M-learning to Support Learning English in a Hong Kong University

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Abstract

This paper reports a project designed to explore the elements that help and hinder the adoption of mobile devices in higher education. This study is focused on the use of mobile phones, specifically iPhones, for teaching and learning in the domain of English language at a university in Hong Kong. Using a range of quantitative and qualitative data, the study illustrates how smart phones and tablets might be used effectively for developing more suitable learning designs, and improving digital literacies in students and academic staff. The artifacts developed by students were used in an e-portfolio environment. There was evidence of students engaging with smart phones in the learning environment, which led to improved learning artifacts. A number of challenges were encountered and these are explored in the paper.

Keywords

mobile devices; e-portfolios; media in education; pedagogical issues; English as a second language; staff development

Introduction

The demands of students in higher education are increasingly moving towards taking advantage of their personal small mobile devices (SMDs), often challenging existing wifi networks and bandwidth capacity. Worldwide, the impact of SMDs in the informal social settings of higher education has dramatically increased in the last few years as students start to download or access high-bandwidth content (e.g. YouTube and NetFlix videos, Twitter/ micro-blogging networks, and mobile access to Facebook). Nowhere is this more apparent than in Asia, where the ownership of mobile phones has reached an extraordinary level; for example, in Hong Kong it is over 230% (Office of the Telecommunications Authority, 2014). Young people, in particular, have made smart phones extensions of their personal connectedness and interactions with friends and family. A great number of activities are about keeping in touch with friends and family, shopping, mapping, finding a good restaurant (for example), but few of these activities are by themselves likely to improve their learning in formal higher-education courses. While current mobile devices support a variety of input and output formats, including text, photographs, video, MS Office documents and audio (podcasts), that could be used for learning, there is a need for ongoing studies about how students actually use them to improve their learning.

The Horizon Report in 2011 (Johnson, Smith, Willis, Levine, & Haywood, K, 2011) postulated that m-learning would finally become part of mainstream higher education. In each succeeding year (Johnson, Adams Becker, & Cummins, 2012; Johnson, Adams Becker, Cummins, Estrada, Freeman, & Ludgate, 2013; Johnson, Adams Becker, Estrada, & Freeman, 2014), this prediction has been extended to emphasize one or more devices or affordances that would be associated with mobility, from the power of the devices, the myriad of applications that make use of all of the media inputs and geo-location services, to the rise in the sales of tablet computers and a corresponding drop in PC sales.

There has been a considerable body of work undertaken over the past 10+ years looking at the use of SMDs for teaching and learning, with more recent work focusing on the advent of smart phones, tablets and phablets (mobile devices that are between a smart phone and a tablet computer, such as the iPad or iPad mini, in size) (Hwang & Tsai, 2011; Hsu, Ho, Tsai, Hwang, Chu, & Wang, 2012). The general conclusions suggest that the technology is primarily being used by students for:

- activities focused on social connectedness (e.g. WeChat, Facebook, Twitter), shopping and games;
- accessing (online) dictionaries (second-language learners); and
- accessing institutional information such as timetables, grades, campus maps, etc.

The value of social networks and social connectedness for learning and indeed in many aspects of life is encapsulated in the term social capital (e.g. Dasgupta & Serageldin, 2000). It appears that students are able to use mobile technology to increase their social capital.

Vavoula and Sharples (2002), over a decade ago, suggested that mobility was an intrinsic property of learning. They postulated that learning has spatial (university, workplace, home), temporal (days, evenings, weekends), and developmental components (the learning needs/ life skills of individuals which change depending upon age, interest or employment). In 2008, Cherian and Williams argued that "m-learning technologies may continue to broaden the boundaries of the conventional classroom, making it possible for the learning strategy to become as prolific and, possibly, as effective as FTF [Face To Face] learning". Surveys have indicated that more and more college students opt for mobile solutions, replacing desktop computers with laptop computers (Smith, Salaway, & Caruso, 2009). At that time (2009), one third of the students were using internet-capable handheld devices, with another third of students owning or planning to acquire a handheld, internet-capable device in the next 12 months. However, Dalstrom (2012) reported that students were still predominantly using mobile devices for social uses rather than in formal learning.

Using a survey of over 300 US institutions, Bichsel (2013) reported the significant investment that is now occurring in providing access to mobile technologies in the US. The mobile terrain is vastly different from that of the early studies in the field: the iPhone was released in 2007 followed by the iPad in 2010 and it is reasonable to say that, with the advent of these two devices, everything changed. In addition, an entire industry was created with the new mobile applications (called apps) facilitating communication and engagement in hitherto unimagined ways.

Earlier technical limitations, such as screen resolution, CPU processing speed, battery life and weight (Trinder, 2005; Keegan, 2005) have been largely overcome in current smart phones (e.g. iPhones, Google Android phone, or Samsung Galaxy IV), with the important exception of battery life in smart phones. These devices now support a vast array of apps and include hardware (e.g. accelerometers, digital compasses, screen resolution that is better than the human eye can resolve) that facilitates content creation (e.g. text, video, voice/ audio), content storage (Word, pdf, web pages), social networking (e.g. YouTube, WeChat, Skype, Facebook, Twitter/ microblogging), geo-positioning hardware and software, and organizational tools (e.g. calendar/ alerts).

A detailed diary survey on how students use their time undertaken with a representative set of students (n=51) from all years and all programmes at a university in Hong Kong (where the author worked for three years) provided data that students' days are fully engaged in a wide variety of activities, but formal study (including time in class) does **not** occupy a majority of their time each day; in this study, the figure given over to class time and study for tests or completing assignments was only 21% of the total time available in hours each week. Therefore, we have opportunities to broaden student engagement so that these pervasive technologies for teaching and learning can support students trying to "cram learning into the interstices of daily life" (Sharples, Taylor, & Vavoula, 2005, p. 58). Perhaps then the longed-for promise of mobile technology (Sharples, 2000; Saylor, 2012) can be realized.

There are now numerous studies that demonstrate the impact of mobile devices on teaching and learning in higher education in Asia, but many of the studies have provided inconclusive results at best (e.g. Lam, Lam, Lam, & McNaught, 2009; Vogel, Kennedy, & Kwok, 2009). Mobile-learning projects are common in primary and secondary schools in the region (e.g. Hwang, Wu, Tseng, & Huang, 2010), but the impacts do not seem to have moved significantly to higher education, although it is heartening to see recent evidence-based pedagogical papers about designing for use of mobile technology (e.g. Elias, 2011).

