The digital divide between university students and teachers in Hong Kong

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A study presented at ASCILITE 2008 (Kennedy, Dalgarno et al., 2008) suggested that the digital divide between students and staff has been overestimated. This study, conducted at The Chinese University of Hong Kong, investigated the ownership and use patterns of a range of digital technologies by a stratified sample of 689 Year 1 Hong Kong students and 56 of their teachers. The study illustrated that our students on the whole are 'digitally ready'. However, these so-called digital natives are not a homogeneous group and there is variation both in the level of ownership of digital devices and of perceived acquisition of appropriate digital skills. The digital divide between teachers and students is not straight-forward and appear to relate, not to ownership, but to preferences and prior experiences with technology. Factor analysis revealed seven categories of technology-based activities with students reporting higher use and confidence in most areas. Implications for staff development and student-support services are noted.

Keywords: digital natives, digital technologies, digital skills, prior experiences, higher education

Digital natives and immigrants

It is a common view that students are able to use and are using many digital technologies in their everyday lives. The persuasive writing of authors such as Prensky (2001a, b, 2006) have highlighted a dramatic shift in the technologies now available to young and not-so-young people. Studies in Australia (Kennedy, Krause & Churchward, et al., 2006; Kennedy, Krause & Gray et al., 2006), in the US (Kvavik, 2005; Salaway, Caruso & Nelson, 2008) and in the UK (Green & Hannon, 2007) in general confirm that the vast majority of university students in these countries have ready access to web-enabled personal computers and own personal digital devices such as mobile phones. They also use a wide range of digital features and web features in their everyday lives for communication or for forming social networks.

Two general, often unstated, assumptions have arisen:

1. that 'older' folk, the so-called 'digital immigrants', a group that contains most academic teachers, use technology less and are less digitally skilled; and
2. that students can readily use technology in learning, and would welcome or even expect quite different educational environments and strategies than students before them.

Previous literature implies that all (or at least most) teachers will not be able to adapt to a fast-changing digitally enhanced world. Prensky (2001*a*) considered that, like all immigrants, digital immigrants struggling to adapt to the new environment will always retain, to some degree, their "accent", that is, their foot in the past. Examples of the "digital immigrant accent" include printing out a document written on a computer in order to edit it, or reading the manual for a program rather than assuming that the program itself will teach users appropriately.

However, a recent study across three Australian universities (Kennedy, Krause et al., 2008; Kennedy, Dalgarno et al., 2008) provides evidence that the 'digital divide', the discrepancy between the technological skills and dispositions of digital natives and digital immigrants, is not so great.

Avoiding over-simplifications

Even quite recent publications imply that modern students are quite different in character from previous generations. On the basis of these assumptions, quite radical changes are being advocated to curriculum and learning environment design (Tapscott, 2008). Current students have been described as "disappointed", "disengaged" and "dissatisfied" about the outdated and irrelevant curriculum (Bennett, Maton & Kervin, 2008). Mismatches of teaching and learning styles have surfaced in a number of reports, often based at school level (e.g. Downes, 2002; Levin and Arafeh, 2002), where the use of technology in formal education has clearly not met students' learning needs. However, there are uncertainties in the current literature at tertiary level; for example, Selwyn (2008) and Jones and Cross (2009) in the UK reported gender differences but the extensive work of the EDUCAUSE Center for Applied Research (ECAR) in the US (e.g. Salaway, Caruso & Nelson, 2008) uncovered few gender differences (perhaps a national difference?). Further, Jones and Cross (2009), described the concerns of Bennett et al. (2008) as "academic moral panic" and "over exaggerated" (p. 19). Clearly, this is still an area for further clarification. In what ways are our students changing? How do we need to accommodate these changes? How are the learning spaces of the 21st century likely to evolve?

The term 'digital natives' does not describe all young students. In 2005, Kvavik conducted a survey of 4374 students across 13 institutions in the United States. The most common technology uses were word processing (99.5%), emailing (99.5%) and surfing the Net for pleasure (99.5%); only around 21% of respondents engaged in using computers to creating their own content and multimedia for the web. The high figures are echoed in the three ECAR surveys of US undergraduate students' use of IT. Salaway, Caruso and Nelson (2008) provided the third ECAR report, showing upward trends in access to and use of a range of technologies; in addition, there is a growing use of social network technology with younger students being more active. [It should be noted that there are almost no mature-age undergraduate students in Hong Kong; almost all students enter university direct from secondary school – almost all our university students are 'young'.]

The data indicates that most students rely on technology to collect information and communicate; however, a significant number of young people do not appear to use (or possess?) the skills we expect digital natives to have (Bennett et al., 2008, p. 3). It is thus dangerous to over generalize the ability and expectations of our young students. Even the core technology-based skills "do not necessarily translate into sophisticated skills with other technologies or general information literacy" and there are fewer students who have "high level of competence across a wide range of applications" (Kennedy, Krause et al., 2008, p. 117).

