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'Digital natives': An Asian perspective for using learning technologies

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ABSTRACT

Students entering universities in the 21st century have been described variously as digital natives, the millennial generation or the net generation. Considerable study has occurred around the world to determine the knowledge, skills, understanding and the purposes to which this group of individuals makes technology work for them. A number of researchers have begun to question some of the claims made for this group in terms of their ability to engage with and use technology for learning. To date there has been little information specific to the Asian learner and their use of technology. This paper begins with a description and analysis of a survey that examined the knowledge, skills and understanding of students entering first-year undergraduate studies at the University of Hong Kong. This description is followed by a discussion of the potential impact this has for the design of learning environments in higher education.

INTRODUCTION

The group of individuals born in the mid-1980s onwards have been variously described as digital natives (Prensky, 2001a) or the 'Y' or 'Net Generation' (Tapscott, 1998, 2009; Oblinger & Oblinger, 2005). They are the first generation to grow up with a deep familiarity and association with information and communication technologies (ICTs), having 'spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age' (Prensky, 2001a , p. 1). Tapscott (1998) suggested that the access to and use of digital media has fundamentally changed with the ways these young people think, particularly compared to their parents. A number of researchers and commentators have claimed (compared to previous generations) that this group of students:

- are better at multitasking and processing information rapidly;
- prefer non-linear access to information in bit-sized chunks;
- expect information to be provided very quickly and when needed;
- prefer learning in highly interactive ways; and
- use communication technologies to maintain social networks and access information.

(Oblinger, 2003; Oblinger & Oblinger, 2005; Prensky, 2001a, 2001b)

However, this view of digital natives, at least amongst Western students, has been challenged by a number of researchers (e.g. Kennedy, et al., 2008; Bennett, Marton & Kervin, 2008). Kennedy, et al. (2008) in particular have discussed the range of student experiences with new technologies and suggest that no revision of curricular or approaches to teaching and learning is thus far warranted. They propose that rather than making assumptions about incoming students to their institutions, researchers should focus on looking for evidence to inform both policy and practice. Bennett et al. (2008) indicate that the relationship with technology amongst new students is larger and more complex than the views expressed by Prensky (2001) and Tapscott (1998). More recently Jones, Ramanau, Cross and Healing (2010) emphasize that it is far too simplistic to describe young first-year students born after 1983 as a single generation as having equivalent technological skills.

Evidence is being presented that this group is not homogenous in its use and appreciation of new technologies. For example, Selwyn (2009) undertook a comprehensive review of the recent published literatures on young people and digital technology in information sciences, education studies and media/communication studies. The finding is in stark contrast to popular portrayals of the digital native. It is found that young people's engagements with digital technologies are varied and often unspectacular. More recently Helsper and Eynon (2010) have highlighted the distinction between digital natives and the digital immigrant educators in their comment that "we often erroneously presume a gap between educators and students and that if such a gap does exist, it is definitely possible to close it" (p.1).

Researchers in the Western world have in recent years started to more rigorously investigate the 'characteristics' of the net generation. Kennedy, Krause, Judd, Churchward and Gray (2006) surveyed first year undergraduate students at Melbourne University in Australia to provide quantitative and qualitative data on their use of technology. Not surprisingly, the first year university students reported a high use of technologies such as mobile phones, desktop computers and the internet. However, the data relating to the Asian students was very limited in both of these studies, with the final report stating that while Australian students used technology extensively, "the Asian students enrolled at the university used it more frequently"—indicating a lack of data specific to Asian students. Oliver and Goerke (2007) also report that the ownership of laptops, mobile phones and music devices appears to be growing rapidly among the first year undergraduates, along with their use of tools such as instant messaging, blogs and podcasts in Australian universities. Kvavik, Caruso and Morgan (2004) in an earliery study found similar data from students in the USA with ownership of personal computers, with over 90%, with the major activities being wordprocessing, using e-mail and the internet (all over 99%). Salaway and Caruso (2007) used a web-based survey to study how university students use technologies in the USA. They found that the great majority of students (86.1%) owned a cell phone, 73.7% owned a laptop and 60.3% owned a desktop. It is also indicated that the laptop ownership increased from 52.8% in 2005 to 75.8% in 2007. In their sample, almost all students used email, created presentations and used computers to create, edit and publish documents. In the UK, Eynon (2009) found that young people (17-19) are relatively high users of technology and use technologies for a wide range of activities. A more recent study at the University of Hong Kong (HKU) using the same survey instrument developed by the group that undertook the Australian study at the University of Melbourne was undertaken in order to provide more definitive data relating specifically to Asian students. In-coming first-year undergraduates were surveyed across all faculties. While it was not possible to get responses from all students the responses were such that all faculties were represented in the analysis of the results. What has become clear in more recent data is that in some contexts, the mobile phone is the preferred tool for accessing the internet. For example, Thinyane (2010) reported that there is a high level of access (98.1%) and use of mobile phone by university students in South Africa. Therefore it is popular for students to use traditional technologies such as SMS, email than Web 2.0 technologies and this greater usage of the mobile phone is reflected in the more recent surveys of students in Hong Kong. The key issue for the researchers involved in this study has become the implications for the ways in which curricula might need to be changed or adapted because of the massive uptake and use of technology for their learning and daily lives (particularly mobile phones) by students, and if indeed such changes are warranted.

