



## TABLET PCS, MOBILE LEARNING, AND HIGHER EDUCATION: IN SEARCH OF A PARADIGM?

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# TABLET PCS, MOBILE LEARNING, AND HIGHER EDUCATION: IN SEARCH OF A PARADIGM?

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## ABSTRACT

The emergence of tablet PCs marks a paradigm shift in the computing industry. Is there a corresponding paradigm shift in education? Tablet PCs are not always considered in the context of mobile learning, usually on grounds of size. They have obvious potential for business users, but their deployment in teaching and learning is still in the early stages of development, and there is a risk that in failing to consider these devices as part of the panoply of mobile technologies, we may miss out on opportunities to harness the potential of the tablet PC to promote collaborative, informal learning, as well as interactive teaching. This paper cites the tool in its rightful context as a mobile and portable device, arguing that the tablet PC should be properly considered as part of the emerging mLearning paradigm, and reporting on a large-scale wireless campus initiative at the University of Ulster based on this perspective.

## KEYWORDS

tabletPCs, wireless campus, mLearning

## 1. INTRODUCTION

The emergence of tablet personal computers (PCs) marks a paradigm shift in the computing industry. Is there a corresponding paradigm shift in education, specifically in relation to mobile learning? The role that tablet PCs have to play in higher education is an area which is wide open for exploration. Tablet PCs are not always considered in the context of mobile learning (mLearning), usually on the grounds of size: positioned between laptop and notebook computers, they are generally considered to be portable, as opposed to mobile, devices (Anderson & Blackwood, 2004). They have obvious potential for business users, but their potential for teaching and learning is still in the early stages of development, and there is a risk that in failing to consider these devices as part of the panoply of mobile technologies, we may be missing out on opportunities to harness the potential of the tablet PC to promote collaborative, informal learning as well as interactive teaching.

This paper considers the role that the tablet PC should play in the field of mLearning, attempting to cite the tool in its rightful context as a mobile and portable device, and arguing that, in contemporary terms, size is no longer a relevant attribute for categorising mLearning tools. The paper further argues that if the tablet PC is not properly considered as part of the emerging mLearning paradigm, education may miss out on an opportunity to harness new technology which promotes active, social and collaborative learning. Finally, looking to future developments, the paper reports on a large-scale project on the Magee campus of the University of Ulster, involving students and lecturers, tablet PCs and a wireless campus.

## 2. WHAT IS THE TABLET PC?

Tablet PCs are based on laptop computers but with extra functionality. They can be seen as part of a paradigm shift in the computing industry: positioned between laptop and notebook computers, and primarily targeted at the business user, their flexibility of form, combined with wireless capability, enables mobile

computing. As a tool, the tablet is essentially a fully functional PC which enables a user to write directly on the screen with a stylus, or switch to keyboard input, and to connect to the Internet or set up ad-hoc, peer-to-peer wireless networks. The main producers are Acer, Fujitsu, Toshiba and Hewlett Packard. A comparison of these products can be found in (Wood, 2003). There are two styles: convertible tablets (with a keyboard) or slate tablets (without a keyboard option). Both can be used in portrait and landscape mode. They have touch-sensitive screens and allow input through stylus pens. They are A4 in size, and use wireless technologies such as 802.11b for Internet connectivity. For an operating system, Microsoft has developed a version of Windows XP for tablet PCs, which offers extra features such as handwriting recognition which is fully integrated with Office products. In addition, some applications have been developed specifically for the device, including Windows Journal, and Office OneNote.

The main market would seem to be the business user: Acer produces a series of tablet PCs aimed explicitly at business users: the key selling points are mobility, portability and convertibility: they offer 'a fully flexible notebook coupled with the efficiency and convenience of electronic ink and character recognition for daily work' (Acer Publicity, December/ January 2005). There is not much tablet-PC focussed software for education (or elsewhere for that matter), although Microsoft is encouraging developers through its own Tablet PC. Costs range from £900 to £18000.

Developers who are keen to encourage the creation of new applications cite the biggest advantages of tablet PCs (over laptops and desktops): 'all handwritten notes can be stored electronically and later searched by content, and (...) hand-drawn figures can be quickly added to Word documents and PowerPoint slides to clarify or extend them in new ways' (Binstock, 2004).