To what extent do the descriptions of digital natives reflect the needs and abilities of all young people? Is 'living technology' always adapted as 'learning technology'? According to Kennedy, Krause et al. (2008), "the transfer from a social or entertainment technology (a living technology) to a learning technology is neither automatic nor guaranteed." (p. 119). We cannot take it for granted and just believe that all students prefer using video games, movies or mobile phones to learn.

The recent Australian survey shows that there is only limited empirical support for a universal description of digital natives. Digital natives are not a homogenous group. "When one moves beyond entrenched technologies and tools, the patterns of access to, use of and preference for arrange of other technologies show considerable variation" (Kennedy, Krause et al., 2008, p. 117). In this sense, the concept of digital natives is not universal and so the widespread revision of curricula solely on the 'digital natives' argument is not warranted.

Further, there is no strong empirical evidence that students are committed to eLearning, that is, to using the technology-based tools they know how to use with the intention of maximizing their learning experience and outcomes. On the contrary, there are reported instances of student resistance to the use of technology in teaching and learning. Many eLearning strategies lack students' support (McNaught, Lam, Keing & Cheng, 2006). A recent study conducted in The Chinese University of Hong Kong (CUHK) concerning students' perceptions of mobile eBook technology (Lam, Lam, Lam & McNaught, 2009) indicated that eBooks are not yet a useful and practical tool for academic learning. While students who were first introduced to the technology in generally gave us positive comments about the technology, those who actually spent more time on it were much less enthusiastic. Despite the fact that students are able to use digital technologies for many tasks in their daily life, they can be conservative and hesitant when it comes to the adoption of a certain eLearning strategy. There may be novelty effects when students first come across a new technology, but they are very pragmatic and they will soon abandon new methods if the expected benefits do not occur or they find the methods do not meet their needs. The following simple logic does not seem to work: since many students are digital natives they would welcome a digital environment in which to study as well.

Before we "throw the baby out with the bath water" and advocate sweeping changes to our education systems, we need clearer evidence of how students and teachers use technology for life and for learning. As the technology terrain is rapidly changing, we need to accept that our data will be relevant at this time and will not have a long shelf-life.

The study

The study was a Hong Kong counterpart of the Australian digital native study (Kennedy, Krause & Gray, 2006; Kennedy, Krause et al., 2008; Kennedy, Dalgarno et al., 2008). We made minor changes to the survey instrument used in Australia, basically adapting it to better suit the local context. There were two versions of the instrument: a student version and a teacher version. Our contribution is by providing a further source of data in order to:

- investigate the extent of universality of the concepts of digital natives, digital immigrants and digital divide, especially in an Asian context; and
- explore the nature of differences in digital experiences between teachers and students in an Asian context.

The paper reports findings on the quantitative data relating to the **access to various digital technologies** (not including the access on campus) and the **use of various online strategies**. The data on the access of technology on campus has not been included in this paper and will be reported elsewhere.

CUHK is a comprehensive university with eight faculties – Arts, Business Administration, Education, Engineering, Law, Medicine, Science and Social Science. One department in each of the eight faculties in the University was invited to take part in this study. We asked all the Year 1 students in these departments to complete a student version of the digital native questionnaire, and we invited all teachers who taught Year 1 courses in these departments to fill in the teacher version of the questionnaire as well. The teacher and student versions differed only in minimal contextual ways. The overall response rate of students in these eight departments was 83% with 689 responses being received. Apart from Law, the response rates were all >74%; in five departments the response rates were >90%. The response rate of teachers was 39% with 56 responses being received. The variation in response rate was high but in five of the eight departments the response rates were >50% and in two departments were 100%.

Findings

While the data are analyzed by comparing groups, it should be stated that the actual levels of technology use by CUHK students is quite high. The data from the pilot study shows this (McNaught, Lam & Lam, 2009).

When Chi-square tests were used, standardized residuals were calculated; as it is a 2x2 cross-tabulation with only one degree of freedom, any significant standardized residual in one cell is associated with a genuine effect for the overall test. Of the 13 significant chi-square results depicted in Figures 1 and 2, there were four at marginal p-values at 5% level that did not have significant standardized residuals. These four results (relating to portable computer in Figure 1 and the three results with * p-value <=0.05 in Figure 2 – PDA, WiFi and instant messaging) should be treated with caution. In addition, as noted earlier, the lower teacher participation rate needs to be borne in mind when interpreting these findings.

