

# Ownership and use of mobile technologies: planning mobile learning strategies for a Hong Kong university

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Mobile devices, such as handheld technologies and mobile phones, have become an indispensable part of everyday life. With their massive infusion into university and college campuses, a new form of education named mobile learning is gradually emerging. Preparing infrastructure and suitable strategies so that students can readily use mobile technology and devices to learn inside and outside campus requires careful planning. A study of the ownership of mobile devices and students' habits in using these devices was conducted in order to facilitate such planning. The paper reports on a survey conducted at The Chinese University of Hong Kong in an effort to solicit background information about the readiness of students. Implications for planning our mobile learning strategies are discussed.

**Keywords:** Mobile devices usage, mobile learning strategies planning, wireless connectivity

## The potential of mobile learning (mLearning)

Mobile devices such as handheld technologies and mobile phones have become an indispensable part of everyday life. With their significant infusion into university and college campuses, a new form of education – mobile learning or mLearning– is gradually emerging.

A combination of pedagogical and technological development, mLearning intersects between mobile computing and e-learning, and takes place via wireless devices anytime and anywhere. It is identified as the “fourth generation of the electronic learning environment” (Salmon, 2004), where “the value of deploying mobile technologies in the service of learning and teaching seems to be both self-evident and unavoidable” (Wagner, 2005, p. 42).

The capability and multi-functionality of mobile devices, coupled with their pervasiveness among students, offer potential for mLearning. Mobile devices embody three common features which make them an excellent platform for education:

1. **Affordability:** Since the prices of mobile devices such as mobile phones are dropping, more students can afford to own a mobile device.
2. **Portability:** Mobile devices are generally small in size and can be carried around with relative ease.
3. **Versatility:** Many mobile devices are now equipped with sophisticated functionalities. Some new features can also be incorporated into the devices to enrich students' educational experience.

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Sharples, Taylor and Vavoula (2005) noted four fundamental principles for mLearning:

1. Learners are always on the move;
2. A great deal of learning happens outside the classroom;
3. Effective learning is learner-centred and collaborative, based on a sound foundation of knowledge and supported by formative assessment; and
4. Mobile devices are practically ubiquitous.

Low and O'Connell (2006) argued that "learning has always been mobile: we all learn as we go about our lives, with inherent dynamism and personal mobility". MLearning is therefore perceived by some educators to be the more natural type of learning since it calls for a location- and time-independent pedagogy. With the aid of handheld devices, learners can explore new knowledge and skills in real-life settings at anytime they wish. Learning can become more informal and spontaneous, and is no longer confined to the parameters of the four walls of the classroom.

MLearning also complements a learner-centered and constructivist paradigm. Learners can actively search for learning content to meet their specific learning needs in a particular situation or context. Rather than passively consuming knowledge, learners can actively search for it, and thus become empowered as they are in control of the process (Sharples, 2003).

In addition to individual learning, handheld devices allow learner groups to distribute, aggregate and share information with ease, which can result in more successful collaboration (Barker, Krull, & Mallison, 2005). Bryant (2006) described mobile technologies as tools to "expand discussion beyond the classroom and provide new ways for students to collaborate and communicate within their class or around the world". Through learning in an interactive environment, learners can continually enhance their knowledge by sharing their understanding with each other and correcting misconceptions.

In classroom settings, mLearning can be used to design more active learning processes. Students can be given the chance to respond to the teacher's questions spontaneously, measure their performance against peers and receive instant feedback from the teacher.

After class, students can also have access to course-related information, notes and materials to assist in their learning. Students can download and watch the videos of class lectures to improve their understanding of the course content. Learning materials can be converted into e-books, multimedia resources or interactive exercises that can be used on a variety of mobile devices. Students no longer need to carry bulky books and material around and can have ready access to information.

Geographically dispersed participants can also take part in asynchronous online threaded discussions, sharing each others' experiences and reflections on a community basis. The enhanced accessibility guaranteed by mobile devices may promote more dynamic interaction and higher levels of engagement (Ching et al., 2002).

Expertise and experience in the development of mLearning have developed in the past decade. Today there is considerable adoption of mobile technologies in higher education and related studies are being done around the world. For example, in a project named RAMBLE (Remote Authoring of Mobile Blogs for Learning Environments) undertaken by the Oxford University, Year 5 Medical Science Undergraduates on their second year of clinical rotation were asked to record personal learning experience in the form of Web blog entries on their PDAs

(Trafford, 2005). The project cast light on how mobile devices could facilitate students' learning by revealing the concepts they had difficulties with, and also fostered relationships between students and teachers.

