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Are digital natives a myth or reality?: Students' use of technologies for learning

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Abstract

This paper outlines the findings of a study investigating the extent and nature of use of digital technologies by undergraduate students in Social Work and Engineering, in two British universities. The study involved a questionnaire survey of students (n=160) followed by in-depth interviews with students (n=8) and lecturers and support staff (n=8) in both institutions. Firstly, the findings suggest that students use a limited range of technologies for both learning and socialisation. For learning, mainly established ICTs are used- institutional VLE, Google and Wikipedia and mobile phones. Students make limited, recreational use of social technologies such as media sharing tools and social networking sites. Secondly, the findings point to a low level of use of and familiarity with collaborative knowledge creation tools, virtual worlds, personal web publishing, and other emergent social technologies. Thirdly, the study did not find evidence to support the claims regarding students adopting radically different patterns of knowledge creation and sharing suggested by some previous studies. The study shows that students' attitudes to learning appear to be influenced by the approaches adopted by their lecturers. Far from demanding lecturers change their practice, students appear to conform to fairly traditional pedagogies, albeit with minor uses of technology tools that deliver content. Despite both groups clearly using a rather limited range of technologies for learning, the results point to some age differences, with younger, engineering students making somewhat more active, albeit limited, use of tools than the older ones. The outcomes suggest that although the calls for radical transformations in educational approaches may be legitimate it would be misleading to ground the arguments for such change solely in students' shifting expectations and patterns of learning and technology use.

1. Digital natives: Is there evidence?

There is an ongoing debate in the academic literature and mass media around the idea that a new generation of students – variably named Millennials, NetGen, Generation Y, Homo Zappiens, and Digital Natives - is entering institutions of higher education. It has been claimed that this generation, who have grown up with ICT, have sophisticated technology skills and a whole new set of cognitive capacities (Prensky, 2001; Tapscott, 1998; Howe and Strauss, 2000; Oblinger and Oblinger, 2005). Dede (2005) argued that advances in IT are bringing about the emergence of new learning styles adopted by students. These new learning styles, he argues, include “fluency in multiple media and in simulation-based virtual settings”; “communal learning involving diverse, tacit, situated experience, with knowledge distributed across a community and a context as well as within an individual”; “expression through nonlinear, associational webs of representations”, “co-design of learning experiences personalized to individual needs and preferences” (p.7). The educational system, the proponents conclude, is not prepared to accommodate the needs of the new generation of learners. A comprehensive summary of the debate to date is provided by Schulmeister (2008).

The affordances of the emergent technologies themselves form a substantial part of this argument. The concept of Web 2.0, coined by Tim O'Reilly in 2004 (O'Reilly, 2004), has quickly taken hold, denoting a new generation of web-based tools, environments, and services that enable new forms of collaboration and knowledge sharing between users. The developments brought about by these tools and services are characterised by decentralisation of authority in knowledge creation and technology ownership; emphasis on

user-generated, user-controlled and remixable content and data; and the centrality of the notion of “architecture of participation” that harnesses “the wisdom of crowds” (Surowiecki, 2004). A growing number of studies have been exploring the use of social software and initial findings point to:

- Strong association between use of sites such as Facebook and the students’ development and enhancement of their social capital as well as their psychological well-being (Ellison et al, 2007).
- Affordances of social networking environments for knowledge construction processes (Paulus, 2007)
- Emergence of new types of literacy practices (Perkel, 2008; Martin and Madigan, 2006).
- Games and simulations fostering development of metacognitive skills, such as problem solving, interpretive analysis and strategic thinking, and increased motivation (FAS, 2006).
- Enhanced transfer of knowledge between various contexts, such as between online and offline realities and between local and global networks (Mejias, 2005).

Some researchers argue that the rapid adoption of social technologies has resulted in a widening gap between the culture of the educational institutions and that of learners’ social lives. Kukulska-Hulme & Traxler (2005) suggest that there are mismatches in the learning processes involved in classroom settings and social situations as these processes are often based around different models of learning. They suggested that outside formal educational environments individuals act as active participants navigating their way independently through complex multimodal environments, while in school they are expected to submit to a pedagogic regime that is fundamentally premised on the transmission and testing of decontextualised knowledge and skills, and which is dominated by technology underpinned by a radically different philosophy.

However, the extent and the nature of technology uptake as well as the cognitive transformations that technologies bring about, especially amongst teenagers and young adults, is far from clear. Not only much of the debate has hardly progressed beyond rhetoric, it has also been ahistorical. It has long been known from anthropological studies that generational reversals in expertise often arise when societies are undergoing rapid changes (Mead, 1928). Beach (2003) refers to this phenomenon as “encompassing transition” – a form of transformation that individuals in a changing social system must undergo in order to continue participation within the boundaries of the system. In such transitions, younger generation are often seen as more expert in a particular new technology and called upon to assist older generations in acquiring necessary knowledge and skills.

Some commentators have emphasised the need to move away from emotive argumentation and introduce robust evidence to substantiate the debate (Bennet et al, 2008). In an attempt to ground the “digital natives” debate in evidence, a number of empirical studies have begun to investigate students’ use of technologies and learning approaches. The findings have been varied: the studies can be broadly grouped into those that provide evidence supporting the claims about “digital natives” and those that contradict these claims.

Among the studies supporting the claims about “digital natives” is Conole et al (2006) The study is based on a survey of UK undergraduate students (n=427); the survey was supplemented by audio logs (n=85) and followed up by interviews (n=14). This study identifies that students are using the technologies in a “pervasive”, “integrated”, “personalised”, “social” and “interactive” way (p.4-5) and that “students are appropriating technologies to meet their individual needs, mixing general ICT tools and resources with official course or institutional tools and resources” (p.4). Furthermore, this study suggests that students are developing “new forms of evaluation skills and strategies (searching, restructuring, validating) which enable them to critique and make decisions about a variety of sources and content” (p.5). Most notably, the authors suggest that “the use of these tools is changing the way they gather, use and create knowledge... shifting

from lower to higher regions of Bloom's taxonomy... to make sense of their complex technologically enriched learning environment" (p.6). However, the students are also "frustrated... because of the misuse or lack of use of the tools" within their institutions of higher education (p.95).

In another study, Ramney (2007) investigated US undergraduate students' (n=1,232) self-perception of the applicability to themselves of the seven characteristics of the millennial generation identified by Howe & Strauss (Howe and Strauss 2003, cited in Ramney 2007). The characteristics are: special, sheltered, confident, team-oriented, conventional, pressured, and achieving. Ramney found that students' agreement with the seven characteristics was relatively high for all of the characteristics except for team-oriented and sheltered. Statistically significant differences were found between generational self-perception and generational peer-perception for six of the seven characteristics, and significant differences for both self and peer perceptions for the seven characteristics were found by gender, ethnicity, family history of education, and geographical area of primary and secondary education.

Other findings contradict the claims about students' special cognitive and learning styles and extensive use of advanced technologies. For example, Bullen et al (2008) conducted semi-structured interviews with a group of Canadian students (n=69). They found that students do not possess "a deep knowledge of technology, but have a good understanding of what it can or cannot do for them"; that they "use a limited toolkit (Facebook, MSN, email, mobile phones)"; that "outside of class students seek access to practical solutions to their course-related issues and ICTs are often not the most practical solutions"; and that "students use of ICT is not related to their age".

Kvavik's (2005) survey of 4374 undergraduate students in the US revealed similar results. Firstly, "students have basic office suite skills and can use email and surf the Internet with ease but moving beyond basic activities is problematic; it appears they do not recognize the enhanced functionality of the applications they own and use." (p.7.7). Secondly, "they only have a moderate preference for the use of technology in their classes"; consequently, "there is a need for "significant further training in the use of information technology in support of learning and problem-solving skills." (p. 7.17). Finally, "students appear to be slower in developing adequate skills in using information technology in support of their academic activities" (p. 7.17).

Similarly, an Australian study by Kennedy et al (2007) found that students "were nowhere near as frequent users of new technologies as some commentators have been suggesting". They point out that "established applications such as searching for information on the web, email, mobile telephony and SMS messaging" were used very frequently while "newer technologies, such as blogs, wikis, and social bookmarking tools that allow students to share, collaborate, produce and publish material online are used by a relatively small proportion of students". These findings are based on a survey of 2588 first year students, followed up by individual or focus group interview of 46 of these students.

Further, Sandars et al (2008) surveyed undergraduate medical students (n=212), uncovering high levels of use of instant messaging (90%) and social networking sites (70 %). Conversely, their study revealed low levels of use of blogs: 20% read blogs, while only 5% wrote their own blogs. Similarly, they found low levels of use of resource sharing and contribution to wikis; and social bookmarking was rarely used.