BACKGROUND

Hong Kong has a highly developed infrastructure for access to telecommunication and technologies. Even as early as 2005, The Economist Intelligence Unit (2008) gave high scores to Hong Kong, ranking it No. 1 amongst Asia- pacific regions with the highest scores of 8.1 for connectivity and technology infrastructure. Also in 2005, The United Nation agency, International

Telecommunication Union published a first global index, the 'Digital Access Index' showing that Hong Kong was ranked seventh in the world and second among Asian economies. More recently, the Hong Kong Government statistics in 2010 show mobile subscriber penetration rates of 184% and household broadband at 81% (see http://www.info.gov.hk/digital21/eng/statistics/stat.html). With access to fixed and mobile technologies, there is an implicit assumption that Hong Kong students will have very high levels of use of information technologies. However, prior to this survey there was little evidence available as to the actual uses, devices they own, frequency of use, and if these technologies are also used for learning. In addition, no information was available on how these technologies might benefit learning, or if students would wish to use what may be seen as primarily social tools.

HKU is a premier research-led university in the Asia-Pacific region with over 22,000 students in ten faculties encompassing major areas of study (architecture, arts, business and economics, dentistry, education, engineering, law, medicine, science and social science). Fifty-five per cent of the students are undergraduates and around 4,500 students are non-local students from the mainland or (1,400) from countries outside Asia.

Additional factors to consider are the current changes in the design of the curriculum and a move towards adopting an outcomes-based approach to teaching and learning (OBATL) at all University Grants Committee (UGC) funded institutions. The UGC[1], is the body that ensures that at the system level, there are appropriate mechanisms and incentives in place to assist Hong Kong institutions to become more internationally competitive[2], The UGC has mandated the move to outcomes-based approaches to teaching and learning and provided funding to all institutions to help with the initiative. This strategy has echoed moves in higher education elsewhere, including Australia (Chalmers, 2007), Europe (UNESCO, 2000), the United Kingdom (NCIHE, 1997), the United States of America (Ewell, 2001) and Malaysia (Hashim & Mohd Din, 2008). The UGC believes that by focusing on student learning outcomes, academic planning, focus on quality outcomes and the distribution of internal teaching development grants will be enhanced. All eight UGC funded institutions in Hong Kong are also expected to develop a set of graduate attributes, supported by evidence gathered from the broad academic and social experience students experience during their studies. These moves have led to research into the use of OBATL in the curriculum. For example, Au and Kwan (2009) undertook a research project to study university instructors experience of teaching outcome-based computer science courses and how OBATL impacted on students, and themselves. Similarly, Lui and Shum (2010) proposed an Outcome-Based financial accounting curriculum to facilitate more effective student learning of financial accounting in Hong Kong.

This paper reports on a selection of the data gathered and then examines some implications for practice based upon the results. The study has generated baseline data in order to inform those involved in teaching, learning and administration about the digital skills and knowledge of HKU students. The paper then explores the implications for the use of new technologies in providing evidence for a range of graduate attributes as defined by the strategic plan at HKU.

RESEARCH METHOD

The project used similar methodology and the same survey instrument originally developed by The University of Melbourne (Kennedy et al., 2006). The questionnaire was divided into three parts that examined what types of technologies students had access to, how they used them and how they felt that technologies could assist their study. The survey also provided information about

[1] http://www.ugc.edu.hk/
[2] http://www.ugc.edu.hk/eng/ugc/policy/policy.htm

students' use of new and emerging technology-based hardware and software tools in the three areas (communicating, publishing and file sharing) such as instant messaging, file sharing, writing personal blogs, and the creation or use of digital media. The project questionnaire was distributed in two formats: paper and online survey. In addition, a small number of focus groups involving 50 students were undertaken with students in the Faculty of Education at HKU in order to better understand the findings of the survey. However, this data will not be reported in this paper as it was not possible to extend these focus groups to other faculties in the university. Instead, the current paper reports an analysis of the first 1130 responses, the majority of which were completed on paper forms (the online contribution was less than 15% (HKU students are not renowned for completing online questionnaires), representing a 37.7% return rate on the total number of first year undergraduate students. The survey data collection period was for five months.