### **3. WHAT IS MOBILE LEARNING?**

Defining mobile learning is problematic in terms of scope, and yet agreement on a working definition is needed if the area is to become established in terms what has been considered a paradigm shift. Definitions of mobile learning vary according to context: it can be seen as 'the provision of education and training on mobile devices: Personal Digital Assistants (PDAs), palmtops and handhelds and on smartphones and mobile phones' (Keegan, 2002). Mobile learning (or mLearning) is 'the ability to receive learning anytime, anywhere and on any device' (Chabra et al, 2002), although some commentators specify the device in greater detail, where learning takes place 'with the help of a mobile computer device. The device must be capable of presenting learning content and providing wireless two-way communication between teacher(s) and student(s)' (Dye et al, 2003). For many, a mobile device has the following characteristics: it is hand-held and it is wireless. It is this latter attribute which offers a crucial distinction: mLearning is distinct from eLearning in that all communication is wireless.

It has been noted that research on mLearning to date has been little and patchy (Dye et al, 2003). This is unsurprising since it is a rapidly evolving field. Certainly, the impact of mLearning on higher education has yet to be evaluated in a comprehensive manner, but that does not detract from the great sense of promise that surrounds the concept.

### **4. THE TABLET PC AND MOBILE LEARNING**

There is no agreement on the range of devices which mLearning embraces: while most commentators mention PDAs and mobile phones, the attitude to Tablet PCs varies: some choose not to consider these at all, while others feel they fall naturally into the category of mobile devices. Typical of the first group is Keegan (2002) who considered the characteristic of handheld devices to guide developments in smart phones, mobile phones and PDAs. Lockett (2005) referred to handheld computers as 'any small/mobile device that uses computing and information storage and retrieval' and considers them to be synonymous with PDAs. The JISC report on the evaluation of the use of mobile devices in further and higher education institutions explicitly chose not to consider tablet PCs on the grounds of size, although current implementations support all of the characteristics of mobile devices (operating system support, multimodal interfaces, and standard software tools), and address many of their limitations: small screen size, limited performance and slow connectivity (DeFreitas & Levene, 2003).

A more recent JISC report (Anderson & Blackwood, 2004) identified three major classes of mobile devices: PDAs, mobile phones, and Personal Media Players (PMPs), and ignored tablet PCs on the grounds of size: 'mobile devices are small enough to fit into a pocket or shoulder bag so they can be kept with us at all times'. This distinction seems to be rather coarse: while today's tablet PCs are certainly not pocket-sized, they can easily fit into a shoulder bag. Over the years, tablet PCs have got progressively smaller and slimmer: to use the fuzzy notion of 'smallness' to disqualify a tablet PC as a mobile device would seem to be fairly arbitrary.

Anderson & Blackwood (2004) offered a further reason for eliminating tablet PCs from the category of mobile technologies: like many authors, they consider tablet PCs hand-in-hand with laptops, and class them as portable (as opposed to mobile) devices in accordance with the IEEE's distinction (IEEE, 2002). When one considers the concepts of mobile devices and portable devices, the hybrid nature of the tablet PC becomes quite difficult to categorise. A mobile device is described in terms of its IP address: according to part of IETF RC 2002, IP Mobility Support, it may be a cellular phone or handheld or laptop computer (or a router) which is connected to the Internet, and 'whose location and point of attachment to the Internet may frequently be changed' (searchMobileComputing.com, 2005). A portable computer, on the other hand, is described by size: it is a PC which is 'designed to be easily transported and relocated, but is larger and less convenient to transport than a notebook computer' (searchMobileComputing.com, 2005). This in turn leads to the matter of the distinction between a portable computer and a notebook computer, and in relation to the tablet PC, such a distinction is not clear cut: it is a wireless PC which allows a user to make notes with a pen on a touch screen, it is 'similar in size and thickness to a yellow paper notepad and is intended to function as the user's primary personal computer as well as a note-taking device' (searchMobileComputing.com, 2005). By this definition, a tablet PC could be considered to be mobile and portable, since it shares the characteristics of size with notebook computers and notepads, which are designed to fit into a shoulder bag, for example.

Wood (2003) gave explicit consideration to role of tablet PCs, along with PDAs, mobile phones and laptops in teaching and learning, widening the notion of mLearning to include mobile and handheld IT devices. In a comparison table, on grounds of size, she considered that while PDAs can just about fit into large pockets, tablet PCs can be carried in one hand and be used like a clipboard (unlike laptops which are difficult to use on the move). In terms of benefits of mobile devices for education, the tablet PC would appear to be the most promising of the available devices: 'PDAs offer greater functionality than mobile phones and similar advantages to tablet PCs, though tablet PCs are more robust than PDAs and offer additional features' (Binstock, 2004). Naismith et al (2004) acknowledged that 'mobile, to most, means portable and movable'.