Finally, Ebner et al (2008) investigated first year undergraduate students' use of ICT and Web 2.0 at an Austrian and a Swiss university (n=1149). Their findings point to students' high familiarity with and use of Wikipedia, You Tube and MySpace, but low familiarity with and use of social bookmarking, podcasts, (micro-)blogging and virtual worlds. In addition, they found that most of the frequently used technologies

such as Wikipedia are used only for passive consumption of information. Furthermore, when students were asked what form of elearning was the most important for them, the majority of students emphasised the possibility to download lecture notes; opportunities for communication and discussion were unimportant for the majority of the students.

A factor that may determine the types of tools students use and how they use them may be students' expectations of how they will learn at university. There is a significant body of literature in psychology suggesting that expectations shape behaviour, motivation and perception of self-performance (eg. Bandura, 1977; 1997; Jernigan, 2004; Merton, 1968). For example, in a previous study, Littlejohn, Margaryan and Vojt (under review) investigated university entrants' expectations of how they will learn and what technologies they will be using at university over a 4 year period. A key finding of this study is that despite a dramatic increase in students' use of various technologies, their expectations of how they might learn at university – via lecture, textbooks and lecture handouts- remained relatively static over the four year period. This study found that the expectations of learning at university appear to be influenced more by students' prior experience of learning in formal situations -for example at school- rather than their use of technology outside educational settings.

Although abstracting trends and conclusions from these empirical studies would require a systematic meta-review, it is clear that many studies fail to find evidence to support claims that young students use digital technologies in a radically different manner or have a significantly different set of characteristics. While it is not the intention of this paper to provide such a meta-review, it aims to contribute evidence to inform the discussions and developments in this area. This paper reports findings of a study exploring students' and lecturers' use of technology to support learning. The study was conducted in January-May 2007, within two different disciplines (Social Work and Engineering) in two institutions of higher education - University of Strathclyde and Glasgow Caledonian University (GCU), both in the UK. The investigation focuses on the following key themes:

1. The nature and extent of students' use of technologies in formal, informal learning and socialising
2. The nature and extent of lecturers' use of technologies in teaching
3. Students' and staff's views on the educational value of these tools and the factors impacting their adoption
4. Students' and staff's views on the barriers to the integration of technologies within education

The choice of the sample is motivated by two characteristics that we wanted to investigate. Firstly, we wanted to explore whether or not the nature and extent of students' use of technologies for learning and socialising may be different in a technical vs a non-technical subject – ie are the Engineering students more technologically-savvy and do they use technologies in more profound ways than Social Work students? Secondly, we sought to identify whether or not there was an age variation in the nature and extent of technology use. In both institutions, the Engineering cohort is usually comprised of predominantly younger students, while Social Work students tend to be mainly older.

2. Method

2.1. Data collection methodology

The data was collected using a paper-based questionnaire, followed by individual one-hour long interviews. The aim of the questionnaire was to examine the extent of technology use amongst this target group. The paper questionnaire was handed out at the end of a selected number of lectures to all students present at the

lecture; questionnaires were completed and returned to the researcher on the spot. Students were asked to provide their contact details if they wished to volunteer for a follow-up interview.

The questionnaire survey was supplemented by semi-structured interviews with students and staff. The aim of the interviews was to investigate in depth the nature of students' and staff's experiences in using digital technologies for learning, as well as their perceptions of the value of and barriers to integration of technologies in education.

Staff members were recruited via a general email circulated to the heads of the departments under consideration. The leaders of the departments then pointed to staff members who they thought might be interested in participating in this study. The researchers contacted the suggested staff members to arrange for the dissemination of the questionnaire and schedule face-to-face interviews with those who volunteered to participate.

2.2. Data collection instruments

The questionnaire is comprised of three sections (full version included in the Appendix 1):

- 1) **Section A, Personal details:** gender, age, course of study, internet access at the place of residence; types of devices owned and used regularly.
- 2) **Section B, Technology used formally on the course of study:** including tools that are part of the institutional VLE (course info, discussion boards, chat, online assessments, etc) and other tools and devices that are either personally owned (eg laptop, media player, etc) or are openly available on the web (eg. Wikipedia, social networking sites, etc.).
- 3) **Section C, Technology used for learning in relation to the course but that is not formally required through the course:** options in this section included tools and devices that are either personally owned (eg laptop, media player, etc) or are openly available on the web (eg. Wikipedia, social networking sites, etc.).
- 4) **Section D, Technology used for recreational purposes:** similar to sections B and C, this section included options for tools and devices that are either personally owned (eg laptop, media player, etc) or are openly available on the web (eg. Wikipedia, social networking sites, etc.).
- 5) **Section E, Further participation in the study:** in this section students were asked to provide their email address if they wished to participate in a follow-up interview.

Interviews with students were structured around each volunteer's questionnaire responses. The students were asked to clarify and to elaborate on the ways in which they used certain types of tools and what they thought about the educational and social value of these tools. Student interview schedule is included in Appendix 2.

Interviews with staff were loosely structured around a set of key questions related to their experiences with use of tools, perceptions of their educational value, and views on the barriers and enablers to integration of technologies within education. The interviewer encouraged respondents to talk about their understanding, knowledge and views on new and emergent technologies, with a particular emphasis on social software. The staff interview schedule is included in the Appendix 3.

2.3. Respondents

2.3.1. Questionnaire respondents

The survey was distributed to 160 Year 3 students on Social Work and Engineering courses at both institutions. Table 1 illustrates the profile of the questionnaire respondents, according to **university and subject affiliation**.

Table 1. Institution and subject profile of the questionnaire respondents (n=160)

University	Discipline		TOTAL
	Engineering	Social Work	
Glasgow Caledonian	59*	21***	80
Strathclyde	71**	9****	80
TOTAL	130	30	160

Note: * BSc Hons Engineering/Audio Technology programme; ** MEng Electrical and Mechanical/Aero-Mechanical; *** BA Hons; **** MA Hons

While there was an equal number of a respondent from each institution, Engineering students were overrepresented. This is because in both institutions Engineering cohorts were larger than Social Work ones.

In terms of **gender** profile, the overall sample comprised a significantly higher number of male than female students, with females overrepresented in Social Work and underrepresented in Engineering (Table 2). This reflects a characteristic gender imbalance inherent within these disciplines in the UK universities.

Table 2. Gender profile of questionnaire respondents, per subject (n=160)

Gender	Discipline		TOTAL
	Engineering	Social Work	
Female	16	23	39
Male	114	7	121
TOTAL	130	30	160

The overall **age** range of survey respondents is from 19 to 50 years old (Mean=23 yrs, SD = 6.32, n=157). As one can see from Figure 1, engineering students were predominantly younger, the majority 20 years old, whilst in Social Work a wider range of age groups was represented. Table 3 shows the breakdown of age across the institutions, as well as disciplines.

Table 3. Age profile, by subject area and institution (n=157)

Subject	No of respondents	Min age	Max age	Mean	SD
Engineering	127	19	38	21	2.4
Social Work	30	20	50	33	8.7

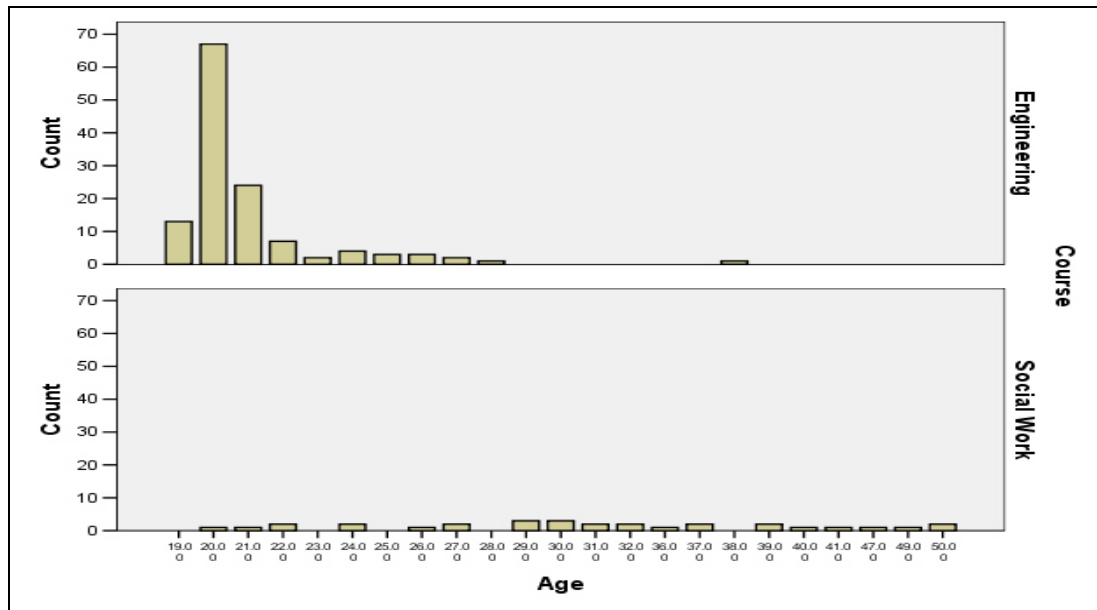


Figure 1: Overall age profile of respondents

Table 4 illustrates the number of so-called digital natives (ie those born after 1980) and digital immigrants (those born before 1980). For the purposes of this paper, students who were 19-27 years old at the time of the data collection in 2007 are categorised as “digital natives” while students who were 28-38 years old will be grouped under “digital immigrants” category.