The Polytechnic University in Singapore introduced an "own-a-notebook" computer scheme in 1999, and now all students have their own laptop computers. Seven years since the adoption of the scheme, a survey was carried out to understand if students felt that their learning had been enhanced. The findings indicate that 95% of the students classified themselves as "experienced" with the use of mobile technology for learning. Based on these findings, Ho and Ali (2008) drew the conclusion that providing mLearning environments was a necessary task since "one of the nation's most important educational goals is to produce students adequately prepared for life and work in the 21st century" (p. 188). However, the technology was mainly used for assessing lecture notes and tutorial material, and mobile-based communications were still relatively uncommon.

### **Students' readiness for mLearning**

Despite claimed successes in the literature, the promotion of mLearning strategies, especially in institutions where such strategies are new, requires careful planning. Many factors control the success of innovations, and among them students' readiness towards the use of mLearning is a key one.

Cook, Pachler and Bradley (2008), for example, stressed learner factors such as the technocentricity of users, and attitudes towards mLearning. Attewell and Savill-Smith (2004) also pointed out some prerequisites for students to adopt mLearning, including investigating whether young adults would be willing to use their phones for learning, and how best to provide a good range of activities and opportunities open to mobile learners.

Drawing upon the above studies, we decided to investigate students' preparedness in using mLearning strategies in three areas, covering the hardware and the soft skills/ habits our students possess.

1. *Ownership of device*: Students' choice of devices is considered to be a factor instrumental to the success of mLearning (Trifonova & Georgieva, 2005). Since the effectiveness of mLearning hinges on the devices' functionality and the services they provide, students' choice of devices will, to a certain extent, determine their learning outcomes.
2. *Current mobile usage*: Knowing the extent of students' usage of devices also assists the institution in providing appropriate and sufficient infrastructural and technical support so as to maximize students' mLearning opportunities. FitzGibbon, Johnston, Oldham and Loxley (2004) reported that exposure to and use of technology, both within and outside the formal education system, helped students to conceive using technology as a tool for teaching and learning. There could be a tension between what designers of devices and instructors believe to be essential, and what users consider as important for themselves (Economides & Grousopoulou, 2008). Therefore, it is important for us to study the types of activities students carry out using mobile devices. This will help us to determine mLearning strategies that better match the current habits of mobile use.

3. *Current mLearning usage*: The third factor that needs to be looked into is students' experience in using and willingness to utilize their mobile devices for learning. Using mobile phones for educational purposes is no longer regarded as an inconceivable notion. But just how common is it for students to perform mLearning activities?

In order to plan an institutional approach to the implementation of mLearning, background information in the above areas is needed. A number of studies have been carried out around the globe in recent years to investigate one or more of the above three factors.

The University of Texas at Brownsville conducted a survey in 2006, asking students questions on their ownership of mobile devices and the type of mobile computing activities they engaged in (Trifonova & Georgieva, 2005). The results revealed that students already participated in a variety of mobile computing and communication activities for recreation. While they felt ready for mLearning and already possessed some of the basic tools needed for facilitate it, they were not integrating mobile technologies into their teaching and learning activities.

Another study implemented by a University in Greece explored the preferences and existing modes of the use of mobile devices by students (Economides & Grousopoulou, 2008). It raised important issues about the usefulness of mobile devices and their appropriate use. According to the results, students used their mobiles mostly for communicating with others and taking photos. They did not use all the devices' features, and needed support and help to be successful with the devices.

A Malaysian university (Jacob & Issac, 2008) also administered a survey to study (1) students' appreciation of mLearning and the popularity of the laptop; and (2) the extent of usage of different mobile devices and the kind of mobile activities students engaged in. The results show that the most popular devices among students were pen drives, cell phones and laptops, and also clearly indicate the readiness of students for mLearning. A majority of students expected true mLearning to be in vogue within the next three to five years and saw mLearning as an effective learning supplement to make the subject interesting.

Oldham, FitzGibbon and Johnston (2005) carried out a survey in Ireland that dealt with students' use of technology for learning. According to the findings, with the exception of mobile devices, ownership of ubiquitous devices was low. Even five years ago, access to mobile technology was the predominant mode with this group of Irish students, the majority of whom had limited experience of technology within the formal educational system.

