turn to supervisors for this kind of support. More Gen Y students (60% of **Gen Y survey sample**) than doctoral students in older age groups (49% of **wider survey sample**) regularly rely on their supervisors in this way.

However, it appears from the **Gen Y cohort** that support from supervisors in information-seeking and using research resources may be more nuanced than it first appears. In interviews with the students in the **Gen Y cohort**, we found that the majority of students do get help from their supervisors in looking for resources. Supervisors might recommend specific articles, pulling down books from their own shelves to share, or direct them to particular archives and other collections. Among the few whose supervisor could not, or would not, recommend resources, the reasons included

- the students knowledge had now surpassed that of their supervisor, or

- the supervisor is more inclined to support the student in other ways, regarding the identification of relevant resources as ‘part of the doctoral journey’;
- the student rarely saw or communicated with their supervisor.

Although I do a lot of searching for information myself and then go to [my supervisor] when I can't find enough info or the right info. She is always very careful not to give me too much information, but to give me hints and then make me go and find the information myself! (Science, technology and medicine student)

Computer scientist Geri's supervisor recommends and emails links to books/articles and conferences and helps her to network with people and companies.

Veronica, studying genetics and nursing and without an MSc degree, struggles with locating resources and has little help from supervisors. She undertakes “mostly self-initiated searches” although the supervisor might suggest places to look if she asks.

When it comes to getting help and support for using technology tools in their research over 30% of the **Gen Y survey sample** also turns to their supervisors (Figure 20). Evidence from the **Gen Y cohort** suggests that this percentage is likely to be students using specialist technology tools, such as textual and data analysis tools,

that have been recommended to them by their supervisors, rather than more generic or Web 2.0 tools. For these, it seems that Gen Y doctoral students mainly rely on their peers for support.

Student peers

Figure 20 indicates that Gen Y students are more likely than older doctoral students to rely on their fellow students and peers for support using technology. Peer-to-peer training and support have the advantages of being *ad hoc*, desk-based and needs-driven.

One thing that I have found is that supervisors often tell you to go and talk to other PhD students. Partnership working is a small aspect of my topic, for example, but collaborative working is a huge part of Nora's, so I went to talk to her about it. And then Gibran found that I was looking at Actor-Network-Theory, so we had a chat about that, and swapped some references - which was really helpful too. Working in research groups, and together in big labs/ offices really helps too. (Social sciences student)

The **Gen Y cohort** suggest that the majority of students, irrespective of their discipline, value the support and advice they get from their peers and networks of research contacts.

I share my office with 4 other PhD students who are at different stages in their PhD's who are also very supportive and useful in sharing information and bouncing ideas from regarding my research. This really helps puts things in perspective. Those who have been there longer than me are great in putting me in the right direction with regards to research/academic related information. (Social sciences student)