Table 4. Digital natives vs digital immigrants, per subject (n=157)

Subject	Digital natives	Digital immigrants
Engineering (n=127)	125 (98.4%)	2 (1.6%)
Social Work (n=30)	9 (30%)	21 (70%)
TOTAL	134	23

In our sample the vast majority of the Engineering students are “digital natives”, while the Social Work students are comprised mainly of “digital immigrants”.

2.3.2. Interview respondents

Out of the 28 students who volunteered for an interview, we were eventually able to recruit eight students (four students at each institution, including two from each discipline). Eight members of staff were interviewed at both institutions. The sample consisted of four lecturers, three support staff, and a manager.

All interviews lasted for approximately one hour. They were recorded and subsequently transcribed and analysed for emergent as well as predefined themes.

3. Results and discussion

3.1. Questionnaire survey results

Firstly, we investigated the location from which students were accessing Internet. The overall results are shown in Table 5, while the breakdown of results subject is outlined in Table 6.

Table 5. Internet access location (n=160)

Internet access:	Yes	No
Access at home:	145 (91%)	15 (9%)
Access on campus:	Yes	No
Library	139 (87%)	21 (13%)
Labs	132 (82%)	28 (18%)
Campus Cafe	38 (24%)	122 (76%)
Other	22 (14%)	138 (86%)

Table 6. Internet access location, by subject (n=160)

Subject/Institution	Access at home	Access on Campus			
		Library	Labs	Campus Cafe	Other
Eng (n=130)	117 (90%)	114 (87.7%)	124 (95.4%)	60 (46.2%)	20 (15.4%)
SW (n=30)	28 (93.3%)	25 (83.3%)	8 (26.7%)	17 (56.7%)	2 (6.7%)

Note: Figures in the table represent the proportion of those who said “Yes” in response to the questions whether they regularly access internet at any of the indicated locations.

It is obvious that the majority of students have internet access at the place of their residence, and that many also make use of the internet access provided by the university library and the computer and Engineering labs located on campus. The figures are broadly similar for both subjects, with the exception of the usage of engineering labs, which are naturally used more frequently by the Engineering rather than Social Work students.

Secondly, we explored what types of hardware devices students own and use regularly (Table 7):

Table 7. Ownership of digital devices, by subject (n=160)

Hardware device	Eng (n=130)	SW (n=30)
Mobile phone	130 (100%)	29 (96.7%)
Portable media player	97 (74.6%)	14 (46.7%)
Personal computer	104 (80%)	23 (76.7%)
Handheld computer	10 (7.7%)	-
Laptop computer	89 (68.5%)	17 (56.7%)
Games console	73 (56.1%)	12 (40%)
Portable games console	23 (17.7%)	6 (20%)
Digital camera	75 (57.7%)	17 (56.7%)
Other	9 (6.9%)	1 (3.3%)

Note: Figures in the table represent the proportion of those who said “Yes” in response to the questions whether they own and regularly use these devices. Devices mentioned under “other” included dvd player (and portable), video camera, pen drive, pro

audio and video tools/mbox protocols, car computer/GPS/traction control, guitar fx pedals/drum machine/synthesiser, 19" monitor, electronic speaking dictionary and thesaurus.

While hardware ownership is higher among Engineering students for nearly all devices except portable games consoles, the differences are not very large. The only relatively major difference is in the ownership of portable media players.

The age differences in ownership of tools are shown in Table 8. There were 3 cases where age was not indicated; these cases were removed from the analysis.

Table 8. Ownership of digital devices, by age (n=157)

Hardware device	“Natives” (n=134)	“Immigrants” (n=23)
Mobile phone	134 (100%)	22 (95.6%)
Portable media player	98 (73.1%)	10 (43.5%)
Personal computer	104 (77.6%)	20 (86.9%)
Handheld computer	9 (6.7%)	-
Laptop computer	89 (66.4%)	14 (60.9%)
Games console	73 (54.5%)	10 (43.5%)
Portable games console	23 (17.2%)	5 (21.7%)
Digital camera	75 (56.0%)	14 (60.9%)
Other	9 (6.7%)	2 (8.7%)

The patterns of differences in technology ownership examined by age are broadly similar to those examined by subject (Table 7), with the exception of ownership of personal computers and digital cameras - a larger proportion of older students own these.

Thirdly, we asked students how many of their modules were making use of the institutional VLE (Table 9). Since this question reflects the course design rather than students’ personal choices, the results are compared by subject and not by age. A major proportion of courses in each discipline appears to make use of the institutional VLE, although the use of VLE seems to be more uneven across Social Work than Engineering.

Table 9. Extent to which courses make use of the VLE, by subject (n=157)

Subject	All of my modules	Most of my modules	A few of my modules	None of my modules
Eng (n=128)	88 (68.7%)	37 (28.9%)	3 (2.3%)	-
SW (n=29)	13 (44.8%)	4 (13.8%)	8 (27.6%)	4 (13.8%)

Fourthly, we investigated what technologies students used to support their learning within courses (Table 10). This includes both the tools available through the institutional VLE (Blackboard at GCU and WebCT in Strathclyde; these VLEs have merged since then) and other additional tools that lecturers may have integrated into the course either directly, or encouraged students to use for themselves. Similar to the previous question, the data reflects lecturers’ choices and is therefore compared only by subject rather than students’ age characteristics.

Table 10. Students' use of technologies on the course

Tool	Eng	SW
Course sites in VLE (Eng=127, SW=30)	119 (93.7%)	16 (53.3%)
Discussion Groups (Eng=130, SW=30)	57 (43.8%)	8 (26.7%)
Virtual Chat (Eng=130, SW=30)	28 (21.5%)	5 (16.7%)
Video Conferencing (Eng=129, SW=30)	7 (5.4%)	-
Online assessments (Eng=128, SW=30)	69 (53.9%)	3 (10%)
mp3 (Eng=130, SW=30)	46 (35.4%)	5 (16.7%)
Digital Camera (Eng=130, SW=30)	62 (47.7%)	5 (16.7%)
Handheld Computer (Eng=130, SW=30)	16 (12.3%)	-
Mobile Phone (Eng=130, SW=30)	71 (54.6%)	14 (46.7%)
Podcasts (Eng=130, SW=30)	18 (13.8%)	2 (6.7%)
Websites (Eng=130, SW=30)	122 (93.8%)	27 (90%)
Google (Eng=130, SW=30)	121 (93.1%)	26 (86.7%)
Wikipedia (Eng=130, SW=30)	109 (83.8%)	14 (46.7%)
Simulations/Games (Eng=130, SW=30)	50 (38.5%)	1 (3.3%)
Message Boards (Eng=129, SW=30)	69 (53.5%)	10 (33.3%)
Text Messaging (Eng=130, SW=30)	77 (59.2%)	16 (53.3%)
MySpace (Eng=130, SW=30)	29 (22.3%)	3 (10%)
Blog (Eng=130, SW=30)	21 (16.1%)	2 (6.7%)
YouTube (Eng=130, SW=30)	64 (49.2%)	2 (6.7%)

Note: Figures in the table represent the proportion of those who said they used these tools “daily”, “weekly”, or “monthly”. Responses under category “other” included MSN Messenger, Bebo, personal website, Facebook, Hi5, email, alluc.org.

Technologies that are used most frequently to support formal learning are VLE, general websites, Google, Wikipedia, and text messaging. There appears to be a rather limited use of social technologies. It is likely that technology use is restricted mainly to institutional VLE due to teachers’ choices in terms of pedagogy. This issue will be explored in the interviews. For example, as we have seen in Table 9, Engineering courses in general seem to make a more significant use of VLE, including its discussion groups and online assessment functionalities, than Social Work lecturers do.

There are clear differences in the patterns of use of technologies between the two subject groups. Engineering students appear to make a significantly more extensive use of the VLE, discussion groups, online assessments, Wikipedia, simulations and games and YouTube to support formal learning. They also appear to use more devices such as mp3 players and digital cameras – it is however unclear whether or not this difference is due to pedagogy.