All the above overseas studies suggest that there is a widespread ownership of mobile devices among students in different countries. It is also common for them to apply the features and functions of the devices for communication or recreation purposes. However, most students had yet to employ the devices for learning even though they acknowledged the emerging trend and potential of mLearning. After getting an overview of students' mLearning habits in other places, the Centre for Learning Enhancement And Research (CLEAR) at The Chinese University of Hong Kong (CUHK) initiated a study to see what the situation is like in Hong Kong. Drawing from the literature and research done by different universities, the study has been designed to mainly investigate the three areas discussed above to gauge students' readiness for mLearning.

## **Study**

A survey was conducted in February 2010. Recruitment was conducted through advertisement open to all Year one students. Ninety-nine Year one students responded to the invitation and participated in the study. Thirty-four of the respondents were male and 65 were female. The numbers of participants in each of the eight faculties at our University were roughly proportional to the numbers of student populations in them. The study was designed to be small in scale as it was the beginning of a series of regular research studies with the overall aim of gauging trends in students' ownership and usage of mobile technologies. The study will be conducted yearly for continuous monitoring of change. There were three main types of questions in the survey. The topics of the sub-questions we asked were:

#### *Ownership of device*

- Mobile phone type: the types of mobile devices such as mobile phones and notebook computers students own and the percentage of students who have them.
- Mobile phone feature: how well the mobile devices can support various functions and features such as internet surfing.
- Mobile internet data plan: the data plan students are currently using to understand their ability in getting access to the internet without reliance on WIFI.
- Device refresh cycle: when did they buy the mobile devices and thus how long they have been using them for. The answers indirectly inform us of the technical capabilities of the mobile devices.

#### *Current mobile usage*

- Playback video and audio files: the amount of use by students in viewing video and audio files on their mobile devices.
- Surf the web: the amount of use by students in surfing the net on their mobile devices.
- Check email/ instant messaging/social network tools (facebook , blog, forum): the amount of use by students in using mobile devices as communication tools beside making voice phone calls.

#### *Current mLearning usage*

- Connectivity (WIFI) in CUHK: how much the students use the WIFI network on campus on their mobile devices.
- Use of device in lesson: how much the students use the mobile devices in lessons.
- Use of device for self-study: how often the mobile devices are used for learning by the students.

## **Findings**

### ***Ownership of device***

#### Mobile Phone type

Figure 1 illustrates the types of mobile phones owned by students. Of the 99 students polled, 98 of them own at least one mobile phone and 82 of them have notebooks, showing both types of mobile devices have been integrated into students' lives. But between the two types of mobile phones available on the market, the ownership of standard phones among students stands at over 80%, significantly higher than that of smart phones. Although smart phones offer more advanced functionality and capability, they are relatively new and it may take a few years for them to become prevalent among students.

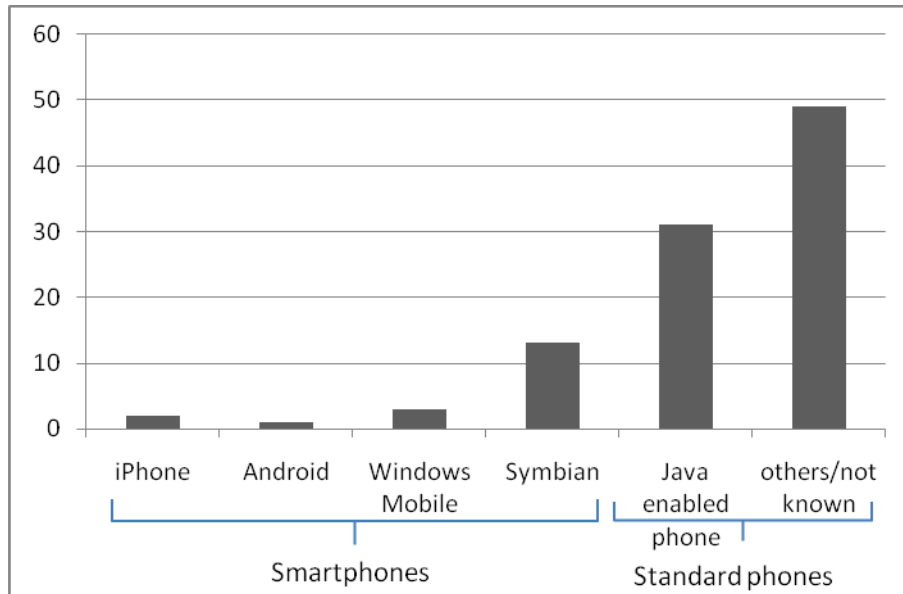


Figure 1: Types of mobile phones owned by students

#### Mobile phone feature

80% of the students own mobile phones that include common features such as audio and video playback support. Over half of the respondents have mobile phones capable of performing add-on applications.