Access to technology: Digital technologies

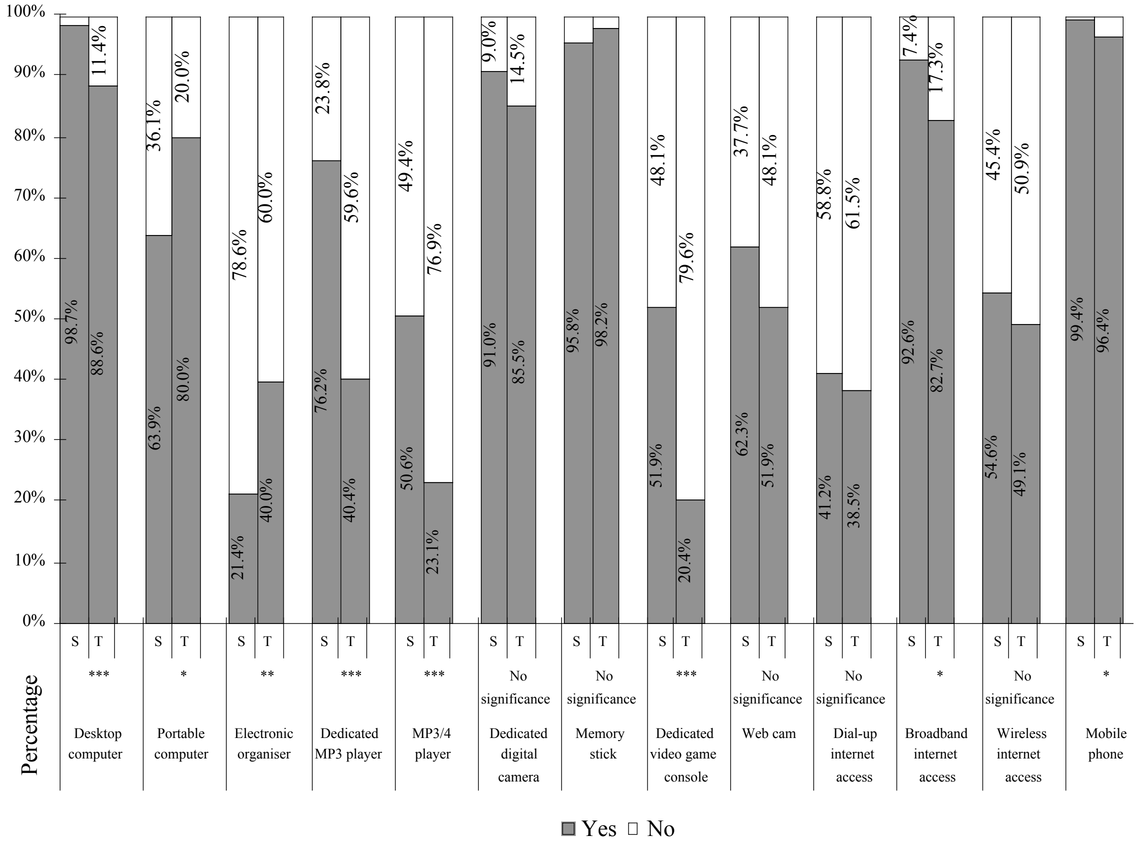
The responses of teachers and students about general access to different types of technology were compared using Chi-square tests; results are shown on Figure 1. The differences were found to be statistically significant at the level of 0.05 or below in 8 of the 13 items. In most of these items, more students than teachers in general had access to the digital technologies (desktop computer, dedicated MP3 player, MP3/4 player, dedicated video game console, broadband Internet access and mobile phone). In Hong, where housing is very cramped, and students use shopping malls and public places for study, the type of Internet access is relevant. Teachers had more access than students to two items: portable computer and electronic organizer.

We investigated the variations of digital experiences among our students by further investigating the student data on the dimensions of discipline, year of birth and gender. The multivariate tests (MANOVA) we ran showed that students vary in their access to digital technologies and the difference was statistically significant at the level 0.005, both when considering discipline of study ($F_{(91,\ 3400)} = 2.153$, $p = 0.000$) and gender ($F_{(13,\ 549)} = 8.308$, $p = 0.000$). No statistical significant differences were found on year of birth.

Follow-up univariate t-tests were then ran on the data to seek more detail about these differences between individual disciplines and gender. We found that students of different disciplines had statistically significant differences in access for 7 items (Table 1, shaded cells), and males and females differed mainly on their access to the 6 items listed in Table 2 (shaded cells). In general, students in the Faculty of Law and the Faculty of Education in our study seemed to have better access to technology outside the campus. Also, in our study more males than females had access to the various digital items except that more females seemed to have access to a digital camera. Numbers in all tables refer to a 5-point scale.

Access to technology: Mobile phones and their features

Mobile phones are ubiquitous in Hong Kong with current ownership greater than 150% of the population. The section of the questionnaire focusing on the types of mobile phones the teachers and students had access to is therefore quite significant. Teachers' and students' responses are contrasted in Figure 2.



Ownership of digital devices by students [S] and teachers [T]
[*** p-value<=0.001 **p-value<=0.005 *p-value<=0.05]

Figure 1: Ownership of digital technologies by teachers and students

Chi-square tests were run. Statistically significant differences were found that showed teachers and students were different in 6 of the 9 items. This time, the differences did not show a one-sided advantage towards the students. Teachers' and students' phones seemed to be equally sophisticated in functions. While more phones of students had PDA functions, video cameras and MP3/audio players, teachers' phones were on the whole stronger in supporting WIFI and instant messaging.