One factor that could have impacted these results is that, as it became clear during the interviews, students did not always easily distinguish between formal and informal learning. When during the interviews students were asked to give examples of the use of some of these technologies, especially social technologies, it became clear that the way some students responded to the Section B of the questionnaire (tools for formal learning, Table 10) was, in some cases, similar to Sections C (tools for informal learning, Table 11 below). However, this lack of delineation is not critical, since the study explores the use of technologies both inside and outside of class and how students merge their use of technologies for learning and social purposes.

Fifthly, we explored students’ use of the e-tools for learning outside courses (Table 11).

Table 11. Students' use of technology for informal learning, by subject (n=156)

Tool	Eng (n=126)	SW (n=30)
MySpace/Bebo	28 (22.2%)	2 (6.7%)
Digital Camera	52 (41.3%)	6 (20%)
PCs/Macs	76 (60.3%)	16 (53.3%)
Blogs	29 (23.0%)	1 (3.3%)
Message Boards	56 (44.4%)	10 (33.3%)
Mobile Phone	86 (68.2%)	22 (73.3%)
Virtual Worlds, eg Second Life	11 (8.7%)	1 (3.3%)
Video/Audio Clips	77 (61.1%)	6 (20%)
Course Websites	101 (80.1%)	23 (76.7%)
Internet Websites	109 (86.5%)	25 (83.3%)
Podcasts	18 (14.3%)	1 (3.3%)
mP3 player	51 (40.5%)	7 (23.3%)
Wikipedia	102 (80.9%)	11 (36.7%)
Simulations/Games	34 (27.0%)	3 (10%)
Handheld Computer	19 (15.1%)	1 (3.3%)
Text Messaging	86 (68.2%)	18 (60%)
Instant Chat	63 (50%)	6 (20%)
YouTube	47 (37.3%)	3 (10%)
Google/ Scholar	99 (78.6%)	19 (63.3%)

Note: Figures in the table represent the proportion of those who said they used these tools “daily”, “weekly”, or “monthly”.

For informal learning, students in both subject groups appear to make use of mainly general websites, course websites, Wikipedia, Google, and text messaging. Use of social technologies, virtual worlds, games and simulations, podcasts and video sharing appears to be relatively low.

Despite both groups clearly using a rather limited range of tools for informal learning, there are significant differences in the level of use of these tools, the most pronounced gaps showing in the use of social networking sites (22.2% among the Engineering students vs 6.7 % among the Social Work students); blogs (23.0% vs 3.3%); video/audio clips (61.1% vs. 20%); Wikipedia (80.9% vs. 36.7%); and YouTube (37.3% vs. 10%).

The results of the comparison of the data between the two broad age groups are outlined in Table 12:

Table 12. Students' use of technology for informal learning, by age (n=152)

Tool	“Natives” (n=129)	“Immigrants” (n=23)
MySpace/Bebo	28 (21.7%)	1 (4.3%)
Digital Camera	51 (39.5%)	5 (21.7%)
PCs/Macs	77 (59.7%)	12 (52.2%)
Blogs	26 (20.1%)	2 (8.7%)
Message Boards	57 (44.2%)	8 (34.8%)
Mobile Phone	88 (68.2%)	18 (78.3%)
Virtual Worlds (eg Second Life)	10 (7.7%)	1 (4.3%)
Video/Audio Clips	73 (56.6%)	7 (30.4%)
Course Websites	104 (80.6%)	17 (73.9%)

Internet Websites	113 (87.6%)	18 (78.3%)
Podcasts	15 (11.6%)	2 (8.7%)
mP3 player	51 (39.5%)	4 (17.4%)
Wikipedia	102 (79.1%)	9 (39.1%)
Simulations/Games	35 (27.1%)	2 (8.7%)
Handheld Computer	20 (15.5%)	-
Text Messaging	87 (67.4%)	16 (69.6%)
Instant Chat	62 (48.1%)	4 (17.4%)
YouTube	45 (34.9%)	4 (17.4%)
Google/ Scholar	97 (75.2%)	18 (78.3%)

Note: Figures in the table represent the proportion of those who said they used these tools “daily”, “weekly”, or “monthly”.

Younger and older students’ patterns in technology use for informal learning are broadly similar to the differences that showed up in the comparison between the two subject groups (Table 11). The exception is that compared to younger students, a slightly larger proportion of older students appear to use mobile phones, text messaging and Google Scholar for informal learning. However, it is obvious that the range of technologies used for informal learning is rather limited for both the “natives” and the “immigrants”, with the top most frequently used tools being general websites, course websites and Wikipedia (for “natives”) and mobile phone, general websites, Google Scholar and course websites (for “immigrants”). Use of social technologies, virtual worlds and other emergent technologies is very low for both age groups.

Finally, we investigated students’ use of technologies for socialising and recreational purposes. The outline of the result by subject is shown in (Table 13).

Table 13. Recreational use of e-tools, by subject (n=159)

Tools	Eng (n=129)	SW (n=30)
Music (e.g., iTunes, mp3)	128 (99.2%)	21 (70.0%)
Photo sharing (e.g. Flickr)	97 (75.2%)	14 (46.7%)
Video sharing (e.g. YouTube)	89 (69.0%)	10 (33.3%)
Blogging	63 (48.8%)	5 (16.7%)
Social Networking (eg. Bebo)	96 (74.4%)	10 (33.3%)
File Sharing (e.g. Napster)	86 (66.7%)	12 (40.0%)
Discussion groups (e.g. Yahoo)	43 (33.3%)	8 (26.7%)
Chat Rooms	31 (24.0%)	6 (20.0%)
Wikis (e.g., Wikipedia)	106 (82.2%)	15 (50.0%)
Virtual Worlds (eg Second Life)	11 (8.5%)	3 (10.0%)
Internet Gaming	60 (46.5%)	7 (23.3%)

Note: Figures in the table represent the proportion of those who said they used these tools “daily”, “weekly”, or “monthly”. There was one tool mentioned under category “other”- PSP.

A slightly broader range of tools appear to be used for recreational purposes than for formal and informal learning. The four most frequently used tools include music download sites such as iTunes, Wikipedia, photo sharing sites, social networking sites (in the case of Engineering students) and file sharing (among Social Work students). The most pronounced differences between the Engineering and Social Work students are in the use of video sharing (69.0% vs 33.3% respectively); blogging (48.8% vs 16.7%); social networking (74.4% vs. 33.3%); and Wikipedia (82.2% vs 50%). Interestingly, a slightly larger proportion of Social Work than Engineering students are using virtual worlds.

Table 14 shows the differences between the two age groups in the use of technology for socialising:

Table 14. Recreational use of e-tools, by age (n=159)

Tools	“Natives” (n=136)	“Immigrants” (n=23)
Music (e.g., iTunes, mp3)	134 (98.5%)	15 (65.2%)
Photo sharing (e.g. Flickr)	104 (76.5%)	7 (30.4%)
Video sharing (e.g. YouTube)	95 (69.9%)	5 (21.7%)
Blogging	62 (45.6%)	3 (13.0%)
Social Networking (eg. Bebo)	100 (73.5%)	6 (26.1%)
File Sharing (e.g. Napster)	89 (65.4%)	9 (39.1%)
Discussion groups (e.g. Yahoo)	44 (32.4%)	5 (21.7%)
Chat Rooms	32 (23.5%)	4 (17.4%)
Wikis (e.g., Wikipedia)	110 (80.9%)	14 (60.9%)
Virtual Worlds (eg Second Life)	12 (8.8%)	2 (8.7%)
Internet Gaming	61 (44.9%)	4 (17.4%)

Note: Figures in the table represent the proportion of those who said they used these tools “daily”, “weekly”, or “monthly”.

Comparison of age-based and subject-based differences (Table 14 and 13) shows broadly similar patterns of use of technologies for socialising, however the gap between “natives” and “immigrants” is larger than the difference between the technical and non-technical subjects, especially in terms of music download, photo and video sharing, social networking, use of discussion groups and chat rooms, and internet gaming. The most frequently used recreational/socialising tools are: for “natives”- music download, Wikipedia, and photo sharing; for “immigrants” – music download, Wikipedia and file sharing. The least frequently used tools are: for “natives” – virtual worlds, chat rooms and discussion groups; for “immigrants” – virtual worlds, blogs, and chat rooms and internet gaming.

It is apparent that both older and younger students are using a larger variety of tools for socialising than for informal learning (Table 12). Note, for example, the differences in the use of blogging for informal learning (used by 20.1% of “natives” and 8.7% of “immigrants”) and for socialising (45.6% of “natives” and 13.0% of “immigrants”). Similar differences appear in the use of social networking for informal learning (21.7% of “natives” and 4.3% of “immigrants” use it) vs for socialising (used by 73.5% of “natives” and 26.1% of “immigrants”). Similar differences are also found in the use of internet gaming and virtual worlds.