For the provision of Internet services, the number of students with mobile phones that have 3G/GPRS data access and WIFI access are 62 and 30 respectively. But among those owning phones with access to the internet, only a small number of them have activated/ installed function such as Podcasting RSS reader, software to check email and a web browser. This is because running such functions requires a high data quota and it is costly to subscribe to a mobile data plan.

#### Mobile internet data plan

Nearly one third of the respondents do not have 3G/GPRS access included in their mobile internet data plan. Only 21 students subscribe to a data plan of 100M or below. Students seem to be deterred by the high price of data plans and would rather not go online via mobile phones.

#### Notebook portability

Around 40% of the respondents own notebooks which are ultra-light or lightweight (Figure 2). Another 40% of the students have notebooks that are of medium weight. Less than 20% of them describe their notebooks as heavy. The high portability of the notebooks allows the students to carry them around on campus with ease – one of the prerequisites for mLearning.

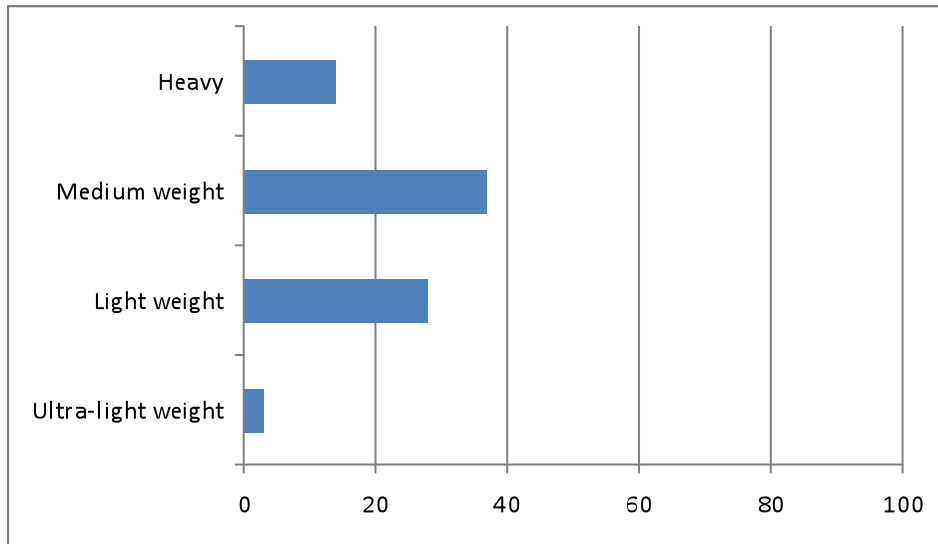


Figure 2: Portability of notebooks

Notebook operating system

The most common operating system for notebook users is Windows Vista, followed by Windows XP (Figure 3). The percentages of users for these two systems are 55% and 30% respectively. Only two students use MAC OS as their notebooks' operating system. Based on this finding, the University could concentrate on applications targeting Windows Vista or Windows XP users.