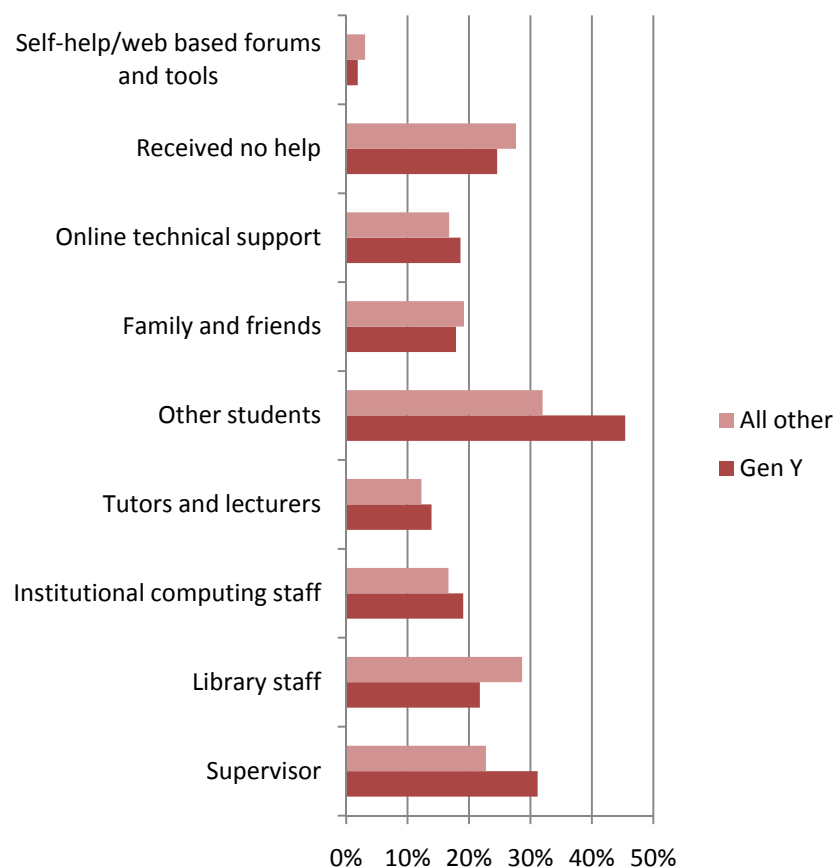


Figure 20: Gen Y and wider survey samples: sources of support in using technology tools

It does appear, however, that science students place a much greater, positive emphasis on having access to this support.

This is consistent with a higher proportion of science, technology and medicine students in both the **Gen Y cohort** and in the **Gen Y survey sample** choosing to work mainly from an institutional base rather than from home.

I am also in the privileged position of sharing an office with 9 other PhD students studying in the same field so we share books amongst ourselves and between us we have a couple of bookcases of relevant texts. (Science, technology, medicine student)

What is not yet clear is how effective this peer support is; whether, for instance, it results in significantly greater adoption and use of innovative technology tools to support doctoral research overall, and whether this implies a disadvantage in working mainly from home.

Main place of work on research

While students tend to vary where they work according to the kind of work they need to do and the kind of resources they need to access, Gen Y students overall are more likely to work principally from an institutional base than older doctoral students (Figure 21).

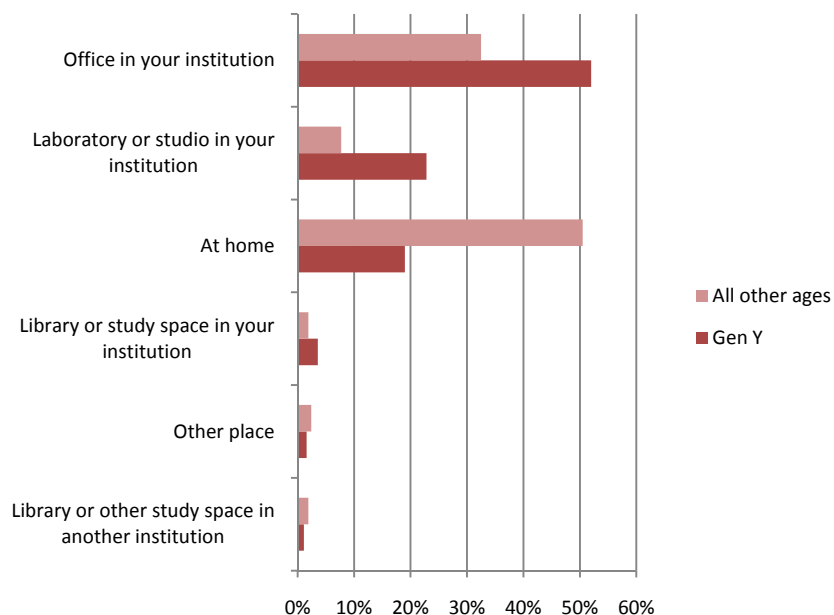


Figure 21: Gen Y and wider survey samples: principal place of work

This difference is probably largely explained by the much greater prevalence of arts and humanities and social science studies among the **wider survey sample** than in the **Gen Y survey sample**. Within the **Gen Y survey sample** there are marked differences in

choice of main work base between the subject disciplines, as Figure 22 shows: considerably more arts and humanities students favour working from home than those in other disciplines.