The ubiquitous nature of mobile devices and wireless connections in major centers (such as Hong Kong) suggests that an investigation of their use in higher education for creating more flexible, student-centered learning environments that support learning inside and outside the classroom is overdue. This study is focused on the use of mobile phones, specifically smart phones (the iPhone) for teaching and learning in the domain of English language. Mobile phones have been seen as

offering opportunities for language learning for some time (Chinnery, 2006, Cui, & Wang, 2008) and learning vocabulary (Lu, 2008), for example.

Methodology

Designing the intervention

This paper reports the results of intervention in a compulsory English-language course focused on oral presentations in English at a university in Hong Kong. A key feature of many institutions in Hong Kong is the focus on languages, particularly English language as the majority of courses are taught in English. Selecting the course involved four main criteria. The first was the most important: a course where the intended student learning outcomes would be most likely supported by the affordances of a smart phone. The second requirement involved the course teacher who was willing to incorporate mobile devices into the learning environment. The third element required rethinking the curriculum design in order to ensure that students could engage with the course content using a variety of technologies, in and out of class. As part of the planning for the study, considerable effort was invested in the learning design (Lockyer, Bennett, Agostinho, & Harper, 2009) to ensure that the curriculum learning outcomes, the activities designed to assist in the attainment of those outcomes, and the final means of providing evidence of attainment of the outcomes (assessment) were consistent. Useful learning is an interactive and complex process where knowledge is constructed from a variety of sources (McNaught, Storey, & Leung, 2004). The learning design had thus a strong focus on the principles of curriculum alignment (Biggs, 1999; Biggs & Tang, 2011) within a constructivist environment (Shay, 2008). In the learning activities, the SMDs were made central to content creation in the course (video and audio), as well as use of YouTube for receiving peer feedback. Content creation was thus by the students, moving them from content consumers to content creators.

It was essential to ensure that the assessment tasks were likely to provide evidence of the desired student learning outcomes. In the previous iterations of the course, assessment was by a single presentation and graded only by the teacher. In the course redesign, students had multiple opportunities to make presentations which were self- and peer-assessed; the peer assessments were incorporated into the final grade for the course, which also included an overall teacher assessment across all presentations.

The students were drawn from a group that was enrolled in a second-year English-language course (Language and Communication in English, LCE 202). The data in this study were collected in the academic years 2009–2010 and 2010–2011, though the course has continued to be delivered, based on the findings of the study. The course was designed to assist students to become better presenters/ speakers when using English as the mode of delivery. While the skills taught can be transferred to other languages of presentation and can be used in a variety of content domains, all students in the classes were required to present in English. In the study, students were provided with an iPhone for the duration of the course. The students had 24/7 use of the devices for about 12 weeks and could download any free software they wished to use, were encouraged to use the iPhones for language learning (as well as social purposes), and bring them to class. It should be noted that the use of paid apps was problematic since it was not easy for students to establish an account via iTunes to purchase apps and they were aware that they would have to return the iPhones at the end of the semester.

Choice of technologies for the study

The three technologies that were key to the design of the intervention were iPhones, a YouTube channel and a group in the e-portfolio system supported by the University. The rationale for these technologies to support student learning is as follows.

The ***iPhone*** was selected because it has the most consistent user experience and simple-to-use interface, an enormous number of applications (or apps) that can be used for learning, and would be perceived as highly desirable by students to have, even if only for a short time (this was shown to be the case). The iPhones supported a range of student-centered activities including communication, video for self-evaluation of personal presentations, as readers to access resources for the course, access to dictionaries, and as classroom-response tools (using the application eClicker).

YouTube is a Web 2.0 application that supports social networking including peer commentary, and Real Simple Syndication (RSS) feeds to update students who are following the channel. This cloud service was selected because content can be shared quickly and efficiently (upload to YouTube is supported directly from the iPhone interface), and it was possible to set up a channel for sole use by

the class. YouTube also provided a means of supporting peer feedback. The YouTube channel was established by the class teacher, leveraging off students' knowledge about uploading, commenting on, and viewing videos as part of their social activities (although most of the students in this class had previously accessed only Chinese versions of YouTube).

The ***e-portfolio*** system (Mahara) was able to support the management of the class (uploading help files such as 'how-to' videos for using the iPhones, course outlines, assessment guides, etc.) and create a 'View' so that student performance over time could be easily seen by all students, commented on, and easily graded by the teacher.

An e-portfolio was seen to be an important part of the learning environment because, in the domain of language learning, an e-portfolio has the potential to provide more compelling evidence of student achievement. For example, language learning often requires more than just text media (e.g. audio or video presentations). An e-portfolio can be used to 'present' a variety of media in a single webpage (including reflections on practice) and therefore can reduce the time required by teachers to grade students (Kennedy & Shirley, 2011).

McNaught, Lam, and Chan (2009) defined five categories that support the use of e-portfolios, each of which address either the intended learning outcomes and level of student input required or a combination of these two. They suggested that e-portfolios can be used for assessment, learning tools, articulating personal development over time, student presentations (e.g. for CV purposes), and a means of allowing groups of student to collaborate and present findings effectively. In this study, the e-portfolio platform was used specifically for:

- assessment, forming the means by which student presentations could be tracked longitudinally, thus supporting a more student-centered approach to learning (Pelliccione & Dixon, 2008); and
- learner support, using the files area as one of the means of distributing documents (e.g. how-to documents/ videos, course guidelines and assessment rubrics), and a means of providing a venue for peer discussion, self-reflection, improving the use of technology by students and feedback (Sun, 2003).

Data-gathering undertaken in this research

The research generated both qualitative and quantitative data (not all the data generated is reported in this paper due to space constraints and the focus of the paper). The *quantitative* data reported in this paper are:

(1) a survey for an internal university report, 'A study on students' experience with technology'. This survey was undertaken with a representative group of students (from every year and every discipline) selected by the University as part of a quality-assurance (QA) process in 2010;
(2) the same survey of technology usage by all incoming first-year students in the 2009–2010, 2010–2011 and 2011–2012 cohorts;
(3) the same survey of technology usage by students in the research group (LCE 202) that used the iPhones (two groups, 2009–2010 and 2010–2011);
(4) the 'IT usage survey for University teaching staff' undertaken in late 2009 to provide information about the perceptions of the use of technology in teaching and learning amongst academic staff;
(5) class surveys of the applications students in the research group (LCE 202) found most useful for learning (data from 2010–2011 reported in this paper); and
(6) a survey (n=13) of how iPhones were being used by the LCE 202 students.