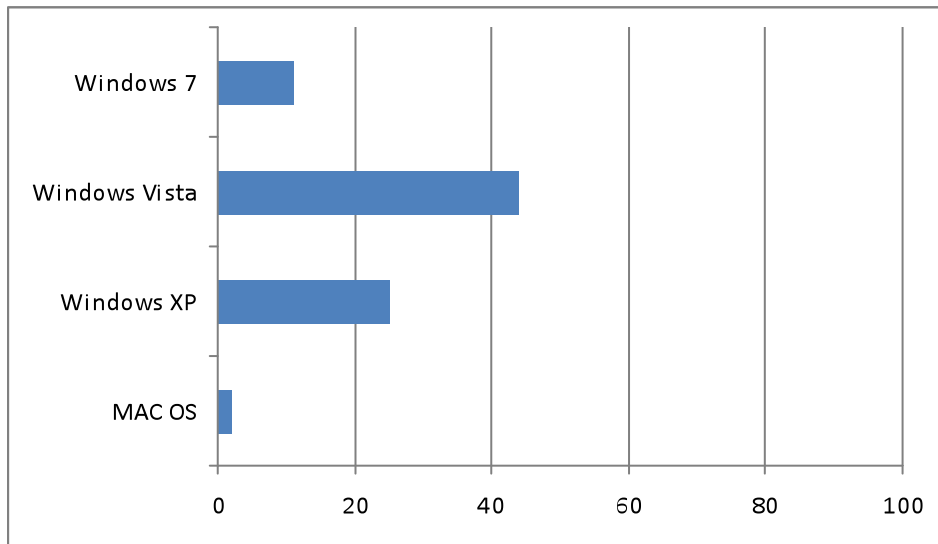


Figure 3: Notebooks operating system

Device refresh cycle

The percentage of students who have used their mobile phones for one to four years is the highest, representing approximately 55% of the total correspondents. One third of the respondents have used their mobile phones for less than one year. Only five students have used their mobile phones for more than four years.

The usage period of the notebooks among students is similar to that of the mobile phones. One quarter of the students have used their notebooks for less than one year, while 60% of them have used their notebooks for a period of one to four years. Only two students have used the notebooks for more than four years.

Given the pace at which phone and notebook companies churn out new products, it is not surprising that students switch to new models every couple of years. The short replacement cycle of the devices also suggests that students are willing to spend money on technological items because they are sometimes seen as the extension of personality.

***Current mobile usage***

Playback video and audio files

More than half of the students who own a notebook play back video or audio files several times a day, more than four times those who own a mobile phone (Figure 4). The number of students playing back video and audio files on notebooks once a day is also significantly higher than those who employ the same function on mobiles. But when it comes to the playback of video and audio files several times a week to once every few months, more students choose to do so via mobile phones than notebooks. Also, there are 20 students who have never used mobiles to playback video and audio files, as compared to three students who have never used such applications on notebooks.

It can be seen that although students are aware of the audio and video playback support provided by mobile phones, they seldom use it. Notebooks, on the other hand, have been used frequently by students to playback video and audio files.

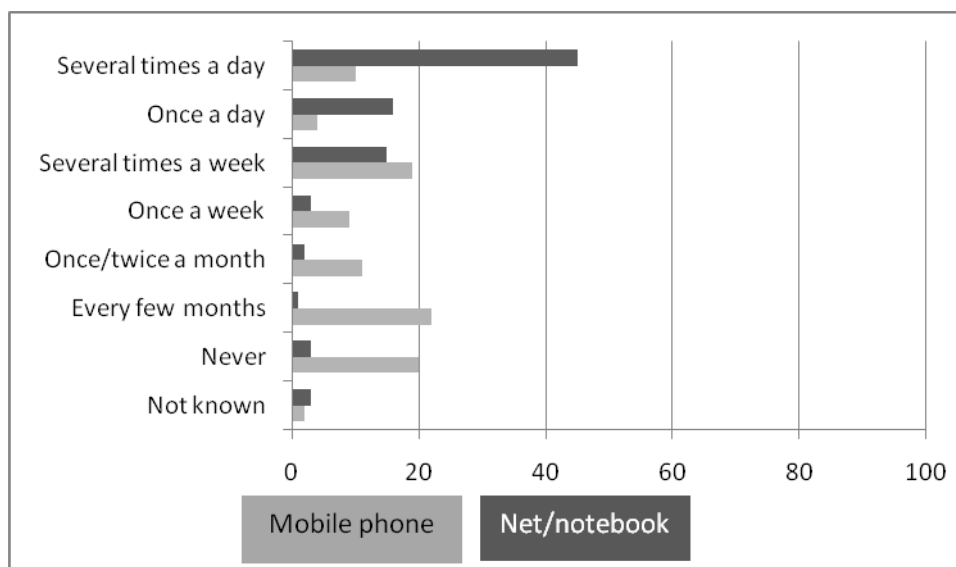


Figure 4: Playback of video and audio files on mobile phones and notebooks

Surf the web

Notebooks are clearly one of the major tools through which students access the internet (Figure 5).

Nearly 90% of the respondents surf the internet via notebooks several times a day, as compared to only 10% of students who go online via mobiles. But there are more students accessing the internet on a weekly basis through mobiles than notebooks. Two students have never used notebooks to surf the web while the number of students who have never accessed



the internet via mobiles stands at nearly 60. This may be attributable to the fact that few students have sufficient data quota in the mobiles to support their surfing the internet.