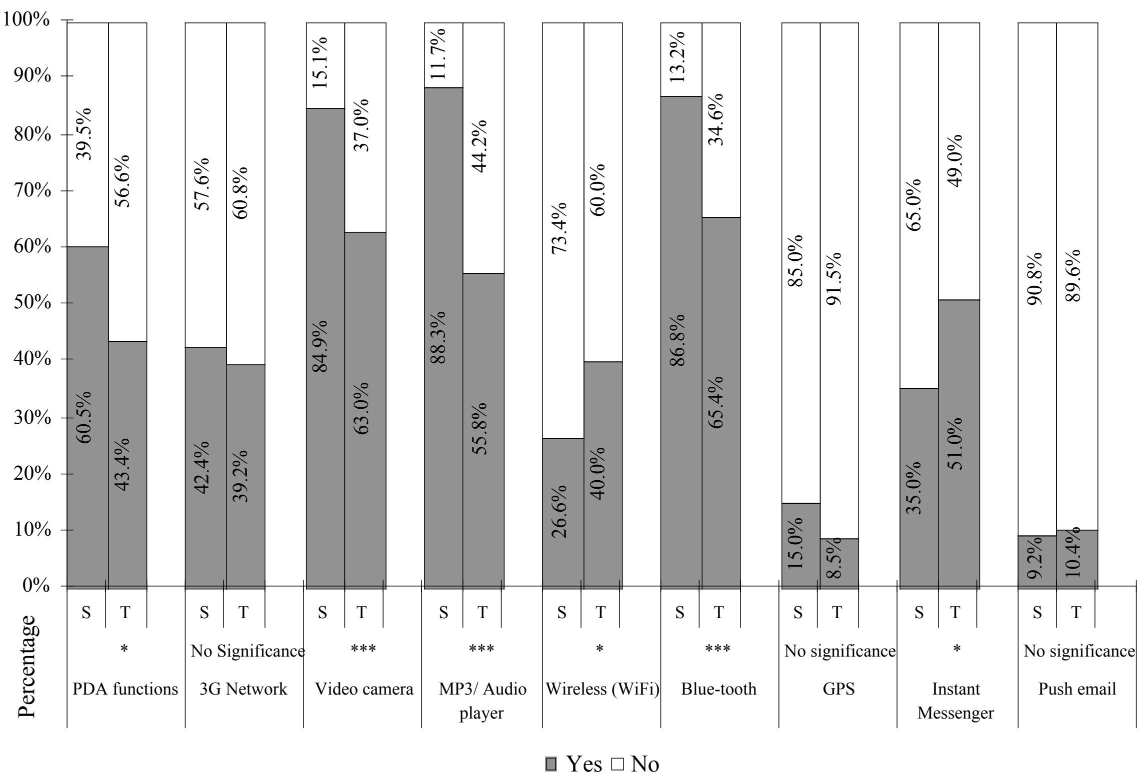
In order to investigate the variations in digital experiences among our students, we further analyzed the student data on three dimensions: discipline, year of birth and gender. The multivariate tests showed that students of different disciplines, ages and gender all had statistical significant differences for the features of their mobile phones (Wilk's Lambda, p-value = 0.000, 0.140 and 0.000 respectively). Follow-up univariate t-tests, however, showed that the students only differed in a few individual items. Regarding students in different disciplines, for example, only the function push email (p-value < 0.05) had a significant difference. Regarding age, only 3G network, WiFi and push email (p-value < 0.05) were significantly different. Regarding gender, only questions relating to video camera, MP3/audio player and blue-tooth (p-value < 0.05) had statistically significant differences.

Table 1: Univariate differences on access to technology between disciplines of study

Q	Access to technology ARTS	BA	EDU	ENG	MED	SCI	SOC	LAW	F	p
Portable computer	3.64 (1.32)	3.12 (1.16)	2.94 (1.34)	3.46 (1.23)	3.51 (1.23)	4.03 (1.32)	3.78 (1.23)	**4.25 (1.36)**	4.724	0.000
Electronic organiser	2.40 (0.97)	2.48 (0.94)	**2.88 (1.31)**	2.62 (1.05)	2.23 (.61)	2.46 (1.01)	2.48 (1.01)	2.25 (0.87)	2.231	0.030
Dedicated MP3 player	4.34 (1.17)	3.87 (1.19)	4.06 (1.06)	3.71 (1.28)	3.75 (1.25)	3.83 (1.29)	3.35 (1.32)	**4.67 (.89)**	3.334	0.002
MP3/4 player	3.32 (1.41)	3.13 (1.19)	**3.63 (1.20)**	3.27 (1.26)	3.03 (1.20)	3.23 (1.37)	2.61 (1.04)	3.42 (1.51)	2.113	0.041
Dedicated video game console	3.04 (1.14)	3.11 (1.16)	**3.44 (1.37)**	3.24 (1.24)	2.91 (1.13)	3.63 (1.26)	2.74 (0.98)	2.42 (1.00)	3.129	0.003
Broadband Internet access	4.52 (0.65)	4.33 (0.81)	3.88 (1.15)	4.29 (0.85)	4.13 (0.90)	4.54 (0.51)	4.00 (1.03)	**4.67 (0.49)**	3.489	0.001
Wireless Internet access	3.32 (1.35)	3.06 (1.18)	3.31 (1.25)	3.32 (1.19)	2.92 (1.15)	**3.69 (1.13)**	3.11 (1.12)	3.50 (1.45)	2.518	0.015