DEMOGRAPHICS OF HKU STUDENTS IN THE STUDY

In many Western universities, the average age of undergraduate students has risen considerably, with students less than 21 years old often representing less than 50% of undergraduates[3]. In contrast, 92% of HKU students come straight from school and had an average age of 18 to 19 years in 2012. The majority of the sample (91.0%) consisted of local Hong Kong residents. The remainder were from mainland China (7.6%) or international students (1.4%). Therefore, the majority of the students received their secondary education in Hong Kong (88.4%), including 4.4% from local international schools. Other students come from the mainland China (7.3%), Macau (0.1%) and from overseas (4.1%). Demographically, 97.4% of the students were born on or after 1985. The students' sampled fit the digital native profile perfectly. The next part of the paper deals with the data from the survey and is primarily descriptive.

BROAD FINDINGS

Access to Technologies

In part one of the questionnaire, students were asked to describe their access to various types of technology, from 'Access exclusively for my own use' to 'No access' or 'Not sure'. Their responses were then re-categorized: 'Access exclusively' and 'Access any time I need it' was used to create the category 'Unrestricted access' while 'Shared with other people' became 'Limited access'. Students who responded 'Not sure' or did not provide data were combined into one category in the same way. Table 1 summarizes the key findings.

In Table 1, the data from Kennedy et al. (2008) is shown along with Hong Kong's figures. In general, as expected student access to mobile phones and computers was very high with many students having access to a multiplicity of devices. Mobile phones, are the most commonly used device in the list with 97.8% of students having unlimited access. Computers are the next most accessed device with 90.1% and 81.3% of students reporting unrestricted access to desktops and notebooks respectively, with 73.6% (n=826) of students have unlimited access to both. Compared to the data reported by Kennedy et al. (2008), Hong Kong students unlimited access to notebook computer is considerably higher than the Australian students (18.1%). Critically, only three students indicated that they have access to neither desktop or notebook computers. This is in spite of the wide availability of computers on campus. Anecdotal evidence suggests that the students without any access to either desktop or notebook computers come from either extremely

[3] http://www.usc.edu.au/university/about-usc/key-statistics/ and http://www.aucc.ca/_pdf/english/publications/trends-2011-vol1-enrolment-e.pdf

poor Hong Kong families or students from mainland China, but this was not confirmed by hard data.

Table 1: *Access to Technologies. Data for Australia from Kennedy et al. (2008)*

	Unrestricted Access (%)		Limited Access (%)		No access (%)		Not Sure / No response (%)	
	HK	Aus	HK	Aus	HK	Aus	HK	Aust
Mobile Phone	97.8	96.4	1.1	0.9	1.0	1.5	0.2	1.3
Desktop Computer	90.1	89.5	6.5	4.9	3.1	3.5	0.3	1.9
Memory Stick	89.2	72.5	5.3	7.1	5.1	17.3	0.4	3.1
Notebook Computer	81.3	63.2	6.6	10.0	11.6	24.0	0.4	2.8
Digital Camera	77.3	76.0	12.8	8.9	9.3	13.7	0.5	1.4
MP3 Player	63.4	68.9	12.4	5.7	22.8	23.3	1.4	2.2
Web Cam	54.6	-	14.8	-	29.0	-	1.6	-
Video Games Console	41.8	47.4	15.0	13.2	41.1	36.6	2.1	2.8
MP3/4 player with video	35.0	-	12.6	-	50.8	-	1.6	-
Electronic Organizer	17.7	10.8	11.6	7.8	68.2	77.3	2.5	4.1

Generally, males and females reported similar access to technologies, except for a dedicated video game console (males), while females were more likely to have unrestricted access to a digital camera and/ or mp3 player. Jacob and Issac (2008) reported a similar result on laptop ownership, the most popular devices among students are pen drives (i.e. USB drive/Memory stick), cell phones and laptops, and nearly 90% agreed that the laptop is the best and most efficient form of mobile device available at the time. A recent study reported by Jones, Ramanau, Cross and Healing (2010), shows that in UK three quarters (77.4%) of the respondents owned a laptop and over one-third (38.1%) owned a desktop computer. Almost all students owned a mobile phone (97.8%) and these phones were often equipped with a camera (91.9%), music player (77.25%) and Internet access (75.7%).

Other devices, primarily for personal entertainment use, included digital cameras, MP3 players, a web cam and video games consoles, recorded moderate to high popularity. An electronic organizer was the least common device (17.7%) suggesting that curriculum developments relying on PDAs would be ill advised. It is clear from the data that in general access to hardware was equivalent or exceeded the Australian study based on the same survey instrument. This observation will be repeated frequently in the analysis of the data.

Access to the internet

In Hong Kong, the highly developed telecom industry, high population density and increasing affluence has brought affordable internet access to almost everyone. In addition, the Hong Kong Government launched a Government Wi-Fi Programme (Gov*WiFi*), aiming at providing free wireless Internet access services to all citizens by installing Wi-Fi facilities at designated government premises. The number of Wi-Fi hotspots (access points) installed for provision of public Wi-Fi services is 9,555 throughout Hong Kong (Tsang, White, Fox, & Kwok, 2008). The current household broadband penetration rate in Hong Kong is 82.1% (OFTA, 2010). Table 2

presents the results of the students' internet access, 87.7% of students stated that they had unrestricted access to broadband internet. Nearly two thirds of the students (65.6%) had accessed the internet via wireless technology and less than one third (29.5%) accessed the internet through 'traditional' dial-up technology (29.5%). Compared to the access level of the internet reported by Kennedy et al. (2008), Hong Kong students have higher unrestricted access to the internet than their Australian counterparts in terms of Broadband Internet (14.8% more unrestricted access by Hong Kong students) and Wireless Internet (28.6% more unrestricted access by Hong Kong students).