Through the survey, we have explored the *extent* of students’ use of technologies for formal and informal learning and recreation/socialising, along two sets of variables – subject and age. Despite a rather limited use of tools by both groups overall, there appear to be some differences in the range of tools used, with the younger students and Engineering students using more tools for both learning and recreation. While some of these differences, especially those concerning formal learning, can be explained by lecturers’ choices of tools and possibly the subject of study, the results may indicate that younger students are making somewhat more active, albeit limited, use of tools than the older ones.

In the next section, which summarises the findings from interviews, we will explore in more depth the *nature* of use of these tools, particularly whether or not students are using them effectively for learning.

3.2. Interview results

3.2.1. Findings from student interviews

3.2.1.1. Ownership of hardware devices

The survey showed that mobile phones are one of the most ubiquitous devices used by the students. Interviews revealed that students use mobile phones mainly for texting, which was considered low cost and convenient. Some interviewees had old generation phones (without cameras, music players, or Internet access). Where mobile phones were Internet-enabled, no interviewee used their phones to access Internet due to perceived high costs. Texting is considered cost effective and is used extensively – one student reported sending 2000 text messages in a month.

There is a widespread use of desktop computers, with some students owning more than one PC. Laptop computers, in contrast, appear to be less popular, as both the survey and interviews showed: 5 out of 8 interviewees owned laptops. Those who own laptops tend not use them as portable devices, as these were older generation (eg without wireless access), heavy and impractical to carry around. While these factors clearly limit their potential use, some students are unaware of the impact of these limitations. When on campus, students tended to use computers provided by the University via the library or computer labs, although some students suggested that at busy times accessing computers on campus may require a long wait. Overall, interviewees appeared to be satisfied with the hardware provision and internet connectivity on campus: *“There is plenty of computers in the lab that they provide so we can if we need to we can look up things o the internet but there is nothing else really they provide for us. There is nothing else that we really need to be honest”*.

Digital cameras and portable media players were popular devices among interviewees. Out of 8 respondents, 5 owned a digital camera and 3 owned an mp3 player or an iPod. Digital cameras, however, are not used often, with some students preferring to use cameras integrated within their mobile phones. An Engineering student commented: *“I don’t know if I’d really take [my camera] out, I’d be scared to loose it or break it; I’d never get stuff printed off of it so I don’t feel there is much point”*.

Games consoles – as well as gaming in general – did not appear to be popular among these students. Only 2 interviewees owned a game console; of these only one person reported playing games on a regular basis. An Engineering student who said she was “not into games” suggested however that her parents were avid gamers and that they owned a variety of games consoles.

Few students were using other portable devices, such as handheld computers/PDAs. Only 1 of the 8 interviewees owned a PDA, and two students said they did not know what a PDA was. When the interviewer explained the nature of these devices, a number of students said they would not use them since they were not using a diary or an organiser (neither paper-based nor electronic) and did not consider constant, mobile access to internet or email important.

3.2.1.2. Technologies for learning provided through the course

The main technology used in formal courses at both universities is the institutional virtual learning environment (VLE): Blackboard at GCU and WebCT at Strathclyde. Since the latter has recently merged with Blackboard, in this paper we will refer to both VLEs as Blackboard. The GCU Social Work department

uses a locally developed VLE (Clydetown) alongside Blackboard; Engineering departments in both universities use a range of specialist software available to students through the laboratories.

Interviews showed that the VLE is used predominantly as a content repository, allowing access to lecture notes and slides and lecturer's announcements related to various aspects of course administration, eg coursework deadlines and changes to the lecture schedule. In neither institution does the VLE appear to be used to any significant extent to support discussions and other forms of communication and interaction within courses.

Despite such limited use of VLE by lecturers, all interviewees were pleased with their experiences and the possibility to access lecture content online. As a student said: *"I think I am very well provided for, having access to databases online or to the notes online, I am quite happy"*. The majority of interviewees did not seem to be concerned about the lack of use of communication functionalities within the VLE. Students communicate with lecturers mainly via email. Students also use their own tools (mobile phones, instant messaging) to contact peers and discuss relevant issues or collaborate whenever they need to (more on this in section 4.2.1.3). As a student said: *"I never use forums [sic] and stuff like that because sometimes you just go on and it's like months old and they just stay up there forever and nobody visits them"*. Students pointed out the difficulties in contacting lecturers: *"I've had a few lecturers unless it suits them to email you back they won't email you back so I prefer to go and see them...in fact most of the offices are very often empty."*

However, some interviewees were perplexed by the inconsistent use of VLE by lecturers. Students suggested that while some lecturers appear to post learning materials or feedback online others do not upload any resources or outcomes of assignments. As an Engineering student said: *"[the lecturer] must have went [sic] on WebCT religiously every single night to answer people's questions, but I think that's the standard we all through everybody else would follow."*

The interviews made it clear that most students do not fully understand the potential of a VLE to support learning, terming it a *'technology-rich environment'* despite a clear under-utilisation of the tools available as well as their application within a limited pedagogical approach. It is obvious that students did not have an appropriate frame of reference against which they could benchmark the pedagogy and use of technology on their courses.

3.2.1.3. Personal or publically available technologies used for formal and informal learning

The interviewees reported using the following tools: Google (n=7/8); Wikipedia (n=6/8); mobile phone/text messaging (n=5/8); instant messaging (n=4/8); specialist websites (n=3/8); Google Scholar (n=2/8); social networking sites (n=2/8); blogs (n=1/8); YouTube (n=1/8); fax (n=1/8). Some students had never heard of some of these tools. For example one out of eight interviewees (a Social Work student) was not familiar with a concept of a blog. Another Social Work student was not familiar with social networking sites. An Engineering and a Social Work student had never heard of Google Scholar. Two of the students we interviewed were not familiar with Wikipedia and an Engineering student did not know what a podcast was.

Students reported using their **mobile phones** mainly to contact peers for organising project meetings, collaborating on group assignments and for mutual support during the *'pre exam panic'*. In addition, some students used phones to record lectures. Preferences for the mode of communication via mobiles – voice calling or text messaging – appear to depend on a mixture of personal characteristics, suitability of the medium, time of day the communication takes place, where the communicating individuals are located and

who the communication is with. Interviews showed a marked preference towards **text messaging** rather than e-mail as a means of communicating with peers, because *“text messaging is quicker”*.

A popular form of communication is **instant messaging (IM)**, although some interviewees did not use IM because they considered it an intrusive form of communication. A few students expressed a clear preference for IM rather than discussion fora because of their perception of the control they have over whom with and when they can communicate: *“There’s a lot of people on the course and I wouldn’t really speak to everyone. I would only speak to only about six or seven people so I just keep them on MSN”*.

Surprisingly **fax** devices are still being used by some students. For example, a Social Work student said he and a group of classmates used fax to exchange their essays and comments.

Students frequently use **Wikipedia** and **Google Scholar** to source information for assignments. Lecturers encourage students to use Wikipedia. However, the use of Wikipedia is passive: none of the respondents had contributed or edited entries in Wikipedia. This of course is consistent with the general pattern of use of the Wikipedia. An Engineering student stopped using Wikipedia when she realised it could be openly edited by anyone: *“I have used [Wikipedia] quite a lot but I thought that was a sort of authorised thing and then somebody pointed out to me that people go and edit it themselves, so I sort of veered away from it after that because I wasn’t too sure really how accurate the information would be”*. Furthermore, not all students who used Wikipedia extensively appeared to understand the underlying principles and potential forms of use of wikis: in their view, wikis were for (encyclopaedic) content presentation rather than collaborative development and editing of information or knowledge sharing.

While most of the interviewees appear to use **YouTube** primarily for recreational purposes detailed in the next section, one student reported using YouTube to learn about new hardware devices: *“If a new piece of hardware comes out and I can’t afford to buy it but I want to see it, people get a video camera and they do like their own little review or something like that, I think that’s quite cool”*.

While **social networking sites (SNS)** and **blogs** do not appear to be very popular among this groups of students, when they are used, it is mostly in contexts that students do not seem to link to learning. As an Engineering student said: *“My view of things like My Space or a blog would be that it would be more of a social thing than a work-related thing.”* Interviewees seemed to be unaware that blogs were a personal publishing tool and could be used in ways other than as an online personal diary; for example, none of the students were familiar with the concept of professional blogs. Only in one instance was a social networking site (Bebo) mentioned in a learning-related context: a social work student suggested that one of her classmates had posted in her Bebo site an exemplar of a completed assignment from the previous year’s group, in order to share it with her peers.

3.2.1.4. Personal or publically available technologies used for socialising and recreation

For socialising and recreational purposes, interviewees used a range of personal or publically available tools, including YouTube (n=5/8); SNS (n=4/8); music download (n=3/8); Instant Messaging (n=2/8); computer and online games (n=2/8); photo sharing (n=2/8); blogs (n=1/8).