Table 2: Univariate differences on ownership relating to gender of students

Question	Possession of device Male	Female	F	p
Desktop computer	**4.48 (0.64)**	4.31 (0.63)	9.367	0.002
Electronic organiser	**2.63 (1.10)**	2.29 (0.71)	19.909	0.000
Dedicated digital camera	3.94 (1.00)	**4.21 (0.80)**	12.614	0.000
Dedicated video game console	**3.43 (1.27)**	2.80 (1.03)	42.986	0.000
Broadband Internet access	**4.41 (0.73)**	4.17 (0.92)	11.229	0.001
Wireless Internet access	**3.31 (1.21)**	3.01 (1.18)	8.603	0.003



Features of mobile phone owned by students [S] and teachers [T]
[*** p-value<=0.001 **p-value<=0.005 *p-value<=0.05]

Figure 2: Functions of mobile phones by teachers and students

Use and confidence of use

Questions in the one section of the questionnaire asked teachers and students to comment on 1) the frequency of use, and 2) the level of skill they felt they had in using 45 online tools or strategies. Factor analysis was used on the data in order to find a coherent set of groupings for these online tools and strategies. Principal component factor analysis was the statistical method used; the nature of the data, sample size and a range of statistical indicators were all acceptable for the use of principal component factor analysis.

Table 3: Factor analysis to show 7 factors (32 variables)

		Factors						
	Items	1	2	3	4	5	6	7
Q67A	Use a mobile phone to post entries in blog	**.800**						
Q65A	Use a mobile phone or GPS to navigate	**.784**						
Q46A	Use the web to publish podcasts (e.g. using Podifier, Podcaster, PodProducer)	**.775**						
Q44A	Use social bookmarking software on the web (e.g. del.icio.us)	**.737**						
Q49A	Use the web to make phone calls (e.g. VoIP using Skype)	**.723**						
Q55A	Use the web to contribute to the development of a wiki	**.711**						
Q60A	Use a mobile phone to make video calls	**.636**						
Q38A	Use the web to buy or sell things (e.g. eBay, Amazon, air tickets.)	**.583**						
Q50A	Use the web for webconferencing (e.g. using a webcam with Skype or MSN Messenger)	**.580**						
Q39A	Use the web for other services (e.g. banking, paying bills)	**.510**						
Q52A	Use the web to keep your own blog or vlog		**.866**					
Q54A	Use the web to comment on blogs or vlogs		**.855**					
Q53A	Use the web to read other people's blogs or vlogs		**.829**					
Q41A	Use the web/Internet for instant messaging / chat (e.g. MSN, QQ, ICQ)		**.458**					.437
Q27A	Use a computer to play games			**.830**				
Q29A	Use the Internet/web or a LAN to play networked games			**.778**				
Q28A	Use a games console to play games			**.748**				
Q32A	Use a handheld games console (e.g. NDS, PSP) to play games			**.628**				
Q23A	Use a computer to manage or manipulate digital photos (e.g. using iPhoto, Dig. Image, Picasa)				**.664**			
Q24A	Use a computer to create or manipulate digital images (e.g. using Photoshop)				**.636**			
Q31A	Use a smart phone which includes a PDA, wireless and Internet functions				**.617**			
Q30A	Use a PDA or handheld computer as a personal organiser (e.g. diary, address book)	.403			**.583**			
Q57A	Use a mobile phone to text / SMS people					**.774**		
Q56A	Use a mobile phone to call people					**.744**		
Q58A	Use a mobile phone to take digital photos or movies					**.703**		
Q62A	Use a mobile phone as a personal organiser (e.g. diary, address book)					**.421**		
Q34A	Use the web to look up reference information for study purposes (e.g. search engines, online dictionaries, e-Journal)						**.765**	
Q35A	Use the web to browse for general information (e.g. news, holidaying, event timetables)						**.685**	.400
Q40A	Use the web/Internet to send or receive email (e.g. Hotmail, Yahoo, Outlook)						**.606**	
Q25A	Use a computer for creating presentations (e.g. PowerPoint)						**.440**	
Q36A	Use the web to listen to sound recordings (e.g. via streaming audio or iTunes)							**.604**
Q37A	Use the web for other pastimes (i.e. for leisure activities)							**.604**

After multiple cycles and refining the item set (exclusion of 13 items in the process by removing the variables with low communalities – less than 0.50 – and the variables loaded on more than one component – loadings greater than 0.45), SPSS extracted 7 components indicated by the latent root criterion that could explain 62.178% of the total variance. The 7 factors and their 32 variables are listed in Table 3.

The factors can be explained by the following 7 conceptual categories:

1. *Advanced web or mobile features*: the use of contemporary web-based and mobile technology such as web videoconferencing, buying and selling on the web, social bookmarking on the web and the more sophisticated mobile functions such as GPS and making video calls on the phones.