The QA survey group (1) focused on student access to mobile technologies and their opinions regarding learning technologies. This group of students was selected by heads of academic programmes (and the Registry) as being representative of the University's students. Of the 144 students from this group, 108 students or 75% responded to the survey (online). The survey was based on a validated survey used in both Australia and Hong Kong (Kennedy, Krause, Churchward, Judd, & Gray, 2008; McNaught, Lam, & Ho, 2009).

The first-year, student-technology survey (2) contained both Likert and free-response questions. The questions addressed student access to technology, how frequently they used those technologies, and opinions relating to learning and mobile technologies. In 2009–2010, 783 of the 800 first-year students responded, representing a 98% response rate. In 2010–11 and 2011–12 the response rates were similar, as were the results. In succeeding years, the number of smart phones increased, as did the number of potential applications that could have been used, but the basic activities of students did

not change with SMS (low cost), the camera and video functions, and social networking forming the bulk of the usage of the devices.

The staff survey (3) contained both Likert and free-response questions targeting teacher usage and opinions of technologies that can be used in or out of class, with a 54% response rate. Surprisingly, interviews with academic staff (data source 9; see below) indicated that they were quite positive about the use of mobile phones and the possibilities for improved communication. Instructors at the University claimed to be looking for new ways to engage their students. However, in practice, mobile phones are not encouraged in the typical university classroom, and occasionally actively discouraged.

The student survey (5) was used to determine what apps were being most frequently used by the research group (n=28). The student survey (6) focused on how LCE 202 students viewed the use of an iPhone for learning (n=13).

Figures 1, 2 and 3 show the percentages of respondents versus the percentage of students or teaching staff in each faculty, illustrating the very good representativeness of the data.

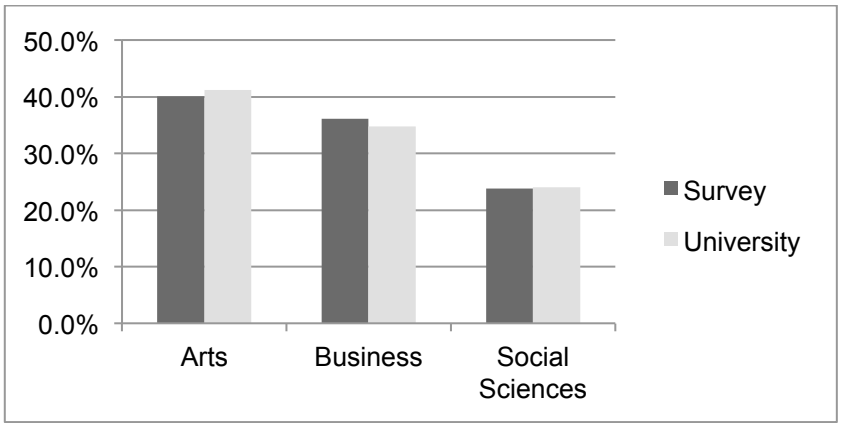

Figure 1. Student respondents to the first-year survey by academic unit for 2009–2010, compared with the overall student profile for the University (data source 2; n=783)

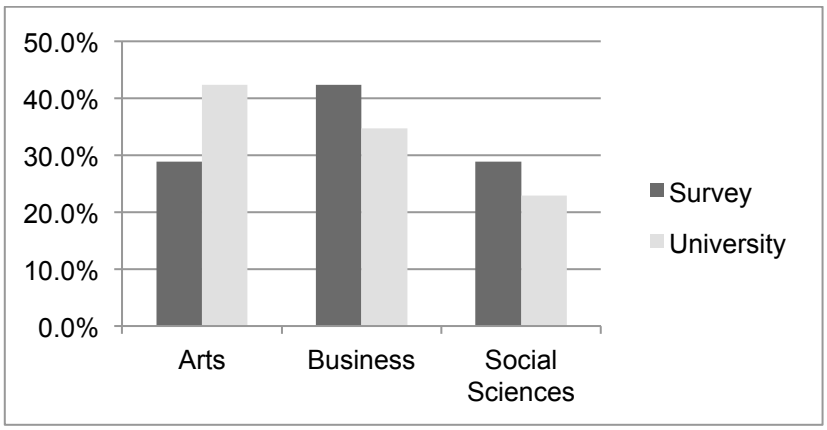

Figure 2. Student respondents to the QA survey by academic unit in 2010, compared with the overall student profile for the University (data source 1; n=108)

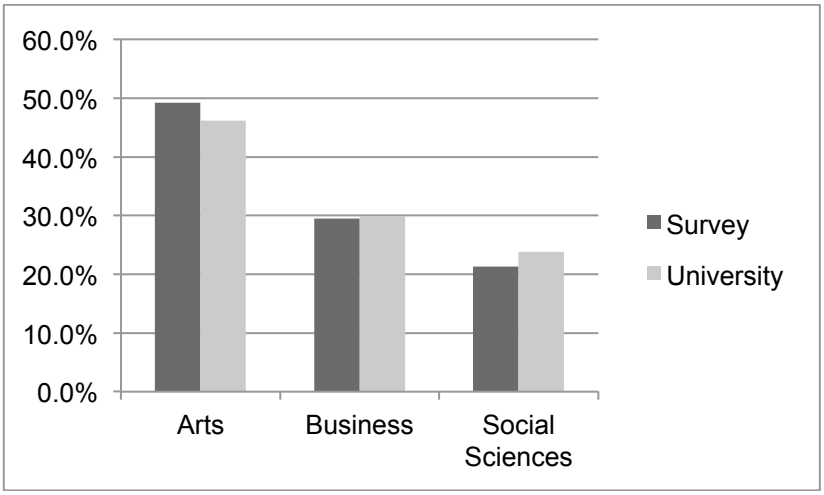

Figure 3. Teacher respondents to the IT usage survey by academic unit in 2009–2010, compared with the overall staff profile for the University (data source 4; n=93)

Qualitative data gathered in this research involved:

(7) interviews with students in the classes provided with iPhones, including:

a. focus groups (n = 5 and 4) early in the semester that primarily looked at difficulties in using the hardware/ software, the apps students were using most frequently, and general questions about their experience/ confidence with using the iPhones;
b. a SWOT analysis undertaken by students (n=9) to ascertain their overall views of the use of an iPhone for learning; and
c. ad hoc in-class discussions regarding the use of iPhones for learning (done as part of the regular class, particularly focused on issues of usage for communication and the use of video for presentations).

(8) a sequence of three videos of each student presenting which were uploaded to YouTube; self, peer and teacher assessments were made for each video. The video presentations were embedded in the e-portfolio used by the University for easy comparison of progressive work by both the student and the teacher (see Figure 9). All data was visible to the whole class.

