A five-year study of on-campus Internet use by undergraduate biomedical students

Terry Judd a,*, Gregor Kennedy b

a Medical Education Unit, Melbourne Medical School, The University of Melbourne, Parkville VIC 3010, Australia
b Faculty of Medicine, Dentistry & Health Sciences The University of Melbourne, Parkville VIC 3010, Australia

ABSTRACT

This paper reports on a five-year study (2005–2009) of biomedical students’ on-campus use of the Internet. Internet usage logs were used to investigate students’ sessional use of key websites and technologies. The most frequented sites and technologies included the university’s learning management system, Google, email and Facebook. Email was the primary method of electronic communication. However, its use declined over time, with a steep drop in use during 2006 and 2007 appearing to correspond with the rapid uptake of the social networking site Facebook. Both Google and Wikipedia gained in popularity over time while the use of other key information sources, including the library and biomedical portals, remained low throughout the study. With the notable exception of Facebook, most ‘Web 2.0’ technologies attracted little use. The ‘Net Generation’ students involved in this study were heavy users of generalist information retrieval tools and key online university services, and preferred to use externally hosted tools for online communication. These and other findings have important implications for the selection and provision of services by universities.

1. Introduction

A high level of familiarity with and use of Internet technologies by university students is more-or-less taken for granted, as is the provision of and access to reliable Internet services by the institutions they attend. Both students and institutions are faced with a rapidly changing technological landscape, where new Internet capable devices (e.g. Netbooks, iPhone) and web-based tools (e.g. Facebook, Twitter) emerge, evolve and flourish or disappear at a rapid rate. While the adoption of new technologies within the educational sector often lags behind uptake within the wider community, university students typically belong to an age group that is more likely to include early adopters (Salaway & Caruso, 2007). Students might therefore be expected to co-opt new technologies to support their learning practices well ahead of their integration into official curricula.

The degree to which students adopt new technologies and how institutions and educators should respond has been the subject of much recent commentary and research, typified by the ‘Digital Natives’ versus ‘Digital Immigrants’ debate sparked by Marc Prensky in 2001 (Prensky, 2001a, 2001b). In a nutshell, this debate suggests that ‘Digital Native’ students of the ‘Net Generation’ are technologically proficient and have a natural affinity with technologies. Students’ familiarity and sophistication with technology in their everyday lives has, so the argument goes, fundamentally influenced their expectations about how they should be taught, how it is best to learn and technology’s role in their education. On the other hand, ‘Digital Immigrant’ educators are seen as laggards when it comes to technology and as such their teaching practice is regarded as out of step with the expectations of their ‘Digital Native’ students (see Lorenzo, Oblinger, & Dziuban, 2006; Oblinger, 2003; Tapscott, 1998).

Many ‘Net Generation’ advocates see students’ overall technological proficiencies, and particularly their use of so-called Web 2.0 technologies, as fundamentally misaligned with the technologies their institutions adopt (Oblinger, 2003; Prensky, 2001a). While universities favour the use of entrenched technologies and closed administrative systems such as email and learning management systems, students are seen as ‘produsers’ who appropriate technologies as and when required and prefer tools that allow them to easily create and...
repurpose content, and then share it with their peers (Bruns, 2007). This argument is typified in a recent paper by McLoughlin and Lee (2008) who contend that “today’s students demand greater control of their own learning and the inclusion of technologies in ways that meet their needs and preferences... In their use of the Internet... students are no longer passive consumers but active producers of knowledge” and, moreover, “Many higher education institutions are discovering that new models of teaching and learning are required to meet the needs of [this] generation of learners” (p. 1).