2. *Social features*: the use of the web for social networking and web-based publishing such as the use of blogs and chat.
3. *Games*: playing online, computer and video-console games.
4. *Management of personal data and multimedia files*: the use of the computer or the phone to handle personal data, including the management of personal photos.
5. *Simple mobile functions*: the use of the comparatively more basic functions of mobile phones (e.g. making phone calls, taking photographs and address book).
6. *Simple web/ computer functions*: the use of the comparatively more basic web (e.g. searching for information) or computer strategies (e.g. making PowerPoints).
7. *Entertainment*: the use of the computer for entertainment other than games (e.g. listening to recordings).

Reliability scores of the 7 scales were satisfactory. The Cronbach's Alpha of the 7 factors ranged from 0.6 to 0.88 as shown in Table 4.

Table 4: Cronbach's Alpha of the 7 factors

Factors	Conceptual category	Cronbach's Alpha
1	Advanced web or mobile features	0.888
2	Social features	0.862
3	Games	0.801
4	Management of personal data and multimedia files	0.737
5	Simple mobile functions	0.656
6	Simple web functions	0.638
7	Entertainment	0.608

The factors are, on the whole, comparable to those identified in Kennedy, Dalgarno, et al. (2008). The main difference is that we had a conceptual category that combined three of the factors in the Australian paper, namely *Advanced technology use*, *Advanced mobile use* and *Web-based services* into one, *Advanced web or mobile features*. We had a new category called *Management of personal data and multimedia files* which had items that belonged to *Standard mobile use* and *Digital media presentation* in the study of Kennedy, Dalgarno, et al. (2008).

Figure 3 illustrates how frequently our teachers and students used the strategies in each of the 7 categories. We used High, Medium, Low and Nil usage in our analysis as a means to simplify the representation. *High* usage corresponded to using the strategies more frequently than once a week on the questionnaire. *Medium* usage meant using it more frequently than once a month but less frequently than once a week. *Low* usage means less frequently than once a month. *Nil* meant the teacher or student had never used the strategy before.

Chi-square tests were run. Statistically significant differences were found between the teachers' and students' in 6 of the 7 categories of computer strategy use (all except factor 4: *Management of personal data and multimedia files*). Among these 6 categories that showed significant differences, students were found to use most of the computer strategies much more frequently than the teachers. The only exception was teachers' use of the simple web functions (factor 6) where teachers had more frequent use than the students.

Apart from reporting how frequent they used these computer and web strategies, the teachers and students were asked to comment on their perceptions of the level of skill (novice to expert in 5 rankings) they had on each of them.

Table 5: Univariate differences between teachers and students' self-reported skillfulness in technology use

	Perceptions of skill			
Factor	Students	Teachers	F	p
Advanced web or mobile features	**3.80** (0.87)	3.22 (1.01)	10.227	0.001
Social features	**3.12** (1.00)	2.64 (0.98)	5.684	0.017
Simple web functions	3.72 (0.80)	**4.13** (0.73)	6.100	0.014
Entertainment	**3.75** (0.92)	3.34 (0.61)	4.749	0.030

We ran MANOVA on the data and found teachers and students on the whole differed statistically significantly on perceived skill levels ($F_{(7,\ 513)} = 13.205$, $p = 0.000$). Follow-up univariate tests indicated that statistically significant differences were found in 4 of the 7 factors. The scores of teachers and students in the 4 factors are shown in Table 5. Students reported higher confidence of their computer skills nearly in every domain. Teachers, however, reported they considered themselves to be more skillful in handling the basic web strategies.

We investigated whether students who had different backgrounds had varied perceived levels of computer skills. We analyzed the student data about confidence on three dimensions: discipline, year of birth and gender. Frequency of use was not contrasted because of the categorical nature of the item. The multivariate tests (MANOVA) we ran showed that students of different disciplines ($F_{(49,\ 2451)} = 2.354$, $p = 0.000$) and gender ($F_{(7,\ 487)} = 14.408$, $p = 0.000$) vary in their confidence in computer skills while age did not seem to be a determining factor (as mentioned, the students had similar ages).