(9) two focus groups with academic staff to determine their attitudes to the use of technology, particularly mobile technologies, in their classrooms; these discussions fleshed out the data from the IT usage survey (data source 4).

Key Findings

The larger student surveys indicate that over 90% of students at the University have access to a mobile phone. Students therefore are increasingly interconnected via mobile devices, and such devices have the potential to be used for educational purposes, particularly communication. The latter is important because the interviews revealed that instructors and students have communication problems at the University. The University uses email as the primary form of communication between staff and administration, and students. However, the evidence is that students don't check email very frequently, and certainly not in real time. The dissemination of critical information is therefore hampered, and may be better undertaken using mobile-phone technologies in the future. For example, Figure 4 shows that the majority of students at the University have access to the Internet and a video camera from their mobile phones. Access to the Internet means access to email and potentially other micro-blogging tools such as Twitter or Weibo (the major platform in China and used by Chinese students in particular). In this study, students appreciated the opportunity to communicate via Twitter once introduced to the platform, seeing it as more immediate and useful than email.

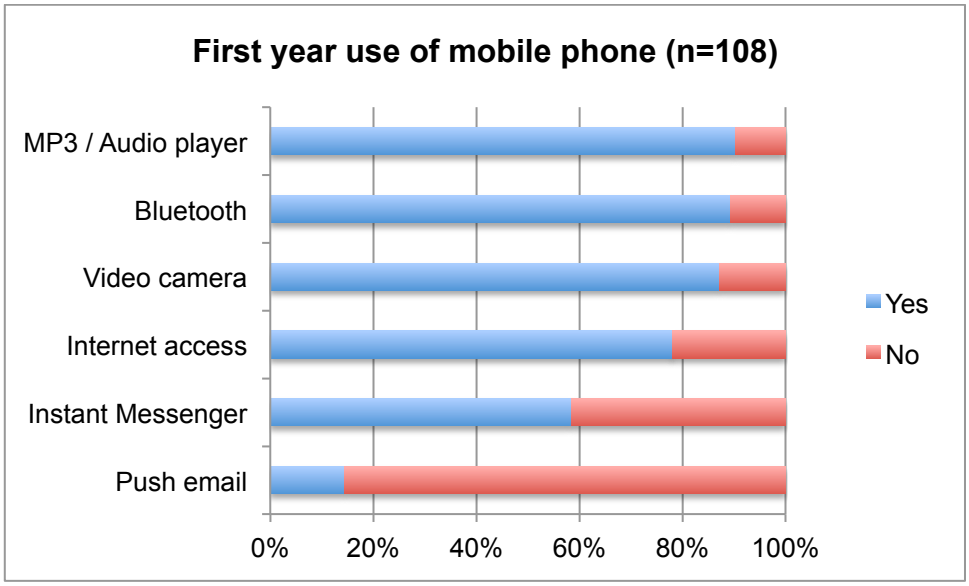

Figure 4. Features that students use with their mobile phones (data source 1; n=108)

The students from the first-year undergraduates (2) were compared to the students in the LCE 202 class (3) and it was found that, by the end of the course, students in LCE 202 were using iPhones and technology significantly more than the group in the major survey of incoming students in 2009, 2010 or 2011 (see also Figure 10). Figure 5 provides some information on students' perceptions in LCE 202 (5).

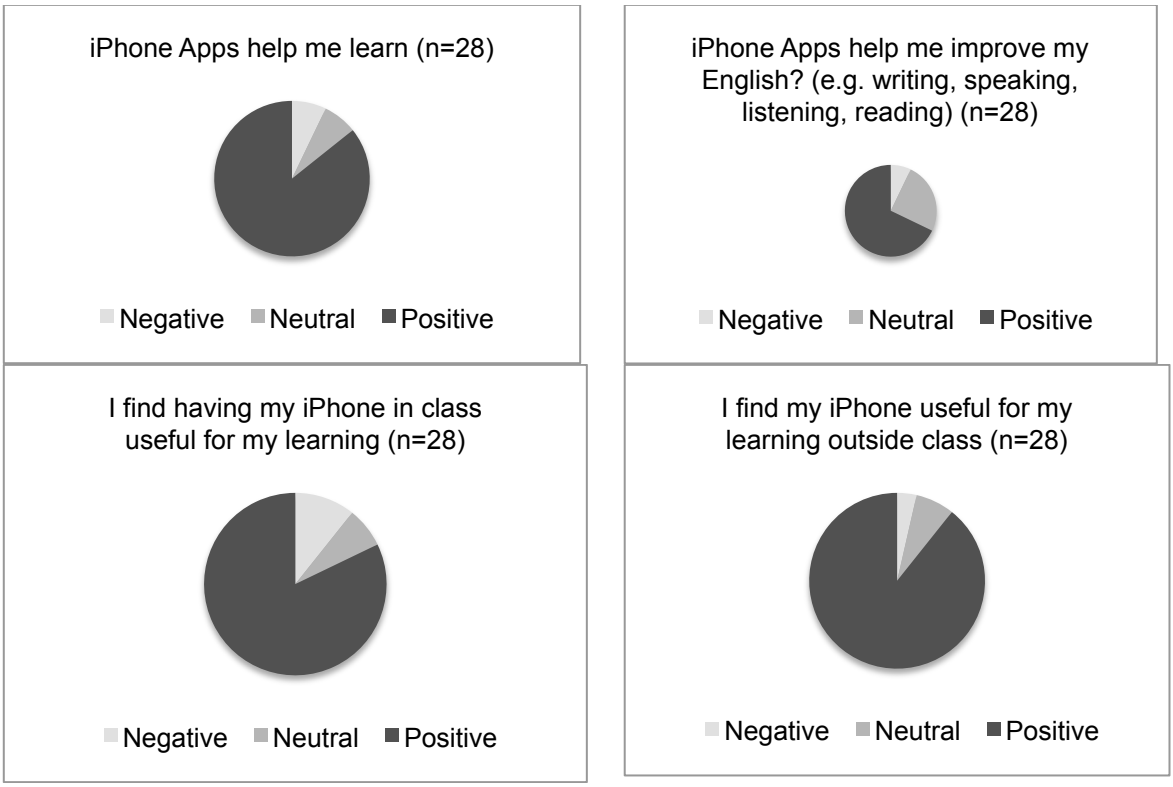

Figure 5. Perceptions of the value of iPhone apps for learning by students in the research group LCE 202 (data source 5)

It is clear from the data that students, once they have some experience and receive some level of instruction, find having an iPhone useful for learning, both in the class in which the iPhones are employed as part of the learning environment, and in other classes; at least one third of the group started recording lectures in other classes for later study and viewing. Figure 6 shows that 75% of the

students in the group started to use their mobile phones in more active ways to enhance their own learning.