Table 2: *Internet Access*

	Unrestricted Access (%)		Limited Access (%)		No Access (%)		Not Sure / No response (%)	
	HK	Australia	HK	Australia	HK	Australia	HK	Australia
Broadband Internet	87.7	72.9	5.5	5.7	5.3	18.1	1.5	3.3
Wireless Internet	65.6	37.0	11.4	8.6	22.0	48.3	1.1	6.1
Dial-up Internet	29.5	44.1	9.6	6.1	55.6	44.0	5.4	5.7

Findings: Mobile phones and their functions

Students were asked what functions are included in their mobile phones. Key functions reported by most students were: BlueTooth (80.9%), a video camera (80.7%) and an audio player (80.0%). Some 40% of students also have a mobile phone with access to the newer 3G networks. Some gender differences in the choice of mobile phone functions were noted. Females were more likely to own a mobile phone with PDA functions, and GPS, whereas their male counterparts were more likely to have phones with wireless and push email (e.g., Blackberry).

Findings: Students' Use of Technologies

In the second part of the questionnaire, students were asked to report how often they used the listed technologies in three areas: computers, mobile phones and the internet. To indicate the frequency of usage, they could choose from 'several times a day' to 'once/ twice a year' on a seven point Likert scale. The response percentages were summarized under 'daily', 'weekly', 'monthly or 'not used' in Table 3 (only key findings are reported).

Findings: Using technologies for play and work

The results indicated that very few first-year students do not use a computer to prepare presentations (1.2%), create documents (6.8%) or manage digital photos (14.4%). However, these technologies were not used as frequently compared to playing games. Up to 57% of students indicated that they used a computer to play games at least weekly, while only 35.7% used one to create presentations at least weekly. Notably, use of a PDA is not high among students, with 47.4% of students stating that they do not use one.

Table 3: *Use of computer-based technologies*

	Daily (%)	*Weekly (%)*	*Monthly + (%)*	*Not Used (%)*
Use a computer to manage or manipulate digital photos	12.8	34.6	45.7	6.8
Use a computer to create or manipulate digital images	6.9	23.7	54.9	14.4
Use a computer for creating presentations (e.g. PowerPoint)	5.9	29.8	63.2	1.2
Use a computer for creating or editing audio and video	4.8	13.7	53.8	27.8
Use a computer to play games	25.2	31.8	34.5	8.5
Use a games console to play games	11.0	22.2	34.3	32.4
Use a PDA or handheld computer as a personal organiser	13.6	15.0	24.0	47.4
Use a handheld games console (e.g. NDS, PSP) to play games	14.1	22.0	25.4	38.4

Findings: Mobile-Phone Based Technologies

Students used a mobile phone to call and text people at least weekly (94.3% and 89.9% respectively). Other mobile phone-based technologies that students used often were the camera function, MP3 player and personal organizer. Nonetheless, emergent mobile phone technologies at the time of this study had not yet gained wide popularity among students such as video calls (54.5%), access information on the web (57.8%), send or receive email (69.7%), use GPS (71.9%), access instant messaging services (68.5%), or post entries in a blog (73.7%). More than half of the students do not have access to a smart phone with these higher level functions (only 26.3%). However, as the technology advances such functions will become standard in mobile phones. This current situation is expected to change as mobile phones become more sophisticated and include more intensive functions. Just a few years ago a camera and a mobile phone was an expensive accessory, however, it is now difficult to buy a mobile phone without a camera.

Findings: Internet-Based Technologies

The results indicate that the majority of students regularly use internet-based technologies for three purposes: obtaining up-to-date information, communication, and entertainment. Significantly, over 90% of students use the web to look up general and study-related information at least weekly. Up to 71% of students indicated that they visited the university intranet daily.

E-mail and instant messaging are the predominant methods for students to communicate using the web. Other communication technologies, including web phone (e.g., Skype), web-conferencing, and social networking software, were less popular with 57%, 38% and 31.9% of students having never used them, respectively. However, one of the key findings is that approximately 90% of students read or comment on blogs. Some 80% of students even maintain their own blogs. It would seem that blogs have become a popular web-based technology widely used among HKU students.