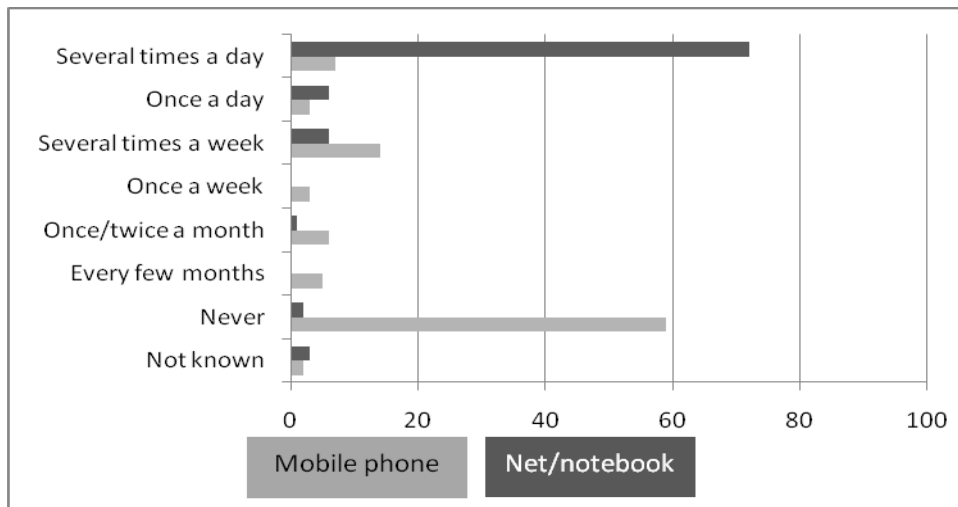


Figure 5: Use of mobile phones and notebooks for internet access

Check email/ Instant messaging/ Social network tools (facebook , blog, forum)

Over 90% of the students use notebooks at least once a day for checking email and communicating with others via instant messengers and social network tool. Less than 5% of them use the above functions via mobiles. 80% of the students have never used mobile phones to employ the above functions, compared to only three students who have never tried such functions on notebooks.

***Current mLearning usage***

Connectivity (WIFI) in CUHK

Nearly one third of the students go online via notebooks in CUHK several times a day, as compared to only a few students who do so via mobile phones on campus (Figure 6). The number of students who have never accessed the internet on campus via mobile phones is also three times more than those have never gone online through notebooks.

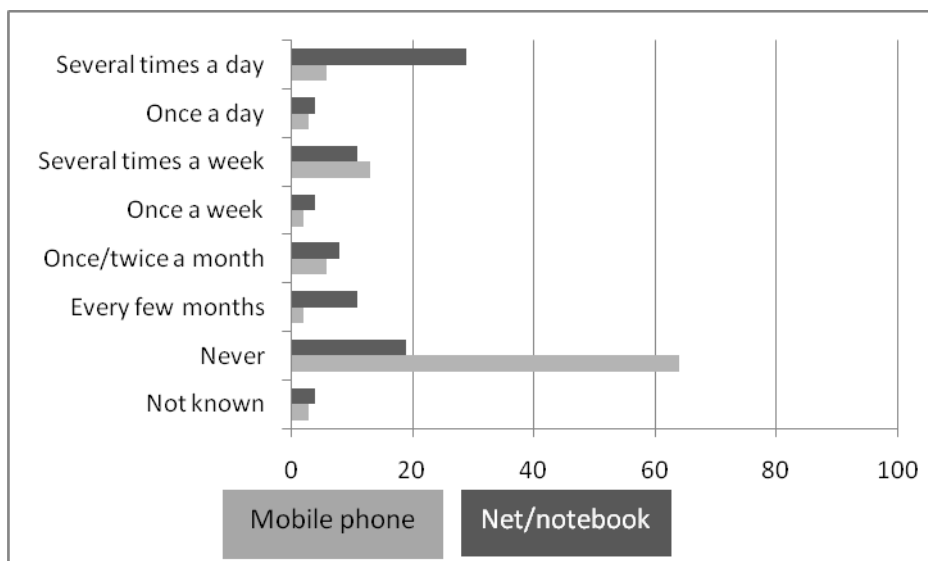


Figure 6: Internet access on mobile phones and notebooks in CUHK

Use of device in lesson

Compared with notebooks, the use of mobile phones in lesson is more common among students (Figure 7). Nearly one third of them use mobile phone in lesson several times a day, more than double those who use notebooks. But it should be noted that the number of students who have never used mobile phones in class is also higher than those who have never used notebooks. A possible explanation is that in certain lessons, students are asked to turn off their mobile phones.