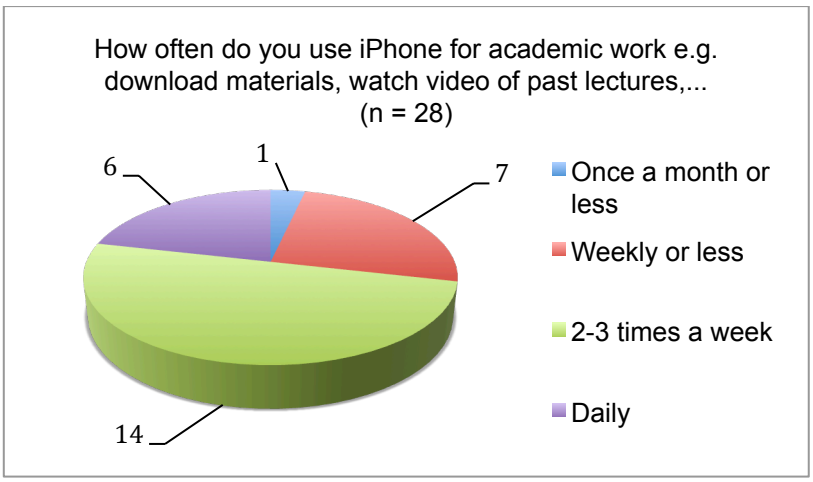

Figure 6. LCE 202 students' frequency of use of iPhones for learning (data source 5)

Students who didn't use the mobile phones for learning cited reasons such as the phone not actually being theirs to keep and so they felt limited in its use, or preference for another device which may have not had the functionality of the iPhone apps. In particular, the Samsung devices were rapidly gaining in popularity in the University (with aggressive marketing and feature-rich systems, the mobile phone 'wars' have escalated since the advent of the iPhone in 2007). With the increased competition in the marketplace many institutions have adopted a BYOD (Bring Your Own Device) philosophy, recognizing that it is very difficult for institutions to mandate which devices will be supported (Traxler, 2013; Vanwelsenaers, 2012).

During the classes, students were encouraged to explore the vast array of free applications and then asked to name their favorite apps for learning (Figure 7). Three areas in particular stood out: language-learning applications to test grammar, vocabulary and listening skills; news services (particularly CNN and BBC); and English–Chinese dictionaries. The implication for this study is that once students start to use applications they deem important and useful for their learning, they quickly make these applications part of their everyday activities and are used very frequently, including in class when encouraged. Over 70% of the apps nominated by students were drawn from the English language, news, dictionary and communication categories.

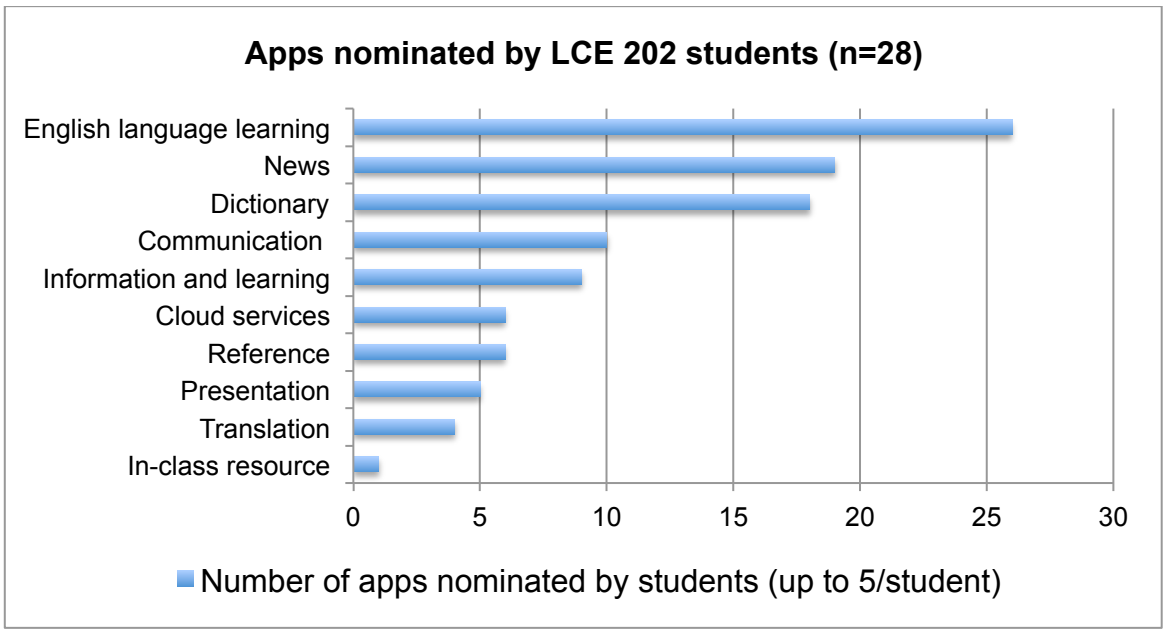

Figure 7. Categories of apps used by LCE 202 students when asked to nominate their favourite apps for learning (data source 5)

In the study, students made use of a wide range of features and apps on their iPhones (Figure 8). The camera feature was fundamental to the course. Students could practice their presentations and then replay them in private prior to the actual assessment. Students generally made good use of this feature.