These ideas about ‘Net Generation’ students have persisted despite mounting evidence to the contrary (Bennett, Maton, & Kervin, 2008; Kennedy et al., 2007; Kennedy, Judd, Churchward, Gray, & Krause, 2008; Sheely, 2008). Annual investigations from the Educause Centre for Applied Research, and studies from the UK and Australia reveal that many students in Higher Education are neither particularly frequent nor advanced users of technology (Conole, de Laat, Dillon, & Darby, 2006; Ipsos Mori, 2007; Jones & Ramanau, 2009; Kennedy et al., 2007, 2008; Kennedy, Judd, Dalgarbo & Waycott, in press; Kvavik & Caruso, 2005; Kvavik, Caruso, & Morgan, 2004; Oliver & Goerke, 2007; Salaway & Caruso, 2007; Salaway, Caruso, & Nelson, 2008; Salaway, Katz, & Caruso, 2006). In general, these studies show that while the vast majority of students rely heavily on the Internet for activities such finding information (e.g. Google, Wikipedia) and communicating (email, Instant Messaging and more recently social networking), and on mobile phones for calling and texting, their use of many other Internet technologies, including those that are well suited to teaching and learning activities (e.g. blogs, wikis, social bookmarking) is patchy at best. In this context it is difficult for tertiary institutions to successfully navigate the evolving technological landscape and accommodate the diverse set of requirements, and preferences of students and staff. It is essential that the decisions that educational institutions make about the selection and use of technologies to support the practice and administration of learning and teaching are based on evidence.

As shown by the research cited above, an evidence base in this area is emerging. But to date it is mostly comprised of self-reported snapshots of technology use taken at a single point in time. While studies using this approach undoubtedly make a useful contribution, few studies have included either measures of actual technology use or variation in technology use over time. The best example of (quasi)-longitudinal research in this area are the ECAR series of studies, but these are also based on self reports, and do not necessarily allow direct year-to-year comparisons of individual technologies (Kvavik & Caruso, 2005; Kvavik et al., 2004; Salaway & Caruso, 2007; Salaway, Caruso, & Nelson, 2008; Salaway, Katz, & Caruso, 2006).

Studies of students’ Internet use based on actual rather than perceived usage data would certainly improve our evidence base, and could directly inform Institutional policy making in the areas related to technology, teaching and learning. In this paper we report on a large-scale study of biomedical students’ on-campus use of Internet technologies over a five-year period. The study focuses on technologies related to four key activities associated with learning and teaching: information seeking, communication, university services and information sharing. While the setting for this study cannot entirely represent ‘Net Generation’ students’ day-to-day Internet use, it does shed light on their educational, personal and social use of technology in an educationally relevant context (see Judd & Kennedy, 2005).

2. Methods

2.1. Participants

The study involved an assessment of on-campus Internet use by undergraduate medical and biomedical students. It spanned the years 2005–2009 and was based on logs of individual Internet sessions captured within a large open-access computer laboratory. The proportional composition of the student population (consisting of medical, science, dentistry and physiotherapy students) was stable from year to year with the exception of the 2009 sample, which did not include first year medical students due to a transition from an undergraduate to graduate medical curriculum.

2.2. Materials

A custom-built monitoring system was installed on approximately 50 workstations in a large open-access computer laboratory. The monitoring system determined the applications and websites that were used during each individual user session (i.e. between the user logging onto and off from a workstation). This study, including the monitoring of student computer use, was approved by the Human Research Ethics Committee of the University and notices were displayed in the lab and on each workstation informing students that their computer use may be monitored for research and evaluation purposes. Each workstation was preinstalled with a range of in-house and third-party teaching resources and software applications and provided unrestricted access to the Internet. While the laboratory is regularly used to host scheduled classes and activities, the vast majority of usage (more than 90%) occurs on a ‘drop-in’ basis. Approximately 1700 individual students use the laboratory to access the Internet in any given month and about 60,000 Internet sessions are conducted each year. Our analysis was based on the first 5000 sessions collected during August and September of each year.

2.3. Measures

During each user session, the monitoring system regularly polls the active processes to determine which application and document/URL have focus. Each time this changes, such as when a user switches applications or navigates to a new URL in a web-browser, an entry consisting of a timestamp, the application name and document name and URL (where applicable) is added to a session log. This log is uploaded to a networked database at the completion of each session.