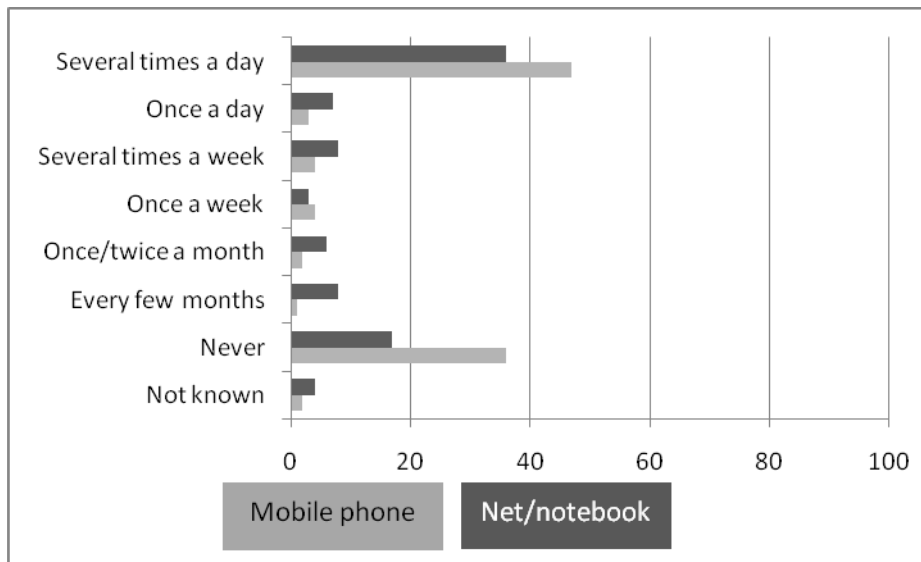


Figure 7: Use of mobile phones and notebooks in lesson

Use of device for self-study

Nearly two thirds of the students use notebooks for self-study and reading e-books at least once a day (Figure 8). But only 10% of the students read e-books and engage in self-study daily with the help of mobile phones. More than half of the students have never tried self-study or reading e-books via mobile phones.

The results suggest that most students regard mobile phones as a tool for communication or recreation. They have yet to associate mobiles with learning and use them for educational purpose.

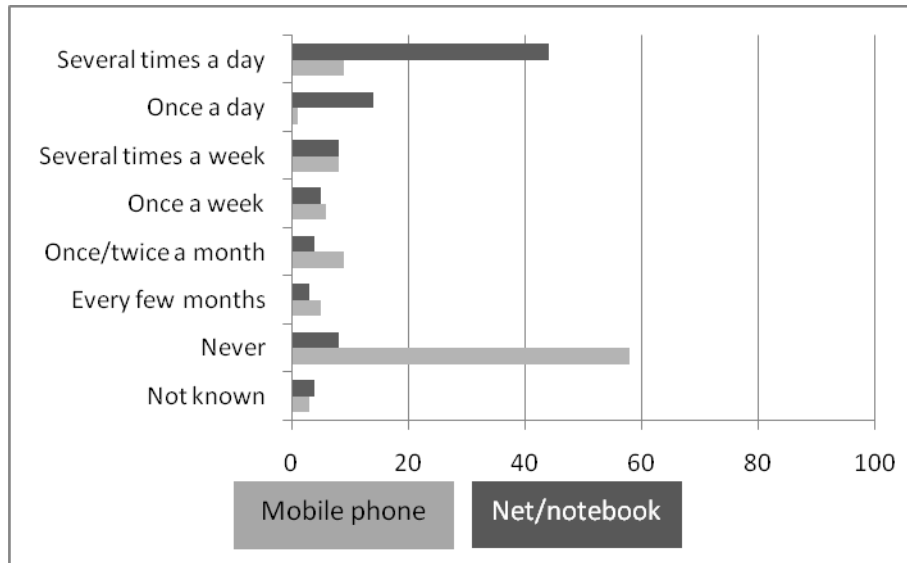


Figure 8: Use of mobile phones and notebooks for self-study

## Discussion

### *Hardware readiness*

Nearly all the students in the study had mobile phones and a majority of them (over 82%) also owned notebook computers. The devices were relatively new, with few of them older than four years old.