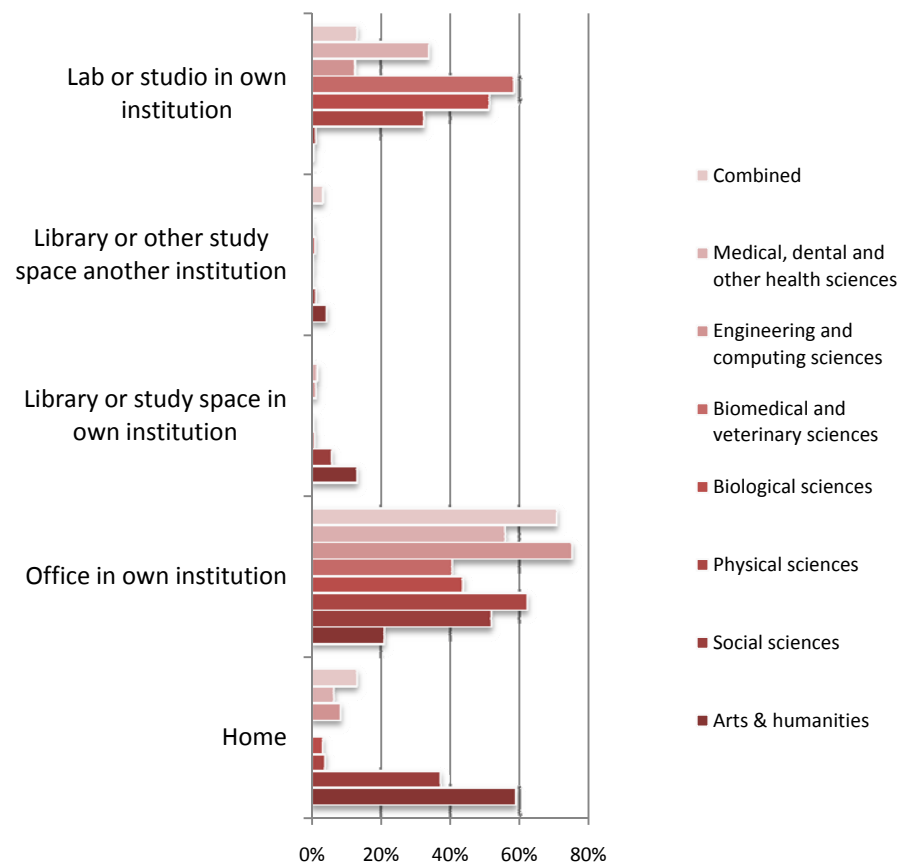


Figure 22: Gen Y survey sample: main place of research work of Gen Y survey sample by subject discipline

The research indicates that the student's choice of principal work place may have an impact upon a range of research behaviours.

For instance, working mainly from an institutional base has implications for networking among peers and academics and may correlate with the student's access to research support of various forms. Figure 23 indicates that more institution-based students in the **Gen Y survey sample** make use of help and advice from their peers, supervisors and other staff in using technology tools in their research, than do the home-based students.

The majority of the social science and science, technology and medicine students in the **Gen Y cohort** has a dedicated or shared office space (including university laboratories) within their institution which is their preferred place to work. It appears to be preferred because they can talk to their peers and other people doing similar research and bounce ideas around. In some cases they are expected to be in their institution work place by their supervisors.

Bob, studying politics and Web 2.0, says that his shared office space is an excellent place to work; allows networking with PhD students in similar fields. His institution is such a huge university that there are masses of academics and researchers in social sciences and other areas that he can contact for advice, tips, information etc.

On the other hand the majority of the arts and humanities students in the cohort prefer working from their personal residence. Working mainly in their own room or own home, they tell us, offers quiet and comfort, but they acknowledge it can be isolating. Those working from home appear to put less emphasis

on peer networking and support in their blogs and highlight the individualism of their research: no-one else can help them because no-one else is doing similar studies.

Michael, an arts and humanities student, uses his own flat for ideas generation because he can spread his papers! His University department office space, which he shares with other PhD students, is good for typing up and reading because it's quite quiet.