All students reported using **YouTube** to view (primarily music) videos. None of the interviewees appeared to be creating and uploading their own content, although one student said that some of his classmates had

uploaded “*funny videos*”. **Photo sharing** appears to be a more ‘active’ pursuit, with students using their SNS or email, rather than specialised sites such as Flickr, for sharing the photos.

The most popular **social networking site** among this group of students was Bebo, which was used to keep in touch with both peers from university and former classmates from school. All interviewees who used SNS were driven to uptake by peer-pressure. A typical adoption pattern was described as: “*One person would join it and they would convince a few people and they would all convince a few people and they just all seemed to have got round*”. In SNS, students socialise only with existing or past contacts: “*I wouldn’t really enjoy talking to people that I didn’t know, unless I suppose it was about a specific subject that I had a real interest in like social work and you could talk to social workers in America and stuff like that*”. Those who do not use SNS said it was because they “*just don’t like all that*” or “*don’t like posting stuff*” about themselves, or wanted to “*protect my sanity*”.

The use of **computer and online games** among interviewees was low (n=2/8) and we found no evidence of the use of gaming for learning. Those who play games prefer to play individually rather than engaging in online multiplayer games, due to perceived lack of gaming skills. Some play collaboratively in face-to-face settings, eg at home with flatmates or friends or by participating in Local Area Network (LAN) parties (a full day weekend gaming sessions attended by a group of people who bring their laptops and play a number of pre-selected computer games). One student commented: “*I find that games are really complex nowadays, you really have to think quite a lot of the time how to solve problems and they are not just about running around and shooting people...you really have to think, so I find they are quite challenging and they keep my mind kind of quite stimulated*”.

3.2.1.5. Perceived advantages and educational affordances of technology

We explored students’ views about the affordances of technologies and whether it would benefit their learning if tools they used for socialising or informal learning were integrated into their courses. Rather than having clear ideas on the affordances of technologies, students looked to their lecturers for clues as to how to use technology tools for learning. Typical responses were: “*If [lecturers] found a way for everyone to use [technology tools] then it would be quite good*” or “*If they taught us a bit about it before just saying go and do it*”. In general, students viewed many of the tools they used for socialising to be unsuitable for learning, summed up by the comment from a Social Work student: “*I might be wrong, but just from what I see, no, that’s fun and games. And computer is not for that for me. I am too busy studying and I am an academic*”.

When interviewer asked students for ideas as to how the various social technologies could be used to support learning, most had significant difficulty coming up with suggestions; the few suggestions were focused on content dissemination and consumption, for example podcasting lectures. This outcome is not surprising given that lecture content transmission appears to be the predominant form of technology-enhanced learning in both contexts we studied (Section 3.2.1.2).

One suggestion focused on improving communication within courses. A student suggested that Bebo (a social networking site) could be used as a message board for the course: “*If we had [a Bebo site] for our course like everybody could log in and just post message and that would be kind of like texting oh there is a programme on tonight, nine o’clock, Channel 2 or does everybody know that like we’ve got to hand it an extra thousand words for such and such, I think that would be quite good, it would just be like a message board for your course*”. While it is clear that this student valued a centralised communication channel on her

course, it is also obvious that she did not view the existing technologies already available, for example the communication options on the VLE, as a solution.

Some interviewees viewed collective and collaborative forms of learning as being less beneficial educationally than lectures. When asked about whether he would like to use wikis to support group work and knowledge sharing between all groups, a Social Work student said: *“I am not really bothered by what other groups are doing. I know what my group is doing and sometimes I think something else might be quite conflicting or put us off course... we work with case studies so we might take a different approach to it than the other group and for everybody to share their knowledge might cause confusion or make it harder”*. Furthermore, students were unsure as to how they might draw on a variety of collaborative technologies for learning. For example, one student, when asked whether he would like to have MSN to support communication within the course, said: *“The thing about MSN is...I only really put on people that I actually know on there and I think there maybe too many people on the course to make that kind of actually work”*. Some students voiced concerns about the implications for privacy if they used publically available tools, which they viewed as their own, within the university.

Social technologies and Web 2.0 tools seemed equally perplexing. When asked if he would like to use wikis within the course, one Engineering Student said: *“I don’t know because the chances are that the things we’d be doing would have been already explained in whatever notes we are getting and I could maybe see a reason to do that if we were breaking new ground and wanting to keep other people informed, but if the notes are there why not use the notes rather than trying to write our own notes”*. However, when the interviewer suggested that a wiki could be used to support project work, the students said: *“I hadn’t thought of that...it might be useful to go through the process and to keep a log of it or to keep updating. I suppose it could be used like that, it would make it a lot easier when we write the report later on”*. This was a typical pattern of response to interviewer’s probing, suggesting that students do not fully understand the nature of these tools and the repertoire of their affordances, either because they do not use these technologies or because use them in a limited way, for limited types of tasks.

3.2.1.6. Barriers to integration of technologies within education

The interviewees were asked to elaborate on their views about the barriers to the integration of technologies within education. Some interviewees viewed **students’ lack of skills in using technology** as a barrier to the integration of technologies in learning. For example, a student said *“people in the class aren’t really up to speed as they should be in Blackboard. Some people are still wary of new technology, but it’s quite surprising sometimes it’s young people”*. Some students appear to have difficulties in using standard tools like the library system. For example, a Social Work student said: *“I tried to renew books the other day and I don’t know if the system was down or I couldn’t do it right but I just find it a bit difficult... I am not that computer literate”*.

Lecturers’ poor ICT skills were also cited by students as a key barrier. Some lecturers lack skills in using basic technologies: As an Engineering student said: *“Some of them look really kind of confused by certain things, even like overhead projectors and stuff like that. We’ve had lectures where the guy can’t figure out how to bring down the whiteboard or can’t figure how to get the projector to turn, they totally choke on it”*. Students appear to think that age is a factor: *“I think it’s even harder for people who have been doing it for a long time, to get into it as well. Either they just get scared of it or they just don’t understand, then they think of just forget about it”*.

Lecturers' lack of engagement in teaching was mentioned as a barrier. Students seem to be aware of the all too familiar tensions between research and teaching: “...in engineering departments some of [lecturers] get a bit lazy because they only get so much money for research, they won't necessarily like the lecturing side of it and that good lecturers might not be that caring about the research side and it goes both ways because they don't have to go out of their way to help you”.

3.2.2. Findings from staff interviews

Interviews with staff focused around the following themes: (i) nature and extent of use of technologies by staff for teaching; (ii) tools staff are interested in using in the future and their educational value; (iii) drivers for adoption of new technologies within education; and (iv) barriers to integration of technologies within education.

3.2.2.1. Technologies currently used in teaching

There were disciplinary differences among staff in the experience and the level of comfort with using ICT in general. Engineering staff appeared to be more confident in using ICT than the Social Work staff. As an Engineering Lecturer put it: “Remember this is an engineering department so I mean we've been using technology in teaching for 25 years. If we see a piece of technology that will make life easy for us or better for us then we use it. I have never come across, certainly in this department and in this university, apart from a small handful of people out of hundreds not taking up the latest technology”. However, the interviews revealed that what was perceived to be the “latest” technologies by this lecturer are very often quite traditional, well established tools, such as VLEs.

Interviews with lecturers confirmed the findings from student interviews that **VLE** is used mainly as a course administration tool to deposit course information, announcements, lecture notes, and, occasionally, to support online discussions and assessment via multiple-choice tests. Social Work staff also made use of subject-specific tools, such as Learning Exchange, a social work repository where lecturers could source and share teaching materials, and Clydetown, a virtual learning environment comprising video and other resources that was developed locally in 1995. Social Work lecturers we interviewed were more enthusiastic about Clydetown than Blackboard, explaining that: “Blackboard is a little bit one dimensional and that's one of the problems, it just seems quite boring I think”.

Engineering staff at Strathclyde use additional **online self-assessment and testing systems** (such as Mastering Physics, Web Assign). These systems are limited to multiple-choice questions related to course textbooks. Lecturers viewed these tools as “quite successful with students who like the online homework system”. Some Engineering lecturers appear to be using so-called voting or clicker systems for real-time interaction in the classroom. Interestingly, none of these technologies, apart from VLE and Clydetown, were mentioned by the students during the interviews.

Some interviewees, mostly Engineering lecturers, viewed social, Web 2.0 technologies as transient and therefore not worth investing resources in integrating them in education. As one lecturer said: “In five years time the next generation of students will have their own little fad, they won't want this year's students' fads...there is no point in saying let's build MySpace in or blogging because it'll be some other fad”. An Engineering lecturer appears to have experimented with emerging technologies, but reported receiving negative feedback from students: “I have showed [sic] a group of students Second Life. After we had all stopped laughing and we used it for weeks, and these are techy engineering types, they just said no and we

don't ever want to use that again. My experiment just showed that it's [Second Life] is not just for the techy types, it's for the ultra geeks who've got the time to put beards and hairstyles on and fly around the landscape".