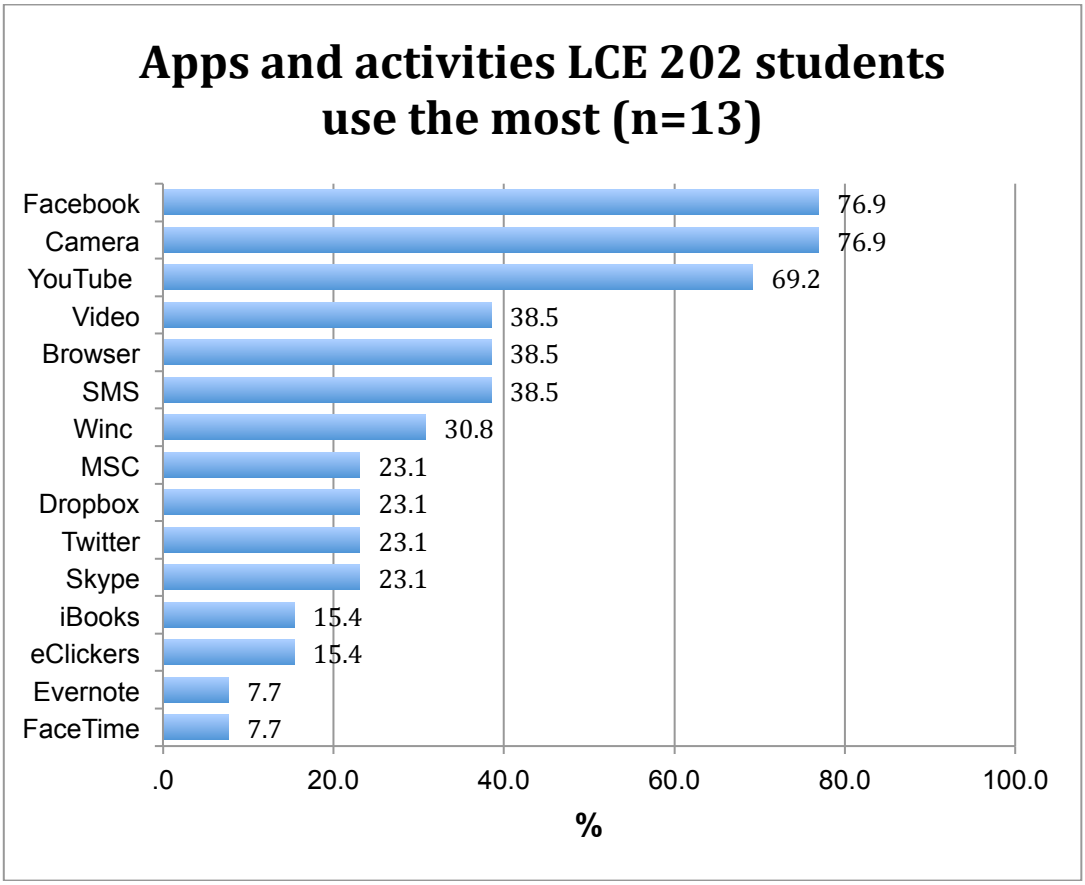

Figure 8. Apps and features preferred by LCE 202 students in the study (data source 6; n=13)

As already indicated, a key part of the learning design involved the use of YouTube. All student presentations were uploaded to YouTube after each of their prescribed assessments (presentations). Figure 9 provides an example of one such upload.

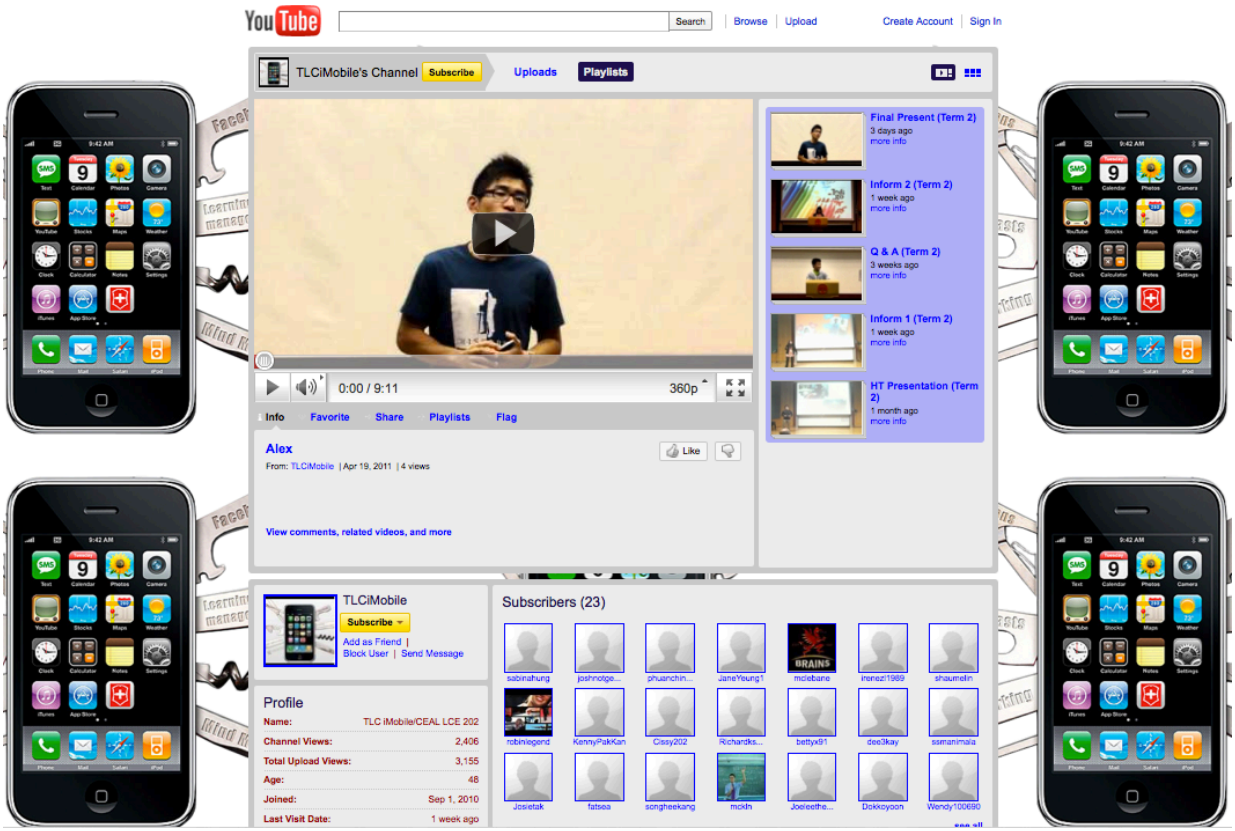

Figure 9. The YouTube Channel (TLCiMobile)

The area under the presentation provides an opportunity (mandated by the class teacher) for students to provide meaningful feedback. Examples of feedback are (reproduced verbatim, though names removed):

- *I think XXX do a good job in controling_ the rate of speech. He speaks in a average rate which can make him calm down and not [appear] that nervous.*
- *I like the topic. It is very interesting. It is also a common_ issue nowadays.*
- *It was well organised, but your tone was a little bit flat. I still think it was an inspiring presentation.*
- *U hv a good smilling face...cant really see yr nervousness...but maybe need more practice, because u seems like not too familiar with yr talk and trying to look for words on the stage....*

It is clear from the peer feedback that key elements significant to giving a presentation (e.g. timing, rate of speaking, interest and engagement, presentation skills, how relaxed the speaker was, etc.) had been internalized by the students and formed the basis for their feedback and comments, providing evidence of their ability to critically analyze a presentation and provide feedback to peers.