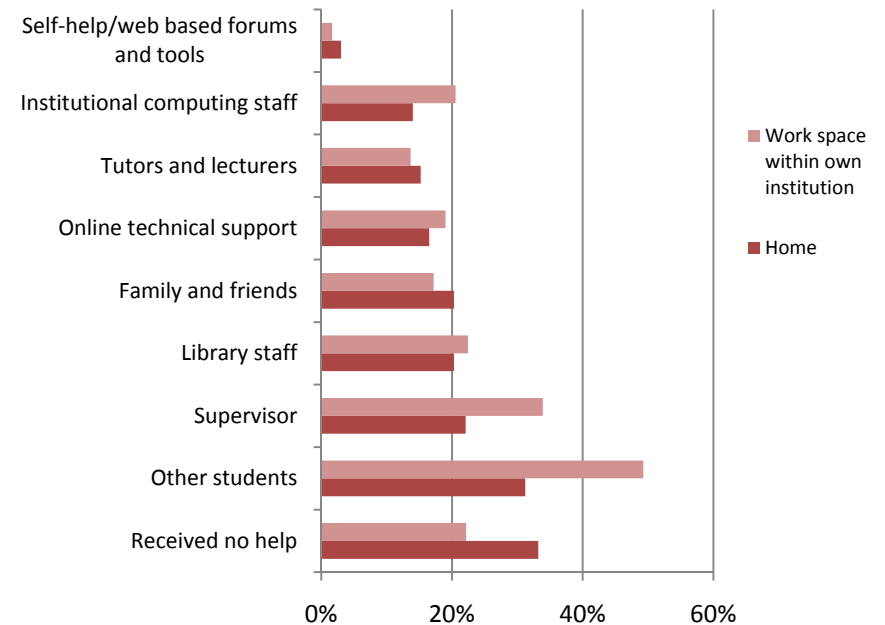


Figure 23: Gen Y survey sample: sources of help with technology tools by home and institution-based students

7 Conclusions

We began this research with some implicit assumptions about Generation Y doctoral students, which we sought to test in the survey and through our longitudinal study cohort of only Generation Y students. These assumptions included:

- **Generation Y students would have and demonstrate good critical information literacy skills, commensurate with growing up in a non-web world.**

The research seems to confirm this: Generation Y students are sophisticated information-seekers and users of information networks but they are not dazzled by the technology.

- **Generation Y students would be less inclined to make use of printed materials and always favour the electronic versions if they could get them.**

The research so far does not support this: e-journal articles certainly dominate as first choice in the Gen Y survey sample. However, that sample is 65% science students and their responses are generally consistent with those from science students in the wider survey sample. Moreover, the experience of reading in hard copy is preferred by many of the Gen Y cohort, including science students, and the notions of quality and authority still cling to print editions of journals.

- **Generation Y students would be highly competent users of information and communications technology.**

This certainly appears to be true, but it is also apparently true of older doctoral students too – the impact of technology on learning and research has evidently been so dramatic that ‘we are all the Google generation now’.

- **Generation Y would be early adopters and keen users of the latest technology applications and tools in their research.**

This research has not supported this assumption. On the contrary, it would appear that Generation Y doctoral students, in common with others, are quite risk averse and ‘behind the curve’ in using digital technology, not at the forefront; and this despite the fact that the majority of Generation Y students answering the survey and in the cohort appear to be keen users of the latest technology applications in their personal lives.

- **Generation Y doctoral students might take a different view of doing research than their older peers, having started their research career in the midst of an information explosion, with web-based access to hugely increased and increasing research resources.**

They might, for instance, take the pragmatic, ‘good enough’ view to achieving information-seeking and research results, rather than risk information overload; they might be more ready to share research because of the ‘web world’ they inhabit.

The research indicates, on the contrary, that Generation Y doctoral students are rigorous in their continuous search for, and absorption of, relevant research resources and set high standards for their comprehensive coverage of their fields, heavily influenced by their supervisors. They are generally unwilling to share their research findings at this stage in their research career.

Annex 1: 2009 context-setting survey

In the 2009 national context-setting survey of doctoral students in the UK, 68 higher education institutions (HEIs) from across the UK collaborated in the distribution of the survey and a total of 6,562 questionnaires were returned of which **5,408** were deemed complete for analysis.