There appears to be a perception among some lecturers that **social technologies are only suitable for "soft" disciplines or pre-university education**. As an Engineering lecturer said "*[blogs and wikis] might make sense in a lot of the softer subjects and primary and secondary education where they're doing it on onsite training and they want to be able to discuss things with their peers and with their tutors plus keep records of their experiences within the school and share that with the rest of the class, but I think there's only one of two enthusiasts [in the department] that are using tools other than what would be built into the VLE*". In addition, there seems to be a perception that using a variety of loosely coupled tools in addition to the VLE would create an undesirable **fragmentation of information and tools**: "*That is much more convenient for the academic if everything is in one place, the VLE, because we can find everything in one place, we don't need to open up one blog and open up MySpace and open up this or open up that then collect all that information together*".

Importantly, the vast majority of staff we interviewed did not have the first hand experience of most Web 2.0 technologies that were discussed – i.e. they did not use these tools to support their personal learning, knowledge management, research or networking with peers. Therefore it is not surprising that they did not appear to fully understand the nature and the affordances of these tools.

3.2.2.2. Potentially useful technologies and their educational value

Interviewers asked staff to elaborate on tools they viewed as potentially useful for learning, even if they were not currently using them. An Engineering lecturer viewed **handheld devices and wireless networking** as important for learning. Interestingly, he viewed these as a means of supplementing the technologies already used in classrooms (eg voting systems), rather than as a way of supporting different types of approaches to learning.

Lecturers appear to view access to content resources as a primary means of supporting learning. They would like to see students having instant access to content (in the VLE or on the web) via wifi-enabled mobile phones. As an Engineering lecturer said: "*they can do voting with it, it changes the whole concept of what happens in the classroom if they can all communicate through their phones...not with each other but get information from the web*". He seems to think that most students have or use wifi-enabled phones, while, as student interviews revealed, many students do not have new generation mobile phones and those who do seldom use these to access the Internet due to the high costs.

An Engineering lecturer suggested that **texting and instant messaging** could potentially be used in teaching, but that currently these technologies were "too crude for organised educational use". In his view these tools did not allow a clear delineation of the personal and the educational, and that the integration of the personal within the educational was undesirable: "*I know that a lot of people think that you should put the two together but the academics see absolutely no reason for the students' personal stuff to be linked in with their academic stuff because we are here, our job is the academic part...They could see it [the educational] on their phone [ie their personal devices] but it's got to be kept separate*".

One interviewee from Social Work suggested that social technologies have greater potential in **workplace learning than formal learning**: "*I have this notion that those kinds of tools [Web 2.0] and informal learning*

tools find a place more easily in the workplace and in work-based learning rather than in formal courses of study. That's not to say that I think they couldn't be harnessed in formal courses, but in social work I don't know of anybody in a formal course of study in a university context who's making active use of web2.0 type technologies".

3.2.2.3. Factors driving the adoption of technologies in teaching

Personal attitudes and open mindset towards experimentation with new technologies were mentioned as a key factor impacting adoption of tools. For example, discussing the adoption of the VLE within her department, a Social Work lecturer said: *"The person who makes the most of it's kind of been a hobby [for him/her]...because they like the technology and they are seeing benefits to their students".*

Some lecturers refer to **students' expectations and characteristics as a driving force**, believing that students entering university were more technology-savvy than the staff or previous generations of students. A Social Work lecturer commented: *"I think schools have changed very quickly and are now using technology and PowerPoint and a whole range of things...so I think it would be the truth to say [younger] students come in with probably much greater knowledge and expertise and awareness of its [technology's] potential than staff".* Whether an extensive experience of using PowerPoint qualifies as evidence of "greater knowledge and expertise of technology" is questionable, but the majority of the lecturers we interviewed echoed this view.

3.2.2.4. Barriers to integration of technologies within education

While a major barrier cited by some lecturers was **lack of time** to experiment with technology in teaching, lack of imagination and **reluctance to change** was also mentioned – with a Social Work staff member commenting: *"A lot of academics will say they don't have time to do it because of other demands, because of tension between research and teaching and I think for a lot they have got a particular way of doing things that they've been doing it over years and years and years delivering it in the same way and therefore it is hard for them to kind of deconstruct that, to loosen up about it".*

Staff IT skills was a further issue. While Engineering staff generally suggested they preferred to "figure out" the technologies themselves, Social Work interviewees seemed to require support to get up to speed with the use of technologies. There also seems to be a perception among some staff that one needs to have advanced IT, even programming skills, to be able to integrate educational technologies in teaching. As a Social Work lecturer said: *"There is a pressure on tutors. I mean I am still enthusiastic but I'm enthusiastic only in principle, I've never been particularly interested and not have the remotest skill to be a programmer." A few interviewees suggested that staff's IT skills were inferior to those of the students: "I find that a little embarrassing because a lot of courses will have a high number of school leavers and I just wonder if people face the same problems as I do, if they're sort of behind the students really who are coming out with advanced skills and at the moment I don't think that we all necessarily have the advanced skills to match it".*

Conversely, **lack of students' IT skills** was another barrier mentioned by lecturers. A Social Work lecturer suggested that technology use within the social work profession in general and social work agencies in particular was *"pretty crude and primitive"* and that this overall technophobia affected some mature social work students' uptake of the VLE and other technologies (mature students in Social Work are usually professionals with often extensive experience of working in the field).

Engineering staff at Strathclyde suggested that many students were reluctant to **use personal devices on campus**. In particular, this concerned laptops, which students were unwilling to bring to the university due to security considerations (eg lack of lockers in sporting facilities).

Some staff members were of the opinion that students' **access to internet outside university** was still an issue for a significant number of students and that this should be considered in developing teaching resources. However student survey and interview results do not back up this concern.

A number of **infrastructure-related issues** were mentioned by staff, including lack of broadband access in classrooms or poor wireless access in the buildings, due to the insufficient number of wireless routers or the architectural style of buildings (thick walls) causing problems with wireless signal.

4. Conclusion

The findings show that many young students are far from being the epitomic global, connected, socially-networked technologically-fluent digital native who has little patience for passive and linear forms of learning. While the use of technologies is limited in terms of the range and the nature, there is some evidence that younger students use some tools more actively than the older students, but neither of these two groups uses these technologies to support their learning effectively. Educators therefore cannot presume that all young students are “digital natives” who understand how to use technology to support and enhance their learning.

The majority of students use a limited range of technologies for formal and informal learning as well as socialising. These are mainly established ICTs - institutional VLE, Google and Wikipedia and mobile phones. Students make limited, mostly recreational, use of social technologies such as media sharing tools and social networking. Findings point to a very low level of use of and familiarity with collaborative knowledge creation tools such as wikis, personal web publishing, and other emergent technologies.

The study did not find evidence to support the claims made by some previous studies regarding students adopting radically different patterns of knowledge creation and sharing or exhibiting new forms of digital literacies. Instead, the study reveals that students' attitudes to learning appear to be influenced by the approaches adopted by their lecturers. Far from demanding lecturers change their practice, students appear to conform to fairly traditional pedagogies, albeit with minor uses of technology tools that deliver content. In fact students' expectations were that they would be “taught” in traditional ways – even though many of these students were engaged in courses that are viewed by these Universities as adopting innovative approaches to technology-enhanced learning. It is clear that the students in this study do not have a frame of reference of leading edge approaches to technology-enhanced learning to benchmark their current learning experiences against.

As students look to their lecturers for clues as to how to use technology tools for learning, many lecturers are unaware of the potential of these tools, since they themselves are not using emergent technologies for their own learning and work. While some lecturers recognise the educational value of some emergent technologies, others view these as ‘fads’. This situation could become exceedingly problematic as many social technologies such as blogs, wikis, and virtual worlds are progressively adopted by organisations, where employees are required to use them regularly for knowledge sharing and communication. This raises the question as to how well universities are preparing students for employment if they continue to dismiss

these tools and more importantly the processes and philosophies of learning and collective knowledge creation underpinning these tools.

So if the “digital natives” are not at the gate of the Ivory Tower demanding a pedagogic revolution quite yet, should the educational system bother to change? The answer is yes. Students and lecturers young or old may still lack digital skills and learning literacies, but these skills are now increasingly defined as “basic” competences that every educated person is expected to have. The ability to collectively create and share knowledge, often beyond the boundaries of one’s immediate groups and communities, the skills and behaviours needed to effectively network and engage with global professional communities, the ability to stay aware of the constantly emerging new knowledge in one’s field of practice – these are already essential competences for a modern professional. The social technologies have the capacity to support these collective and connective learning and knowledge creation processes in effective ways, but without changes in pedagogy universities will not succeed in producing independent, self-regulated learners who are able to take control of their own learning and who will be able to participate productively in the world beyond the Ivory Tower.