By actively integrating the use of mobile technologies into the classroom (students were expected to have their mobile phones in each class for providing peer feedback, accessing documents, looking up unfamiliar words, viewing examples of either student work or good practice on YouTube, etc.), the behaviour of students in the study was markedly different from the general population of incoming first-year students in 2009 and 2010. Figure 10 and Table 1 show that, while the general population use of smart phone tools for learning increased from 2009 to 2011, in the iPhone class (LCE 202) the usage was much higher proportionally and statistically significant, mostly at either the 0.05 or 0.01 level.

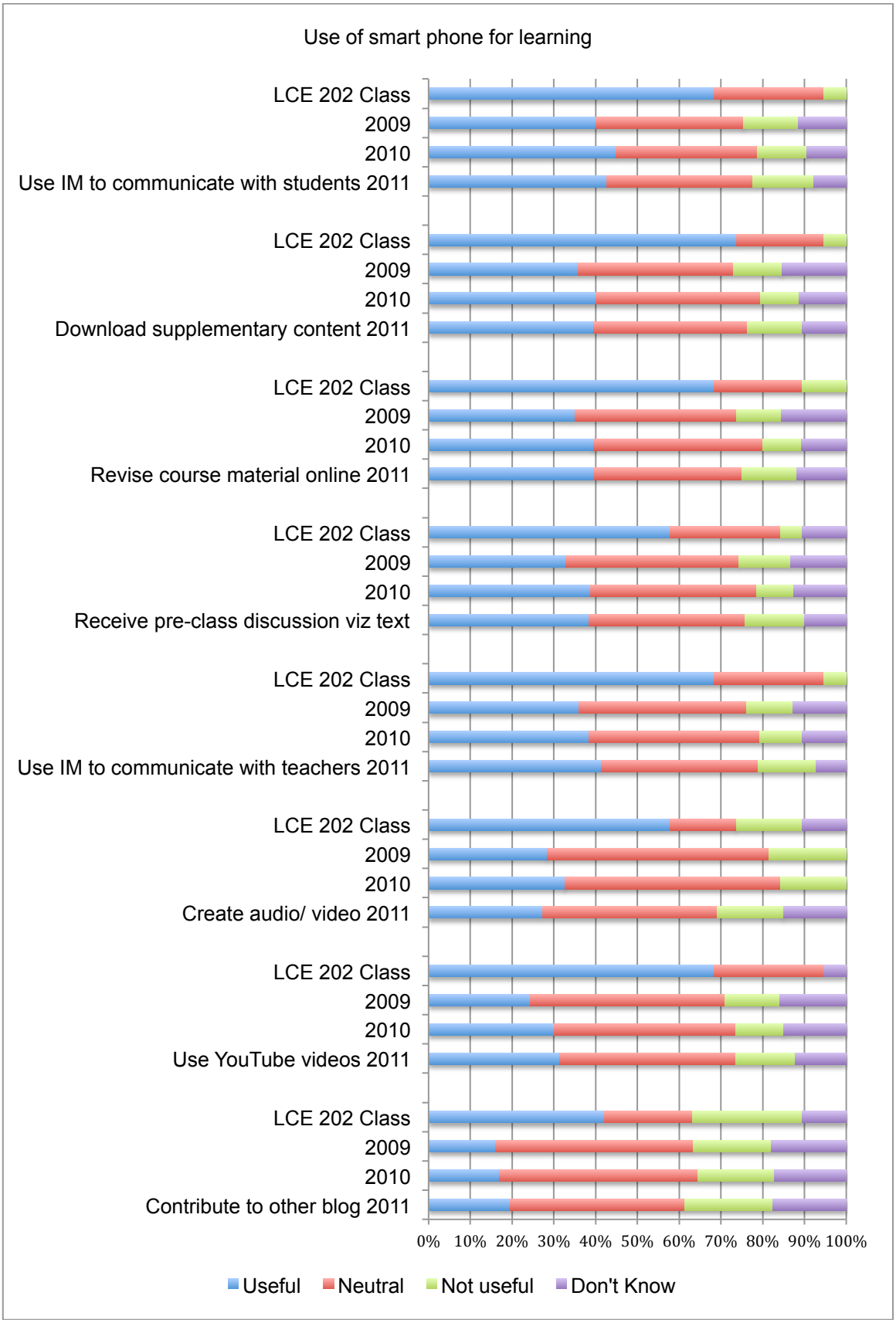

Figure 10. First-year students' (across three years) use of smart phones for learning, compared to the research group

A standard z-Test was done to determine if there was any level of significant difference in the responses of the general student population and the students in the LCE 202 class. Over the course of three years it was observed that for the majority of the questions asked, the proportion of 'Useful' responses from the whole student cohort increased from 2009 to 2011. The z-Test was undertaken between the 2011 student group (n=504) and the LCE 202 Class (n=28). (See http://stattrek.com/hypothesis-test/difference-in-proportions.aspx for further discussion on the use of the z-Test used.)

Table 1.

The z-Test results for any the level of significance between two population proportions

Use of Smart Phone for:	Data source	Useful	Significance (z-Test)
Contribute to other blog	2011	19.5%	p < 0.05
	LCE 202 Class	42.1%	
Use web conferencing with teacher	2011	33.1%	p < 0.01
	LCE 202 Class	63.2%	
Use YouTube videos	2011	31.3%	p < 0.01
	LCE 202 Class	68.4%	
Use web conferencing to communicate with other students	2011	27.1%	p < 0.05
	LCE 202 Class	47.4%	
Create audio/ video	2011	27.3%	p < 0.01
	LCE 202 Class	57.9%	
Use IM to communicate with teachers	2011	41.4%	p < 0.05
	LCE 202 Class	68.4%	
Receive pre-class discussion via text message	2011	38.5%	p < 0.10
	LCE 202 Class	57.9%	
Revise course material online	2011	39.7%	p < 0.01
	LCE 202 Class	68.4%	
Download supplementary content 2011	2011	39.5%	p < 0.01
	LCE 202 Class	73.7%	
Use social networking to communicate with other students	2011	43.9%	p < 0.05
	LCE 202 Class	63.2%	
Use IM to communicate with students	2011	42.7%	p < 0.01
	LCE 202 Class	68.4%	

Assessment Data

It is not possible to do a direct comparison between the competencies of students in this study with those in previous cohorts because the nature of the assessment had changed to have a greater emphasis on providing a platform so that student presentation skills could be arranged sequentially, enabling the student and the teacher to look for evidence of improved learning outcomes more easily. This was done through use of an e-portfolio, where students' work was progressively uploaded throughout the semester. The affordance of the e-portfolio system has been discussed elsewhere (Kennedy & Shirley, 2011). In that study, involving a number of teachers, the findings indicated that, where the teacher was comfortable with the use of an e-portfolio and actively encouraged the students to make optimal use of it, the overall quality of students' ability to provide evidence of their language learning improved in an observable fashion. In this study, where the teacher was strongly supportive of the project, the same observation is true. Also, in this study, the quality of the student artifacts (particularly the final video presentations), the ability of students to provide meaningful peer feedback (as a critical friend rather than a critic), and their increase in technical skills enabling them to better use smart phones for learning (compared with their peers who did not take the class) was considered to be significant evidence of improved learning by the class teacher.