Although most students use the internet regularly, the use of Web 2.0 technologies (e.g., Wikis, Blogs, MySpace, and Facebook) for learning is low. For example, over 60% of students have

never used social bookmarking software (e.g., Delicious), authored and published a podcast, or contributed to the Wikipedia. More than half of the students have not downloaded a podcast, or read RSS feeds. Generally, first year students in HKU are not frequent users of Web 2.0 technologies which are contrary to the predictions made by some commentators that the net generation prefers to be actively involved in the process of new knowledge creation to the passive consumption of knowledge in traditional learning. Preliminary discussions with students indicate a lack of need for study purposes to use any of these technologies. Podcasting, RSS feeds or the use of social bookmarking are not part of the lexicon of everyday student experiences. Such activities are still limited within the university, although more work needs to be done to determine the real extent of such technologies in the university. However, the focus groups indicated almost universal engagement with social technologies such as Facebook. In the focus groups students differentiated between the social and learning aspects of their lives in terms of Web 2.0 technologies.

Findings: Student's self-perceived skills on the use of technologies

After reporting the frequency of the use of technologies, students were asked to report their perceived skills on the use of the technologies. They selected from a 5-point Likert scale from '1 - not very skilled' to '5 - very skilled'. The mean score of each of the technologies is shown in Figure 1. Those who have not used the technologies are categorized under 'not used' option and no score is assigned.

Students reported that they are skilled at using the web to look up information, send or receive email, instant messaging, reading and commenting on blogs (a Web 2.0 technology). However, they are not confident at using some Web 2.0 technologies, such as podcasts, RSS feeds, social bookmarking software, nor do they maintain a website. They are also not familiar with more recent mobile phone technologies, such as accessing the internet, GPS, sending email, etc, but are very skilled at all other common functions (e.g., text and mp3).

When comparing students' frequency of use of technology to their perceived corresponding skills, the data indicates a very high correlation ($r = 0.898$, $p < 0.001$). Graph 1 provides a comparison: mean score between frequency (8-point scale, from 0 – not used to 7 – several times a day) and skills (5 - point scale, from 1 – not very skilled to 5 – very skilled). This result is reasonable, as the more frequently students use the technology, the more skilled they are. The lack of skills in the use of Web 2.0 technologies may be due to the few opportunities that students have to use them. The experience of students in high schools and universities in Hong Kong is primarily face-to-face where often such technologies are not perceived to be useful. Students therefore lack the opportunity and the motive to use Web 2.0 technologies. Although 81% students have notebooks most do not bring them to class. Students in the focus groups and representatives from the Student Union stated that the prevailing pedagogy at HKU does not support the use of ICTs in class. In fact, students stated that only a few lecturers used technology in class and the majority of this use was to display PowerPoint, which were sometimes uploaded to a Learning Management System (LMS).