Table 1: Survey response by type of HE institution

HEI type	No. of respondents	Percentage of total
University: old pre-1962	3145	58
University : old 1962-1991	1372	25
University: new 1992	701	13
University: new post 1992	181	3
HE College	9	0

Table 2: Survey response by UK region

UK Region	No. of respondents	Percentage of total
North East	28	1
North West	190	3
Yorks and Humberside	806	15
East Midlands	604	11
West Midlands	472	9
East of England	242	4
London	955	18
South East	650	12
South West	396	7
Wales	315	6
Scotland	353	7
Northern Ireland	397	7
Total	5408	100

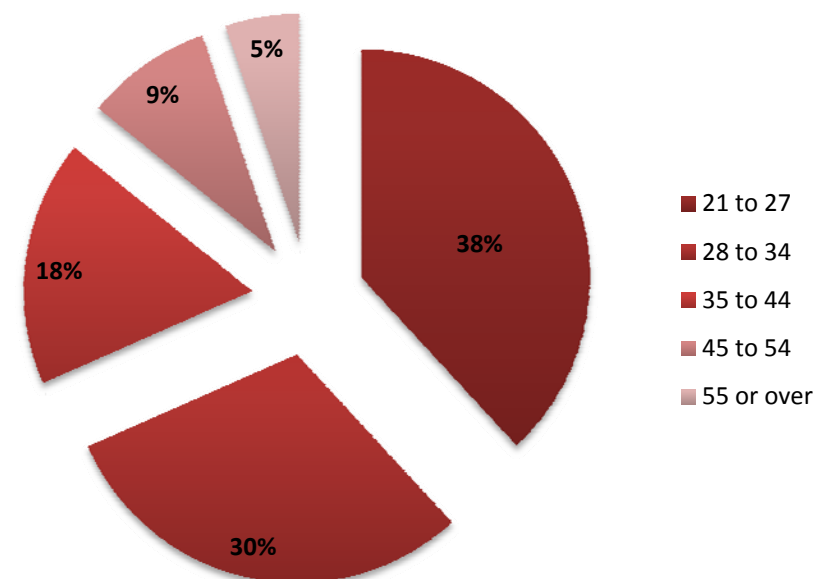
Table 3: Respondents show by HEI mission group

HEI mission group	No. of respondents	Percentage of total
Million+	272	5%
Russell Group	2137	39.5%
1994 Group	1618	29.9%
Guild HE	65	1.2%
Unclassified	1316	24.3%
Total	5408	100.0

Profile of doctoral student respondents

Age range

The survey achieved a reasonable spread across **different age groups** including responses from 2,061 (38% of total) Generation Y scholars. Figure 1 shows the range of responses, which is very similar to the HESA data. The proportion of respondents in the Generation Y age range in the HESA data was 35% compared with 38% in the WCS sample. All other age groups varied by no more than 2% compared to HESA.

**Figure 1: Age range of respondents (percentage of total respondents)**

Full-time and part-time students

Only 23% of respondents are studying **part time**, which is considerably lower than the proportion of part-time students recorded by HESA in the total doctoral student population (43%).

Spread of subject disciplines

The survey achieved a reasonable spread of responses across **subject disciplines** with arts and humanities (AH) and social sciences (SS) slightly ahead (51%) of science, technology and medicine (47%). About 2% of all respondents can be described as undertaking 'combined' or interdisciplinary research.

There are considerable differences between the age ranges of respondents and their spread over the subject disciplines. Generation Y respondents are much more evenly spread across disciplines than other age groups, with 65% pursuing doctoral studies in sciences – in particular physical sciences, biological sciences, and engineering and computing sciences.

Sources of research funding

A quarter (25%) of the survey respondents receive all or some funding from the research councils, in line with HESA data for 2008-09.

Table 4: Funding sources and survey respondents

Source of funding	No. of respondents	Percentage of total
AHRC	260	4.3%
BBSRC	152	2.5%
EPSRC	537	8.9%
ESRC	251	4.2%
MRC	120	2.0%
NERC	108	1.8%
STFC	58	1.0%
Other external funding	2639	48.8%
Entirely self-funded	1137	18.9%
Partly self-funded	692	11.5%
Not answered	59	1.0%
Total¹	6013	100.0%

¹Includes respondents citing multiple sources of funding

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