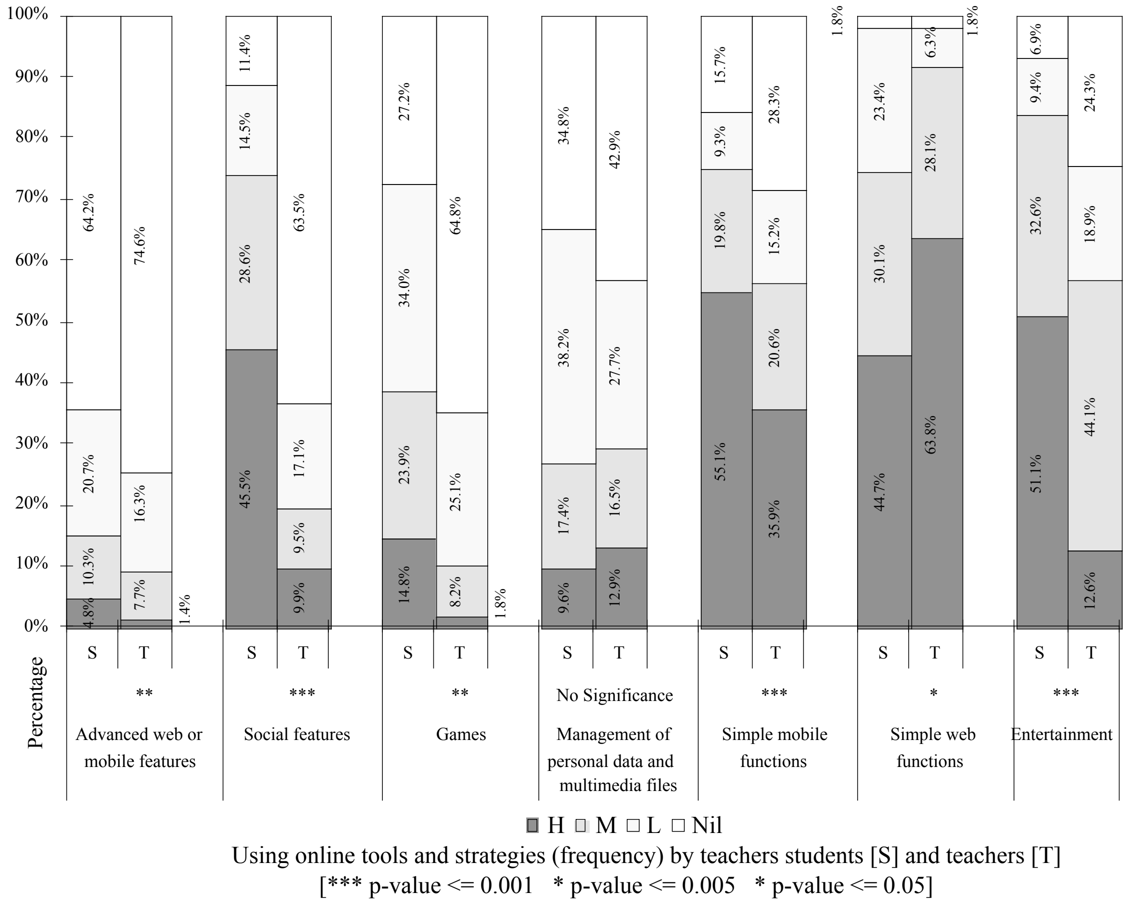


Figure 3: Using online tools and strategies (frequency) by teachers and students

Follow-up univariate t-tests were then run to show students of different disciplines and gender tend to differ in each of the individual factors. We found that students of different disciplines had statistically significant differences in 5 factors (Table 6), and males and females differed in their self-reported skill levels in 6 out of the 7 factors (Table 7). In general, students in the Faculty of Law in our study seemed to have reported high levels of computer skills. We also see students had a wide range of self-reported levels of computer skills.

Males and females had interesting differences in their self-reported levels of skills. Males in general felt they were stronger in handling *games* and *management of personal data and multimedia files*. Females, on the other hand, were more confidence about their skills in using *simple mobile functions*.

We investigated the feedback by teachers on their perceived levels of computer skills contrasted with their different faculties, ages and genders. Results showed that the teacher group in our study seemed to show little variation.

Table 6: Univariate differences between disciplines for students' perceived skillfulness

Factor	Perceptions of skill ART	BA	EDU	ENG	MED	SCI	SOS	LAW	F	p
Social features	3.86 (0.90)	3.98 (0.74)	3.43 (0.92)	3.62 (0.89)	3.73 (0.93)	3.93 (0.89)	3.48 (0.95)	**4.10** (0.91)	2.957	0.005
Games	2.91 (1.04)	3.19 (0.96)	3.19 (1.16)	3.33 (0.93)	3.03 (1.04)	**3.71** (.98)	2.81 (0.75)	2.67 (0.97)	3.650	0.001
Simple mobile functions	4.21 (0.79)	4.26 (0.73)	3.39 (0.90)	3.79 (0.90)	4.23 (0.81)	4.05 (0.94)	3.73 (1.06)	**4.47** (0.40)	5.565	0.000
Simple web functions	3.92 (0.79)	3.85 (0.73)	3.28 (0.99)	3.64 (0.78)	3.66 (0.81)	3.79 (0.94)	3.36 (.77)	**4.04** (0.70)	3.393	0.002
Entertainment	3.95 (0.89)	3.83 (0.89)	3.14 (1.05)	3.65 (0.89)	3.68 (0.95)	3.88 (0.95)	3.46 (0.87)	**4.17** (0.89)	2.689	0.010

Table 7: Univariate differences between gender for students' perceived skillfulness

Factor	Perceptions of skill Male	Female	F	p
Games	**3.56** (0.92)	2.85 (0.95)	67.189	0.000
Management of personal data and multimedia files	**2.97** (0.93)	2.67 (0.95)	11.242	0.001
Simple mobile functions	4.00 (0.86)	**4.19** (0.83)	6.189	0.013

Discussion and conclusions

Variation between teachers and students

Kennedy, Dalgarno et al. (2008) found that the digital divide between teachers was not as clear cut as they expected. In their study, "the younger respondents reported higher use of four of the eight technology-based activities" (p. 488) defined in their investigation. The present study confirmed the suggestions of Kennedy, Dalgarno et al. (2008) that the difference between students and teachers is a "complicated" issue (p. 488) as students did not excel teachers in all aspects of digital experience. However, the present study seemed to show a clear divide between teachers and students, perhaps a gap that is more apparent than that found in the Australian study.