Smartphones and iPhones were less popular among our students (less than 20%). The majority of the students used other phone types which, nevertheless, are also functionally well-equipped, such as with video/audio playback (80%), 3G/GPRS (62%), and WIFI connection (30%). More than 80% of the students had medium- to light-weight notebook computers. The operating systems used in these notebook computers were relatively new, with the majority being Windows Vista or Windows 7. Perhaps because of the portability of the phones and computers, the data showed that students brought along their mobile phones and notebook computers regularly to the University. For example, many students reported they used mobile phones in a lesson every day. Using the notebook computers to connect to the internet through the campus WIFI was also a common practice; more than half of the students did that weekly or even daily.

Overall, students are ready for mLearning in terms of the mobile devices they possess. Further, these devices travel with students and are brought to the University each day. Students have access to feature-rich mobile devices almost all the time. Hardware is not a barrier to students' use of mLearning strategies; challenges are more about connectivity and students' modes of using mobile phones.

### *Connectivity*

WIFI is not the perfect solution to mLearning when compared with data-transfer solutions such as 3G or GPRS. Students are fixed to a WIFI access point and moving from one spot to another leads to disconnection, while 3G/GPRS connections are more suitable for mobile use as users can actually move around. We found that our students do not consider 3G/GPRS

solutions as practical at this time. Few students have subscribed to phone plans that enable them a generous volume of data transfer, which is a must for many mLearning strategies that involve online communication or internet resources.

### ***Soft skills and habits***

Students are more used to using notebook computers for various learning activities. Comparatively, the use of mobile phones for study is not yet prevalent among students. Although mobile phones offer a variety of functions and services, only a small number of students employ these functions for self-study. The number of students using their mobile phones to surf the internet is even lower. They are using phones to perform personal activities such as playing audio and video files, reading electronic books and communicating with friends.

We know that the experience of performing similar tasks (e.g. viewing web pages and reading long text) on a notebook computer, as compared with a mobile phone, can be very different. The fact that students use notebook computers to surf the net and to learn does not mean that students will readily accept learning strategies on a mobile phone.

### **Implications and conclusion**

Careful planning is required in preparing infrastructure and suitable strategies to benefit students, so that they can more readily use mobile technology to learn inside and outside our campus. A small study on student ownership of mobile devices and students' habits of using these devices (a survey study at The Chinese University of Hong Kong) was conducted in order to facilitate such planning.

We found factors that both favour and inhibit the use of mLearning strategies among our students. Our findings indicate that students in general own both mobile phones and notebook computers. But when it comes to their usage, students engage in learning activities on notebooks more often than with mobile phones. Connectivity of these devices is also rather weak and is dependent on WIFI on campus.

These findings present a number of implications to our approaches for promoting the use of mLearning strategies. Given the integration of notebook computers into students' daily lives, we plan to design mLearning strategies appropriate to notebooks, and give a high priority to this work.

We are recommending that more infrastructural support should be put in place to assist students' learning via notebooks. Instead of installing the costly computer labs, the University could focus on providing more sockets on campus to facilitate students' usage of notebooks. It would also be advisable to include more WIFI hotspots to maximize students' opportunities of accessing the internet. (Our University is very mountainous and this is a non-trivial exercise.) As the costs of 3G/GPRS services are likely to go down in the future, we will closely monitor price trends. The success of many mLearning strategies depends on the availability of full connectivity.

For learning via mobile phones, more support is needed to familiarize students with completing various learning tasks using these smaller devices. For example, newsletters and material could be distributed to students to promote the benefits of learning on the go. Workshops and seminars are already organized on ways of incorporating mobile technologies

into learning. Also, a series of mobile development projects is in train so that the versatility of these devices can be truly leveraged.

It has been widely stated that the advancement in mobile technologies will be the ‘next great frontier of learning’. However, despite the benefits that mLearning offers, its potential will only be fully realized when students are ready to embrace it. We have taken an important step by learning about students’ ownership and usage of the two most common mobile devices – mobile phones and notebooks – and this data is valuable baseline data for the years ahead.

A total of 99 students participated in this survey. The findings are better described as indicative rather than representative. The study is a preliminary one with the purpose of forming an overall picture of students’ ownership and usage of mobile technologies. In this regard, we have gathered sufficient data to pave the way for future studies. Similar studies are planned for each year to collect more comprehensive data from students and thus further evaluate their mLearning experiences. Despite the small scale of the study, the findings effectively provided information on appropriate tactics and potential challenges for promoting and enhancing students’ mLearning experience.

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