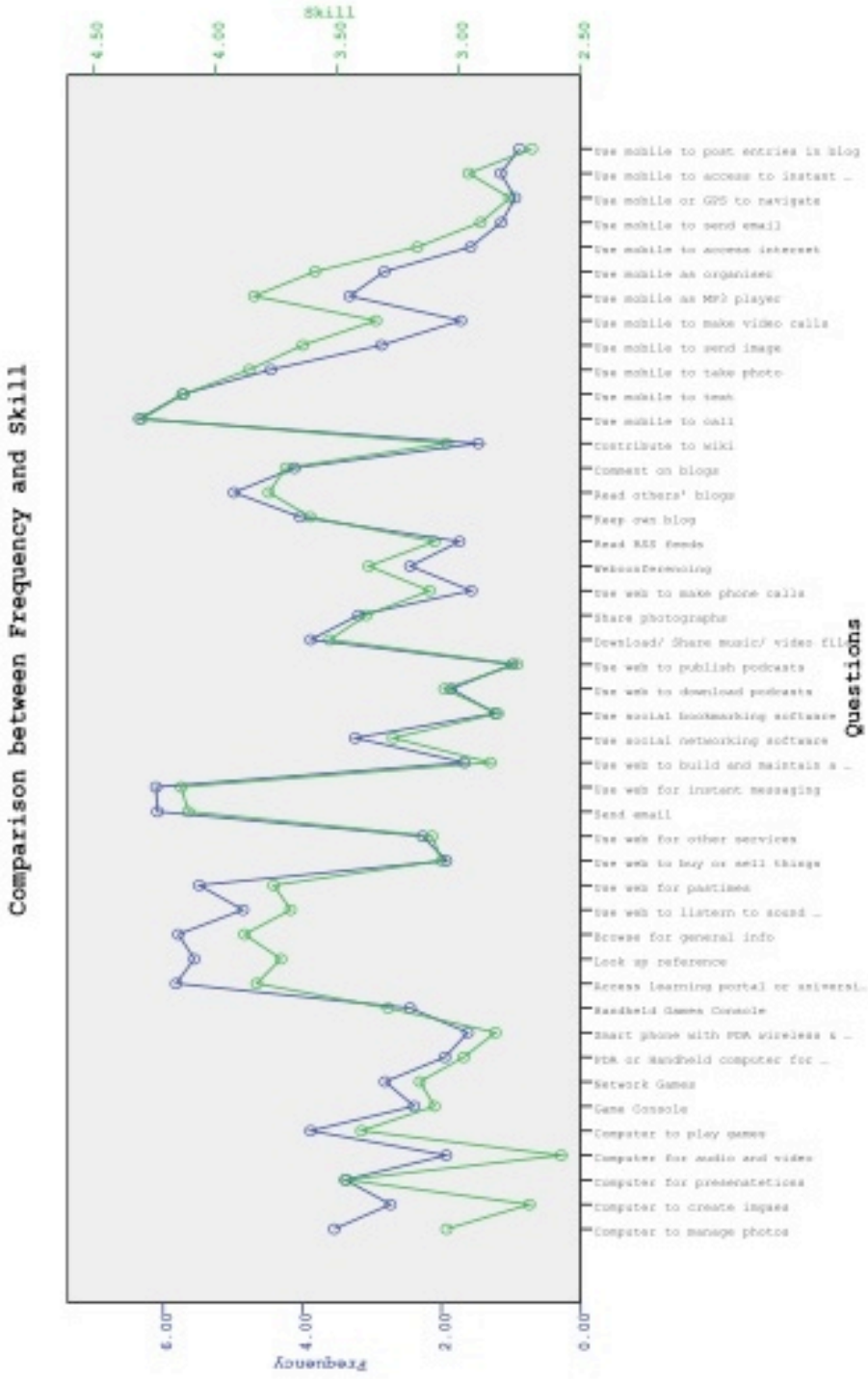


Figure 1: *Comparison on mean score between frequency of use and skills*

Findings: Technologies to assist university studies

In the final part of the questionnaire, students were given a list of technologies and asked to indicate their opinion on how useful those technologies are for helping with or supporting their studies. A 5-point scale from 'not at all useful' to 'extremely useful' or simply indicate 'don't know' was used. Table 4 summarizes the results.

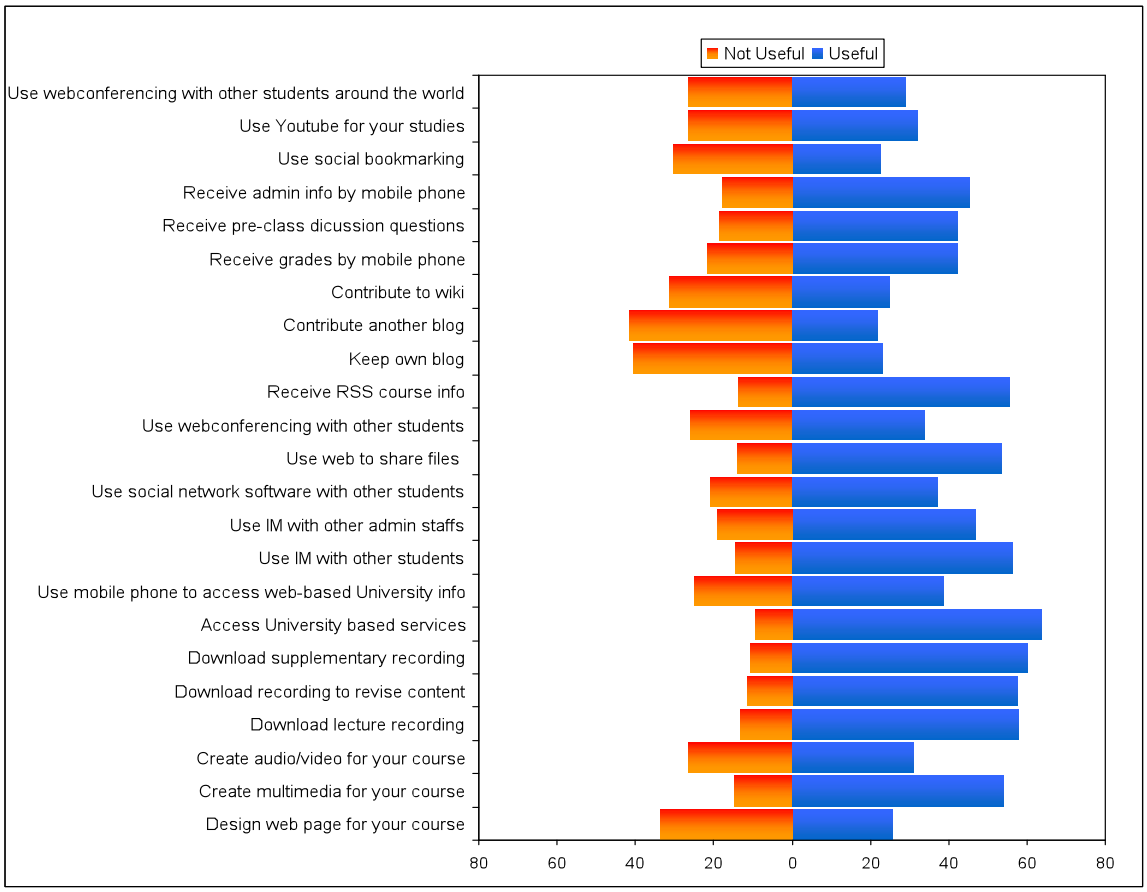
For an alternative interpretation of the data, the categories describing the data have been reorganized and presented in Graph 2 in order to show students' opinions on the use of such technologies for teaching and learning. The graph provides evidence that in general, more students agreed than disagreed that technologies can help their studies. A large number of students agreed that technology is useful in the creation and presentation of multimedia shows, for downloading supplementary materials of the course, sharing files related to courses, and access to university services.