The differences between teachers and students seemed to be more apparent in terms of their use and reported skills in using the technology-based strategies. The paper defined 7 technology-based activities and students reported higher skill in 3 of these activity categories, namely, *advanced web or mobile features*, *social features* and *entertainment*. Many of these differences appear to be clear; for example, the score of students' self-reported skills for using computers and the web for social features was 3.12 while that of the teachers was only 2.64. The area of social networking is perhaps one of the most interesting areas that need future exploration. Here the 'space' is indeed different and the implications for educational use in universities remain unclear

Regarding access to technology the digital divide was less apparent. Nevertheless, students on the whole seemed to have access to more digital technologies, particularly those that related to socializing (e.g. phones), and entertainment (e.g. game consoles, cameras and MP3 players). Teachers, on the other hand, had more access to digital technologies that seemed to be work-related (e.g. notebook computers) and had more expensive items (e.g. WiFi-enabled mobile phones). These results are not surprising, especially in a small, compact and technologically aware place as Hong Kong. Results in a more diverse range of locations would be interesting.

Variation among students

Kennedy, Dalgarno et al. (2008), and also the UK studies mentioned on p. 1 (Selwyn, 2008; Jones & Cross, 2009), found evidence that age and gender could be determining factors for how students use many technology-based activities. This study confirmed the diversity of digital experiences among our students. We found that both gender and the discipline of studies relate to diversity. For example, males were found to be more able to use the advanced web or mobile features and use game-related technologies; females, on the other hand, were more able to use the technology for socializing and for entertainment other than games. As for access to technology, males seemed to be much better 'equipped' than females (higher scores in 5 types of devices while the females had better access to only digital cameras). Discipline-wise, students of some disciplines (e.g. Education, Law, Science) on the whole seemed to have better access to digital technologies and were more able to use a range of technology-based strategies than students in some other disciplines (e.g. Medicine and Arts). Many reasons might be related to these observed differences. For example, medical and nursing students might not find digital devices as handy and useful as these devices are prohibited in many hospital areas. In this study, we did not find students' age a strong determining factor of the variations of students' digital experiences. It is perhaps due to the fact that we focused on Year 1 students in the study and thus most of the student subjects in this study were of very similar age. Also, in Hong Kong, as mentioned, there are few mature-age undergraduates. The findings in general have led us to query whether the concept of digital native is an over-generalized description of a group where there is considerable diversity.

Variation among teachers

The sample size of the teachers in the study was relatively small and we did not feel the data effectively showed variations in digital experiences. From the authors' experience at CUHK our teachers do vary a great deal in their background and preferences for technology. The limited analysis we had with the teachers' self-reported levels of computer skills showed less variation than expected. It might be due to the fact that we had a relatively small teacher group (n=56). Variation among teachers would be much clearer with a bigger sample size.

Concluding comments

The study shows that our students in Hong Kong can be regarded as 'digitally ready' to a level that is compatible to their counterparts in Australia. They are very familiar with information and communication technologies. We found that teachers and students differed considerably in their access to technology and even more in their uses of various technology-based strategies. The differences, however, are not straightforward and the so-called digital natives (students) are not always more digitally-oriented than the so-called immigrants (teachers). Teachers are also very capable with basic computer and web functions. A key advantage that teachers have over students is access to more sophisticated personal devices. However, the use of the more advanced strategies and the use of strategies that relate to socializing, gaming and entertainment seem to be predominantly the domain of the students. Our findings also indicate that students do not constitute a homogenous group as there are students who do not own certain devices and/or appear to have requisite digital skills.

The findings have implications for staff development and student-support services, in that flexible and varied approaches will be needed when considering how technology can enhance teaching and learning environments; some explicit strategies are outlined in Kennedy, Dalgarno et al. (2008, p. 490) and in the final project handbook (Kennedy et al., 2009). There is no 'one size fits all' and the art of using technology in teaching and learning in the 21st century would appears to focus on multiple, flexible but affordable designs for achieving common desired learning outcomes. At CUHK, we are combining discussion papers (such as this paper), with seminars, and access to grants and support staff in an integrated approach to curriculum change (McNaught & Lam, 2009).

The Australian project carried out a number of discipline-related implementation investigations (http://www.netgen.unimelb.edu.au/implementation/index.html). At CUHK, we are using our data to inform two funded university-wide projects:

1. Collection of learning designs (usually blended in nature) showing a number of different approaches to supporting particular types of learning outcomes. This study will enable us to use qualitative strategies to investigate students' preferences for using technology in more detail across all disciplines taught at CUHK.
2. A restructure of our Independent Learning Centre (ILC) to provide more focused, just-in-time access to information and training on a range of learning issues. The ILC has always had a strong emphasis on communication skills. One additional strategy will be how to use learning technologies to provide learning support.

Technology does not make teaching and learning easier. It can make it richer but, unless we recognize the inherent complexity in mass education systems, the potential may not be fully utilized.

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