Discussion of the Challenges Encountered in the Project

One of the statements made at the commencement of the paper indicated that, while the smart phones themselves were likely to be ready for use as powerful personal learning tools, institutional factors (pedagogy of staff and infrastructure) may not yet be ready. This study has confirmed this premise. Harper and Quaye (2009) also noted that many universities and colleges are conservative and slow-moving institutions which are not keeping pace with change – both in terms of technology and also in terms of increasing diversity in the student population. Strategies which enable learning to be personalized to the needs of a wide range of students are likely to be of value, as evidenced by this study where students valued their ability to adapt the technology and the activities in the learning design to their own learning needs.

The findings of this study are coherent with a major synthesis of research into educational effectiveness across ages and subject areas undertaken by the US National Research Council (1999) which concluded that effective learning is learner-centered, knowledge-centered, assessment-centered and community-centered. In this study students had their own devices and online space (learner-centered); were working in the defined and important domain of English language (knowledge-centered); produced assessment artifacts as an endpoint to the course (assessment-centered); and engaged actively and willingly in peer-assessment (community-centered).

While many universities have campus-wide wireless networks in place, until this study, wifi was not generally used intensively by students for study (at least at the university in which this research occurred). Once wireless systems come under intensive pressure from students, either for learning or socializing, then cracks appear. While universities are able to manage the loads generated by social activities using packet-shaping (also called traffic-shaping), where some sources of data are either given priority or downgraded over others, the mechanism of this process means that not all data is treated equally and relies on delaying some categories of packets of information. If the source is YouTube videos, then the clips from YouTube may not play continuously or the connection may time out, preventing the student from viewing the video stream. This problem was commented upon by several students during the course of the study. The issue for the University is making a distinction between, in this case, YouTube videos for socializing and fun, and YouTube videos for learning. As content from, for example, iTunesU or the Khan Academy (http://www.khanacademy.org/), becomes more widely used on campus by students genuinely wishing to learn, making institutional decisions about which content traffic stream will be delayed by packet-shaping will become more complex.

A second more challenging issue related to connecting iPhones to the wifi network. Up to 50% of the students in the study, from both groups, had difficulties logging into the University system due to compatibility and security problems. This was true in a number of the classrooms (not all classrooms seemed to be iPhone-friendly), and the hostels also proved to be very problematic due to the high demand from other students on the network. In the second part of the study, one classroom in regular use by the classes in the study was upgraded by the IT Services Centre after the research group indicated that the services were not adequate (particularly when the eClicker software was being used to obtain real-time feedback on student presentations). The changes made were successfully, but this example indicates that, without real-world loads on a system, use in classes of students equipped with mobile devices that rely upon wifi is likely to be problematic for teachers and students alike.

The third issue was the level of student expertise and experience in using smart phones for learning. Student expertise varied considerably and the move from personal and social use, to active use in learning, produced some interesting responses from the students. Initially, there was a very strong expectation that since these devices were now part of the learning environment, it was the responsibility of the teacher to demonstrate how something operated or to provide advice on how something was done. For example, comments from two students (reproduced verbatim) were:

- *Instruction is not enough, so I think I didn't make full use of it, just as you said in the class, maybe you can provide the students more instructions, especially in the study aspect, because for the entertainment, students always can get it.*
- *I think I do not get clear instructions and I do not even know how to transfer the music from the laptop to the iphone. This really creates problems for me. If iphone is widely used in our campus, I think proper guidelines should be given to the students.*

However, these students were in a small minority by the end of the course as confidence and subsequent involvement grew. Interestingly, a simple search of YouTube would have provided students with answers to many of their questions. As one student pointed out:

- *I suggest a Briefing session about the basic functions of the iPhone can be made. I personally had little problems on iPhones. I managed to tackle the problems with the help from all sorts of online materials. However, i saw some of my classmates faced a lot of problems with technology.*

Briefing sessions were held, online materials were available (created for the project and placed in the e-portfolio group general files) but, clearly, moving activity with the devices from the personal to the institutional seems to change the perceived responsibility for finding out more about the devices and how they can assist learning. The need to induct students into an innovative learning environment is one of the key lessons of the study.

Despite the issues highlighted above and some of the frustrations of the students, the teaching and course evaluation scores received by the teacher were almost one standard deviation above that of the university average. Clearly, the high level of activity required, the expectations for students to be more independent and proactive in their learning, and the demands for self and peer reflection were deemed (by students) to be a valuable and worthwhile experience. Subsequent offerings of the course were evaluated highly by students, indicating that, from the student's perspective, this was a course worth taking.

Conclusion

This paper reports a study where students engaged actively with smart phones for learning, both in and out of class. The revised assessment task enabled students to improve their presentation performance. In addition, students gained skills in peer critique.

A key learning from the project is that for mobile technologies to move from the periphery to the center of a learning environment, all the elements in the learning environment need to mesh seamlessly: these elements are the pedagogy in the form of the intended learning outcomes and the curriculum/ learning design (especially the student activities and assessment), student expectations about the learning environment (these need to be carefully managed if push-back from students is to be avoided), and the technology to support the devices used. While the importance of suitable pedagogies to be adhered to when designing technology-rich learning environments is often acknowledged, the complexities faced by students in what they are expected to master, and the ease of use of technical infrastructure and support has received less attention. Many have already assumed that mobile technologies are already ubiquitous and well understood by students, and all that is needed is for successful implementation is good learning design and engagement by teachers. This study has shown that this is not the case and a multifaceted approach that deals with all of the key issues of pedagogy, student expectations and technical infrastructure is more likely to be successful and have a significant impact on student learning.

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