A wide range sites and services were included in the analysis, including university and popular third-party sites. These were broadly categorized a priori according to their capacity to support four key activities: information seeking, communication, university services, and information sharing. Table 1 lists the key sites and services associated with each of the four activities. Some sites and services were associated with more than one of the four key activities. For example, the university library website is associated with both information seeking and accessing university services. Thus, if this site was accessed in a session it was recorded (counted) in both activities. Similarly, use of the university’s webmail service was recorded in both the university services and communications activities, while use of a third-party email service (e.g. Gmail) was only recorded in the communications activity. In addition, a number of sites and services associated with the
university services activity were linked and could be accessed directly or via another site or service. For example, a student could access lecture recordings through either the student portal or the learning management system (LMS). Despite this, our data capture system allowed us to clearly distinguish each service accessed irrespective of the entry path, allowing us to score each service independently. For example, if a student accessed the lecture recording service through the LMS, which was itself accessed through the student portal, then all three services would be recorded, whereas only the iLecture service would be recorded if it was accessed directly by students.

3. Results

The degree to which particular sites and services within each of the four key activities were used is based on the percentage of sampled session logs in which they were accessed in each of the five years. The results presented in Figs. 1–5 therefore reflect proportional changes within equivalent samples rather than simple tallies of use.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sites and services</th>
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<tbody>
<tr>
<td>Information seeking</td>
<td>Google Web&lt;br&gt;Google scholar&lt;br&gt;Wikipedia&lt;br&gt;University library&lt;br&gt;National institutes of health (NIH)</td>
</tr>
<tr>
<td>Communication</td>
<td>Web mail&lt;br&gt;Social networking&lt;br&gt;Instant messaging</td>
</tr>
<tr>
<td>University services</td>
<td>Learning management system&lt;br&gt;Student portal (one-stop access to learning management system, webmail and a range of existing web-based student services)&lt;br&gt;Library&lt;br&gt;Webmail&lt;br&gt;iLecture (lecture recordings)</td>
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<tr>
<td>Information sharing</td>
<td>Social networking&lt;br&gt;Blogs&lt;br&gt;Photo sharing&lt;br&gt;YouTube&lt;br&gt;Social bookmarking</td>
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Fig. 1. Students’ use of services and technologies within each of the four key activities and at least one of the four activities (any activity).
3.1. Overall use

Students engaged in at least one of the four key activities in between 87% (2006) and 94% (2009) of all sessions (Fig. 1). Three of the four key activities (information seeking, university services and information sharing) showed increased usage over the study period, while the use of communication tools declined, despite the rapid uptake of social networking services (Figs. 1 and 3). Use of information seeking and university services sites and services followed similar trend lines (stable in 2005–2006 then steadily increasing between 2007 and 2009). While the increase in information seeking sites and services was underpinned by substantial rises in the use of Google and Wikipedia (Fig. 2) the overall rise in usage of University services sites and services included increases in three of five targeted services (learning management system, student portal and recorded lecture) and a major decline in one (email/webmail) (Fig. 4).
3.2. Information seeking

Usage of information seeking sites and services increased by 19% over the study period, from 66% to 85% of sessions (Fig. 1). Of the five main information seeking sites and services surveyed (Fig. 2), Google was easily the most popular with students with usage increasing from 24% of sessions in 2005 to 31% in 2009. Wikipedia was also popular, increasing from only 2% of sessions in 2005 to 16% in 2008 and 2009. Students were far less likely to use specialised or academically focused information tools and services than either Google or Wikipedia. Use of the university’s library site was relatively consistent across the five-years of the study, being used in 6–8% of sessions. Use of the NIH group of sites, which includes the PubMed, Medline Plus and the National Library of Medicine portals, declined over time from around 8% of sessions in 2005 to less than 4% in 2009. Google Scholar was used in less than 2% of sessions in all years.
3.3. Communication