Table 4: *Percentage of students' opinion on how useful technologies are for helping their studies*

	Don't Know	Not at all useful	Not useful	Neutral	Useful	Extremely useful
Design web pages as part of course	13.5%	11.3%	18.0%	34.6%	18.6%	3.9%
Present multimedia shows	5.0%	3.8%	9.3%	26.7%	40.0%	15.1%
Create audio/ video	10.7%	7.9%	15.6%	37.0%	24.5%	4.2%
Download recordings of lectures	7.2%	4.1%	8.7%	23.6%	29.4%	27.0%
Revise course material online	6.7%	4.7%	6.8%	26.0%	31.6%	24.3%
Download supplementary content	5.8%	2.4%	7.4%	24.9%	35.1%	24.5%
Access university based services	3.1%	2.4%	5.6%	23.5%	35.3%	30.1%
Use mobile phone to access university info	13.4%	8.0%	14.5%	31.0%	22.7%	10.4%
Use instant messager to communicate with students	4.7%	4.5%	8.2%	26.4%	34.4%	21.9%
Use instant messager to communicate with teachers	8.6%	6.2%	11.2%	29.7%	30.1%	14.2%
Use social networking to communicate with students	14.2%	4.2%	12.1%	34.7%	26.0%	8.8%
Share files related to course	6.7%	3.0%	8.5%	28.7%	35.8%	17.4%
Use web conferencing to communicate with students	12.5%	6.4%	16.1%	34.8%	23.7%	6.6%
Receive alerts about course information	11.2%	3.6%	6.9%	25.4%	28.6%	24.3%
Keep your own blog	13.6%	18.0%	20.4%	29.7%	14.5%	3.9%
Contribute to other blog	13.7%	16.7%	21.5%	30.3%	14.7%	3.1%
Contribute to wiki	16.5%	11.9%	16.3%	36.0%	15.5%	3.8%
Receive grades via mobile	10.0%	8.2%	12.5%	30.1%	25.4%	13.8%
Receive pre-class discussion via text message	9.8%	6.2%	11.2%	34.3%	26.1%	12.4%
Receive administrative info via text	10.7%	6.1%	10.7%	29.6%	26.9%	16.0%
Use social bookmarking	28.5%	9.0%	14.1%	33.7%	11.7%	3.1%
Use YouTube videos	13.2%	9.6%	14.7%	35.4%	21.6%	5.4%
Use web conferencing	19.4%	8.7%	12.9%	35.4%	18.4%	5.2%

They also agreed that technologies such as social networking software, instant messenger, and web-conferencing can enhance their communication with other students and teachers and thus assist their studies. However, when it comes to some Web 2.0 technologies, like contributing to wikis, keeping blogs and using social bookmarking software, a vast majority of students remain neutral or even hold negative views on their potential effect upon learning. This suggests that

students are not familiar with these technologies and do not regard them as a tool to assist their studies, in spite of the very high engagement with these technologies outside formal study.



Graph 2: *Students' opinions on how useful technologies would be to their studies*

DISCUSSION

It is clear from the results of the paper that the overall relationship between students and technology is significant, ubiquitous and a part of the everyday life of a student whether they are engaged in social or educational activities. However, the impact for teaching and learning is less clear. In the study by Grant, Malloy and Murphy (2009), students were evaluated and then tested on a range of computer skills associated with using the three major components of Microsoft Office, Word, PowerPoint and Excel. While students rated themselves quite highly in terms of their competence in using these applications, when tested (except for the use of PowerPoint), they fell well short of their expectations. This is in contrast to the work of Conole et al., (2006), who in a series of very intensive case studies with a number of students in higher education in the United Kingdom, focused on a broad range of technology-related issues (including Web 2.0 applications). The Conole et al., study provided evidence that 'Across all subjects the students made extensive use of personally owned technologies including mobile phones, laptop computers, personal digital assistants and USB memory sticks' (p. 5).

Keengwe (2007) carried out a study with a sample of at least 800 undergraduate students at a participating medium-sized midwest public university in USA. Results also suggest that students expressed high computer proficiency or competency in some technology applications such as email, and the Internet, but they lacked depth in specific areas of their computer skill repertoire such as hypermedia and authoring tools. Nasah, DaCosta, Kinsell, and Seok, (2010) studied a group of post-secondary students (N = 580) by using a Digital Propensity Index (DPI), investigating communication methods, Internet practices and the creation of online content. They suggested students' use of ICTs may be more a matter of digital literacy and access rather than a generational trait.