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Appendix 1. Questionnaire

Higher Education Academy Funded Project “Learning from Digital Natives: Integrating Formal and Informal Learning” Student Questionnaire

The purpose of this questionnaire is to gather details regarding your use of technology, both on your formal course of study and your own personal use of technology. We would be very grateful if you could complete this questionnaire by ticking the boxes corresponding to your answer or entering an appropriate response when indicated. Your participation is entirely voluntary and although completing this questionnaire will not benefit you directly, it may impact on the future use of various technologies in Higher Education curricula. Responses are confidential.

We would also like to identify potential participants for future interviews. There is a section at the end of this questionnaire where you can enter your email address so that we can contact you if you would be willing to take part. If you choose to participate, you will be paid for your time.

Section A – Your Personal Details

1. What is your gender?

Male Female

2. How old are you? (Please enter your age in the box)

3. What is your course of study?

BA Social Work
BSc Engineering

4. Do you currently have Internet access in your place of residence?

Yes No

5. Do you access the Internet on campus, and if so where?

Library Labs
Campus café Other

6. Which of the following do you own and use regularly? (please tick as many as apply)

Mobile Phone	
Portable Media Player (e.g. iPod, mp3 player)	
Personal Computer (e.g. Mac, PC)	
Handheld Computer (e.g. PDA, Blackberry, Palmtop)	
Laptop computer	
Games Console (e.g. Xbox, Playstation, Nintendo)	
Portable Games Console (e.g. Gameboy, SonyPSP)	
Digital Camera	
Other(s) (please give details)	

Section B – Use of Technology on *Your Course*

This section concerns your use of technology on your modules for your chosen course of study.

7. In your current year of study (2006/2007), how many of your modules have content that you can access through the university's Virtual Learning Environment (VLE), e.g. Blackboard or WebCT?

All of my modules	<input type="checkbox"/>
Most of my modules	<input type="checkbox"/>
A few of my modules	<input type="checkbox"/>
None of my modules	<input type="checkbox"/>

8. Please indicate which electronic tools you use **in your course** and the extent to which you use them:

	daily	weekly	monthly	never
Course website (e.g. lecture notes, activities, PowerPoint slides, video clips)				
Online Discussion Groups				
Virtual/Real Time Chat Facility				
Video Conferencing				
Online Assessments (e.g. Multiple choice quizzes)				
MP3 player				
Digital Camera				
Handheld Computer				
Mobile Phone				
Podcasts				
Internet Websites				
Google/Google Scholar				

Wikipedia				
Simulations, games				
Message Boards				
Text Messaging				
MySpace				
Weblog or Blog				
YouTube				
Other(s) (please give details)				

Section C – Use of Technology for *Your Own Learning*

This section concerns your use of technology for the purpose of learning or communication *in relation to your course* (e.g. to talk to other students about coursework), but *NOT* tools provided by your university for the course

9. Please indicate which electronic tools **NOT** provided by the University you use to help you with your studies (e.g. this may be other software or your own tools and devices.)

	daily	weekly	monthly	never
MySpace				
Digital Camera				
Networked PCs/Macs				
Weblog or Blog				
Message Boards				
Mobile Phone				
Second Life				
Video/audio clips				
Course Websites				
Internet Websites				
Podcasts				
MP3 player				
Wikipedia				
Simulations, games				
Handheld Computer				
Text Messaging				
Chat				
YouTube				
Google/Google Scholar				
Other(s) (please give details)				

10. Would you like to use any of these tools/software formally as part of your course if not already being used?

Yes	No	Don't
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		know

Section D – Other Use of Technology/Software

This section is about your use of technology *other than that detailed above*

11. Please indicate the extent to which you use the following electronic tools, software, websites etc., but **NOT** in relation to your course or study (i.e. for recreational use), and which particular ones you use.

	daily	weekly	monthly	never
Music (e.g. iTunes, MP3, etc)				
Photo upload and sharing (e.g. Flickr)				
Video upload and sharing (e.g. YouTube)				
Blogging (e.g. Blogger, Myspace)				
Social Networking (e.g. Myspace, Bebo)				
File sharing (e.g. Napster, BitTorrent)				
Discussion groups (e.g. Google Groups, Yahoo)				
Chat Rooms				
Wikis (e.g. Wikipedia)				
Virtual Worlds (e.g. Second Life)				
Internet gaming				
Others? (please give details)				

Section E – Further Participation In Our Study

Please tick the box below and enter your email address if you are interested in contributing further to our study by participating in a focus group and/or interview about your use of technology. Participants will be paid £5 for up to one hour of their time.

Yes, I am interested in taking part in a focus group discussion:

Please enter your email address (clearly, using block capitals) below:

Thank you for taking the time to complete this questionnaire.

Appendix 2. Student interview schedule

1. HARDWARE

You indicated in the questionnaire that you own and use these devices regularly...

- What do you use these devices for?
- What kind of software environments/Internet sites do you use them to access?

2. USE OF TECHNOLOGY ON YOUR COURSE

You indicated on your questionnaire that all of your modules have content in Blackboard.

- What kind of content do your lecturers/courses make available to you?
- How often do you use Blackboard?
- How useful do you find it? Why?
- Is there anything else you would like to use Blackboard for?
- Are there other tools or software you would like to use in your course? Why?

3. USE OF YOUR TECHNOLOGY FOR YOUR LEARNING

- What other tools do you use to help you with your studies?
- Can you give me examples of how you use them in relation to your learning/coursework?
- Do you use any tools to communicate with other students outside class?
- If so, which ones? Can you give me examples?

4. OTHER USE OF TECHNOLOGY/SOFTWARE

- What tools/software do you use in your own time, i.e. not for your studies?
- Eg MySpace/Bebo – how often do you use it? Do you have your own profile? Who do you talk to on MySpace/Bebo? Do you talk to any other students etc.?
- Eg Blogs – do you have your own blog? What do you write about in your blog?
- What do you like about MySpace/Bebo, Blogging etc.?
- Would you like to use blogs/MySpace/Bebo on your course?

5. INTEGRATION

- Would you like to use more technology/software on your course?
- Would you like to use any tools or software environments as part of your course?
- Which ones in particular? Why/Why not?

Appendix 3. Staff interview schedule

TEACHING STAFF

- Experience using ICT in teaching – the types of technologies used and the nature of use

- Views on the educational value of technologies
- Why did you choose these tools, what influenced your decision?
- What e-tools would you like to use that you don't currently use? Why don't you use these currently?
- Do you see your students using any tools themselves i.e. around campus, in the library etc, or that you know they use off campus?
- If so have you considered tapping into this use for their learning/your teaching? Why?
- What areas of teaching and learning do you think could benefit from use of tools that currently aren't used
- How did you learn to use these e-tools yourself?
- What influenced this?
- Did you get support? Learn yourself?
- Are there any particular projects/initiatives you're involved in that may be of interest to us?
- Could we get back to you to clarify points or ask one or two extra questions? Email, phone?

SUPPORT STAFF

- General views of using technology in teaching & learning, experiences
- What types of e-tools are used on the course(s) that you support
- Do you know why these were chosen? Were you involved in those decisions?
- Do you support any tools and technologies that aren't standard issue across the institution or department/faculty/school?
- How do you find that? What issues are there, problems, solutions, etc? What barriers to using e-tools?
- What type of requests do you get for help (concerning use of e-tools)
- What sort of tools do you notice students using?
- in class, outside the classroom, around campus, in the corridor
- off campus
- any other than those given by the tutors
- Do students talk to you about e-tools, i.e. what they may be using outside campus for other things?
- What type of e-tools do you think could be used but perhaps aren't being. Do you know why this may be?
- Are there any particular projects/initiatives you're involved in that may be of interest to us that we haven't mentioned?
- Could we get back to you to clarify points or ask one or two extra questions? Email, phone?

MANAGERS

- General views of using technology in teaching & learning, experiences
- What e-tools are used in your faculty/school/department?
- How easy has it been to get these tools into use? What barriers have there been?
- What sort of e-tools would you like to see being used and why? Why don't you use these currently?
- Are you aware of students using other e-tools, such as phones, ipods, blogs, and YouTube outside of class? Around the corridors, on or off campus?
- Do you see any of these as having educational value?
- Do staff come to you with ideas for use of e-tools? Are you able to help, if not why not, what type of problems prevent uptake of new ideas and tools?
- Are there any particular projects/initiatives you're involved in that may be of interest to us?
- Could we get back to you to clarify points or ask one or two extra questions? Email, phone?