Usage of communication sites and services declined by 9% overall during the study, recovering slightly to 60% from a low of 56% of sessions in 2007 (Fig. 1). Of the three main communications sites and services surveyed (Fig. 3), email was easily the most popular although its use declined substantially between 2005 (68% of sessions) and 2009 (38% of sessions). Social networking services were relatively new in 2005 and were consequently accessed during only a small percentage of sessions (3%). There was a rapid uptake of this technology between 2006 (4%) and 2007 (25%), rising to equivalence with email (38%) in 2009. Web-based instant messaging services attracted low levels of use in all years.

3.4. University services

Usage of university services sites and services increased by 23% over the study period, from 54% to 77% of sessions (Fig. 1). Of the five main university services sites and services surveyed (Fig. 4), the LMS and the student portal were particularly well used by students. Use of the LMS varied from a low of 37% (2006) to a high of 62% (2009) while the student portal, which was introduced in 2007, was used in between 30% (2007) and 41% (2008) of sessions (Fig. 3). The university's webmail service was popular in both 2005 and 2006 – it was the most widely used webmail service by a clear margin during these two years – but its use declined dramatically in 2007 and by 2009 was accessed in only 4% of all sessions. Access to audio and video recordings of lectures increased from less than 1% of sessions in 2006 to 11% of sessions in 2009.

3.5. Information sharing

Usage of information sharing sites and services increased by 34% over the study period, from 6% to 44% of sessions (Fig. 1). Almost all of this increase was attributable to social networking sites – predominantly Facebook (Fig. 5). All of the other so-called Web 2.0 sites and technologies, comprising blogs (including Twitter), social bookmarking and photo-sharing tools, attracted low levels of use, peaking at 9% of sessions in 2007 (due to a one-off surge in YouTube use) then declining to a low of 3% in 2009 (Fig. 5).

4. Discussion

Information seeking is a key activity for most Internet users. According to a 2005 PEW study (Rainie & Sherman, 2005), on a typical day, 63% of users who went online used a search engine. By 2007, roughly two thirds of UK Internet users reported primarily relying on search engines to find information – a jump of almost 30% since 2005 (Dutton & Helgesper, 2007). Despite having ready access to more specialised information seeking tools and services, generalist search engines are widely used by university-level students (Judd & Kennedy, 2010). Griffiths and Brophy (2005) reported that students routinely turn to search engines as “their first port of call when locating information” (p. 545). Our results reveal students as heavy users of both Google and Wikipedia, with the use of both tools increasing over the study period – from 24% to 31% for Google (which was used almost to the exclusion of all other search engines) and from 2% to 15% for Wikipedia. The increase in Wikipedia use reflects its amazing growth in articles – approximately 2.5 million articles were added between 2005 and 2009 (Wikipedia: Size of Wikipedia, 2010) – but also that Wikipedia articles typically feature prominently in Google search results (Rainie & Tancer, 2007). Notwithstanding the ongoing debate over the accuracy and provenance of Wikipedia content (Fallis, 2008; Reliability of Wikipedia, 2010; Seelye, 2005) – fewer than one in 250 articles satisfies Wikipedia’s own ‘good article’ criteria (Wikipedia: Good articles, 2010) – it has clearly been embraced by students. According to a recent PEW study it is used by 44% of 18–29 year old Internet users; (Rainie & Tancer, 2007) and in this study its use had surpassed that of the university’s library by 2007.