Conole et al. (2006, pp 4-5) categorized the student views of technology and their affordances for learning into eight components. They were:

- Pervasive and integrated, where students use a wide range of technologies in a variety of ways to support individual needs and ways of working.
- Personalised, in which students exhibit highly pragmatic approaches to the use of technology for personal needs, moving between computers, books and the internet seamlessly.
- Social, the technology provides the means to create a 'community of practice' in which peers network, share ideas, ask for help and get feedback (from each other).
- Interactive, 'students' perception of the nature and inherent worth of 'content' is changing'. Students have expectations that material is easily available via the internet, a preference for byte sized chunks of content than can be stored on handheld devices and accessed 24/7, and a perception that content is there to be adapted, annotated, interacted with and remixed to suit the task and application.
- Changing skills set, includes significant increases in evaluation and search strategies in order to make critical decisions about sources and content.
- Transferability, with the experience that access to information is ubiquitous, and simple, they have an expectation that their course will have the same levels of access and interaction.
- Time, with the fragmentation of time, students are increasingly using technology to remain connected and synchronized.
- Changing work patterns, the use of technological tools is changing the way students gather, use, annotate and create knowledge. There is a demonstrable shift towards the higher elements of Blooms' taxonomy.

Moreover, students were also critically aware of the strengths and weaknesses of technologies, discarding those that did not deliver—that is, if there was no direct personal benefit, technologies were discarded. Technology itself was just another tool to support their learning, and not viewed as anything special.

The question then arises, what does this mean for designers of curriculum in higher education? It is quite clear that the data does not provide a causal relationship between the use of technology and overall student learning outcomes. Some writers have argued very strongly for a need for more research into this relationship and the authors of this paper concur. However, does this mean we should wait for the results of this research before acting? Should we assume that the impact of technology on students learning is minimal, and these are merely tools that students used to engage in learning as argued by Clarke (1983) who saw technology as the grocery truck that merely delivered the groceries, having minimal impact on the actual learning process?

In the paper by Kennedy et al. (2008), which used the same instrument (survey) as used in this study, it was pointed out that the findings highlighted "the lack of homogeneity in the incoming first-year population with regards to technology and the potential digital divide between students within a cohort of a single year level". Kennedy et al. (2008) also pointed out that the results ran

counter to the assumptions and assertions made by Prensky (2001a) relating to students born since 1984.

In this paper we argue that the wide use of technology for learning by students provides an opportunity to create blended learning environments that leverage the affordances of a range of learning technologies, where the face-to-face relationships that students value are maintained and opportunities for engagement and assessment extended beyond the traditional classroom experience. What we suggest is that there are opportunities that need to be taken and explored, before the digital divide between staff (faculty) and students widens even further (e.g. Prensky, 2007; Conole et al. 2007)

SUMMARY, CONCLUSIONS AND FUTURE DIRECTIONS

This paper provides evidence that the first-year undergraduate students at HKU are indeed digital natives, using a wide range of technologies for personal empowerment and entertainment, but not always digitally literate in using technology to support their learning. This is particularly evident when it comes to student use of technology as consumers of content rather than creators of content specifically for academic purposes, evidenced, for example, in the production of ePortfolios. Students use a raft of technologies for communication, learning, staying connected with their friends and engaging with the world around them. It is clear from the data that the majority of students view the use of technology in their learning as positive. It is also clear that there are some gender differences in the ways in which students use and engage with different technologies. Further analysis of some of the open-ended replies and focus groups are likely to provide more information about the impact of technology on students' lives, and their learning. However, higher education needs to consider not only the affordances offered by technology, or the diversity of technological skills that incoming students have, but the stated goals of the institution. The majority of institutions have formulated (particularly in Hong Kong) sets of goals variously described as 'graduate attributes' that encompass very high-level learning outcomes. The graduate attributes require students to display evidence of specific, broadly-based learning outcomes[4] that include:

- pursuit of academic/professional excellence, critical intellectual enquiry and life-long learning
- tackling novel situations and ill-defined problems
- critical self-reflection, greater understanding of others, and upholding personal and professional ethics
- intercultural understanding and global citizenship
- communication and collaboration
- leadership and advocacy for the improvement of the human condition

Evidence for achievement of these graduate abilities can often come from more flexible approaches to assessment, moving away from the traditional essay to more inclusive forms of assessment that involve the broader use of media. For example, ePortfolios (particularly those used for assessment) offer ways in which the digital skills of students can be utilized to provide more compelling evidence of achievement of learning outcomes (for example see Mason, Pegler & Weller, 2004; Eynon & Bass, 2009; Yancy, Cambridge & Cambridge, 2009). The authors believe that with careful curriculum design (especially assessment), the digital skills of students offer opportunities for developing student digital literacies and creating innovative and interesting learning environments.

[4] http://tl.hku.hk/reform/

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