While the utility of both Google and Wikipedia continues to improve, the growth in their popularity with students may be as much a response to their perceived familiarity and convenience than to any objective improvements in the coverage or relevance of the content they locate or contain (Judd & Kennedy, 2010). There have also been substantial improvements in the utility of two of the more academically focused information seeking services included in this study (the University library and the National Institutes of Health group of sites) yet their use remains low and has barely changed across the sampling period (Fig. 2). Low levels of use of these and similar tools might not be so concerning if their resources were readily accessible via Google and students used Google (or Wikipedia) with sufficient sophistication to locate suitable resources. However, previous studies indicate that neither is true, with the majority of students using search engines in a quite unsophisticated way (Griffiths & Brophy, 2005; Judd & Kennedy, 2010; Markland, 2005) and Google searches either failing to locate or prominently rank relevant academic resources, or when they do, not providing suitable access to them – as would typically occur when a student locates a resource through their institutions’ library website. Google Scholar overcomes these problems to some extent by providing ready access to many academic resources (mediating access via institutional subscriptions and logins where necessary). However, despite these affordances it was barely used by the students in our study.

It is unclear whether these patterns of information seeking are peculiar to our student sample, which is somewhat biased towards students in the early years of medical and biomedical degrees, although there is some evidence that even these students modify their seeking behaviours somewhat as they progress through their courses (Judd & Kennedy, 2010). Nevertheless, self-directed learning and problem- or case-based approaches are key components of these students’ curricula, and the development of information seeking skills that go beyond simply accessing linked documents in an LMS would appear to be a fundamental requirement. That students make strong use of the university’s LMS and related services to access mandated or recommended course-related content in their learning activities is clear. By 2009, the university’s LMS was accessed during 62% of Internet sessions (up from 37% in 2007), making the single most popular site/technology in the study by a wide margin (Figs. 2–5). This growth accompanied a twenty-fold increase in the number of subjects available through the LMS, which rose across the university from just 212 subjects in 2005–4147 in 2009. Substantial increases in the proportional usage of lecture recordings and the student portal were also recorded, with the latter service gaining rapid acceptance since its inception in 2007 (Fig. 4).

While anecdotal reports point to a declining trend in email use by students, there is little hard evidence that this is the case. In fact, the PEW Internet series of studies suggest that email use among adult American Internet users has changed little since 2000 (Wells, 2008) and
the UK-based Oxford Internet Surveys show a slight increase between 2003 and 2007 (Dutton & Helsper, 2007). A recent PEW Internet study reported that webmail was used by 56% of all and 77% of 18–29 year old Internet users (Horrigan, 2008). Virtually all students reported using email in a 2007 US study (Salaway & Caruso, 2007), with a daily median frequency of use, and our own research has shown that a high proportion of university students – around 93% – are using email on at least a weekly basis (Kennedy et al., 2007).

These previous data sit in stark contrast to the marked decline in email use recorded in this study – down from 68% of sessions in 2005 to just 38% in 2009 (Fig. 3) – with the bulk of this decline attributable to a collapse in students’ use of the university’s webmail service between 2006 and 2007 (Fig. 4). If these findings herald a wider decline in email use by students then there are clear implications for institutional policy makers relating to the provision of technology-based services. For example, should students be expected to use an institutional email account when communicating with their university? Alternatively, should institutions encourage students to use their existing email accounts or allow them to use other communication technologies (e.g. SMS, IM or social networking)? While any institutional decisions in this area will need to consider security and governance issues, the findings from this study suggest that universities need to seriously consider the costs and benefits associated with the provision of technology-based services that may be redundant or underutilized by students. More broadly, the findings from this study indicate that careful monitoring of students’ use of technology-based activities may assist with institutional decision-making about what technologies need to be provided to support students and staff, on and off-campus.

While students’ use of email was declining, their use of social networking was increasing, rising dramatically between 2006 and 2007 (Fig. 3). The rate and scale of its uptake is consistent with the results of both ECAR and PEW studies (Lenhart, 2007; Madden & Fox, 2006; Salaway & Caruso, 2007; Salaway et al., 2006, 2008) although the major initial increase in use appears to have occurred at least a year earlier (2006) in the US-based ECAR study. By 2008, 85% of the ECAR student respondents reported using social networking sites on a daily basis – considerably higher than the 48% of teenage and just 13% of general Internet users reported in a 2007 US-based study (Lenhart, 2007) and 42% of students and 17% of general Internet users in a UK-based study from the same year (Dutton & Helsper, 2007). Recent studies suggest that growth in the use of social networking tools is continuing (e.g. 32% growth in US membership between June 2008 and January 2009; Corbett, 2009) and our data supports this. If these trends continue then Facebook may soon replace email as students’ Internet-based communication tool of choice (Judd, 2010).

An unexpected finding of our study was the consistently low rates of use of web-based instant messaging (IM) tools, which were involved in fewer than 2% of all sessions. This degree of use is at odds with previous reports of IM usage among school and university-level students. While the ECAR series of studies suggest IM usage may have decreased slightly in recent years (see Salaway et al., 2008, 2006), the 2008 study still shows 74% of US students using IM several times a week. Australian studies, including one involving the institution considered in this investigation, also report relatively high levels of IM use by university students (see Kennedy et al., 2007; Oliver & Goerke, 2007). It may be that the low IM usage in our study relates to the particular educational context in which the investigation took place. That is, students may be less inclined to use IM in a campus-based computer lab, than they would in other circumstances, such as in domestic or social settings. Such an explanation is consistent with data reported by Oliver and Goerke (2007) who found that while 57% of students suggested they used IM frequently, this figure fell to 8% when asked about the use of IM for study-related activities. However, there is complexity here, as our own research and that of others has shown that students regularly co-opt university-based Internet services for social and recreational purposes (Brett & Nagra, 2005; Judd & Kennedy, 2005). Moreover, the bulk of the use of social networking tools recorded in our study was presumably associated with personal or recreational use. Such nuanced findings highlight the need for ongoing investigations of the patterns of campus-based technology use, as these may not simply mirror students’ general technology use profiles.

Context-of-use might also go some way in explaining the low use of information sharing tools other than social networking (e.g. blogs, photo sharing, YouTube and social bookmarking). That is, students may view these tools as primarily social or recreational, and simply access them off-campus. However, recent studies indicate that, despite the rhetoric, students are not regular users of the most web 2.0 technologies (Kennedy et al., 2007). Moreover, many appear to rely on quite a small set of core tools and services both in their everyday lives and to support their learning. This is clearly at odds with prevailing perceptions of current ‘Net Generation’ students’ technical capabilities and Web 2.0 preferences (e.g. Bruns, 2007; Oblinger, 2003). The findings of this study provide further evidence of students’ diverse technology experiences and effectively dispel the notion that a majority of students are early adopters of emerging technologies with strong preferences for their use in teaching and learning contexts.

5. Conclusions

There is an emerging body of evidence about students’ use of technology, based primarily on students’ self-reported behaviour. This study contributes to this evidence base by describing biomedical students’ actual use of both traditional and emerging technologies and tools and the variation in this use over time in an on-campus setting. It is clear that, in this context at least, most students do not fit the typical ‘Net Generation’ stereotype. The findings from this study, with respect to the key activities of information seeking, communication, accessing university services and information sharing, indicate:

- Students are increasingly reliant on generalist information retrieval tools, particularly Google and Wikipedia, to support their learning activities.
- There is a movement away from email, especially institutional email accounts, and towards social networking tools.
- The use of core institutional systems and services, particularly learning management systems is high and continues to increase.
- Students are avid users of social networking tools (for personal, social or recreational use) but infrequent users of other so-called ‘Web 2.0’ technologies.

If these findings are indicative of students’ wider Internet use then they have clear implications for the development and application of information literacy skills by students, and for the selection and provision of key services by universities. The high level of use of core university systems and services we observed is consistent with and appears to validate universities’ strategic decisions and abilities to support teaching and learning activities with technology at individual, course and institutional levels. However, we also recorded low usage
and slow uptake of new technologies and non-core services, suggesting that Universities need not rush into implementing technologies in teaching and learning contexts to satisfy a perceived demand by students, or technology advocates.

References