The MOBilearn project adopted a much broader definition of mobile learning, from the perspective of the learner, as opposed to the device: 'any sort of learning that happens when the learner is not at a fixed, predetermined location, or takes advantage of the learning opportunities offered by mobile technologies' (MOBilearn, 2003).

If tablet PCs are accepted as mobile devices, then mobile learning might gain strength as an educational paradigm: the combination of tablet PCs and the wireless classroom could enhance teaching (through improved presentations) and learning (through enhanced collaboration). The predominant paradigm in higher education is the model based on lectures, seminars and tutorials. Mobile learning may be the spur to encourage widespread adoption of models on online-collaborative learning. Benefits for lecturers include the ability to annotate PowerPoint presentations and mark student assignments; benefits for students include the capacity to handwrite notes (and search them electronically) and to collaborate with other learners, communicating informally without wires.

Mobile devices may offer particular advantages to lifelong learners, distance learners, part-time learners and work-based learners (Sharples, 2000). They are considered to facilitate collaborative learning within communities of practice (DeFreitas & Levene, 2003) which applies to campus-based learners as much as off-campus learners. Valenti (2002) observed the benefits of offering media-rich materials in the classroom: students can extract relevant audio and video to help them develop their understanding. This can then be shared among members of an informal work group or learning community. As a collaborative tool, 'social interactions and group processes centred around collaboration may supplant the current use of technology as the gateway to 'knowledge'' (Lomas & Rauch, 2003).

Broad, general claims are made for wireless technology and its benefits for higher education: Leight (2004) felt that there would be increased productivity for students and faculty. Other benefits include flexibility, mobility, and a robust productive environment. Major concerns when considering the

implementation of a wireless campus tend to focus on security, allocation, authentication and technical standards. It is only lower down on lists that one tends to find mention of curriculum models or integration strategies. Similarly, pedagogic concerns come sixth on the list of issues for higher education in Anderson & Blackwood's report (2004).

Issues which are raised tend to be in relation to the medium, rather than the pedagogical role of mobile devices: privacy, security and authentication are all issues (Satyanarayanan, 2003), and there may also be public health worries. DeFreitas and Levene (2003) observed that progress in the development of mobile devices was proceeding at such a pace that suppliers were trying to create demand at what could be considered to be a relatively early stage of development. They identified a major challenge as the provision of 'intelligent and specialised software that is useful in an educational context' (DeFreitas & Levene, 2003).

Debates are starting to open up amongst developers (TabletPCBuzz.com, 2004), who have noted that while it is possible to use existing PC applications on tablet PCs, there would be little point in doing so since they are designed for keyboard input: designers tend to assume that users will be sitting and typing. Many applications which are based on keyboard input could be installed on a tablet PC, but this would slow data entry (however, it would allow for mobility). A further problem is that the education market tends not to have information technology budgets which attract early-in-platform software development funding. The tablet PC has particular graphical user interface requirements, and while there is a presumption that wireless connectivity is always available, it is advisable to design for a disconnected device; the portability that the tablet offers means that it should not be assumed that the devices are constantly connected, rather that they are occasionally connected, with implications such as queuing data for subsequent synchronisation (Binstock, 2004). A final problem is the one which besets the introduction of all new technology: the search for the killer application (Perlin, 2004) which may thwart development of smaller yet very useful applications.

Adoption is being tackled in part by Microsoft's investment in the field. Keen to attract education to the technology, their Education research section cites examples of small and medium scale projects involving tablet PC adoption, such as the Microsoft Future Professors Pilot Project. One such example is the study and development of a research protocol to examine how the combination of a Tablet PC plus OneNote can facilitate note-taking and mastery of course materials (Microsoft, 2004).

## **5. THE UNIVERSITY OF ULSTER PROJECT**

With a view to harnessing the potential of tablet PCs for teaching and learning, the School of Computing and Intelligent Systems at the University of Ulster is undertaking a pioneering Wireless Campus project. The Magee campus (together with the campus of the North-West Institute for Further and Higher Education and the city council offices) has been enabled for wireless computing by staff and students. Thirty academics in the School received Toshiba Tablet PCs, which they are using to deliver lectures and communicate with students. At the start of the next academic year in September 2005, all first-year single honours and computing major students will also be issued with wireless-enabled tablet PCs to encourage interactive, collaborative learning on the campus. This is a large-scale project, involving the distribution of approximately 150 tablet PCs to students in 2005 and again in 2006. At the same time, a new Wireless Technology Centre has been established. Both the campus and the centre are part of a larger initiative, as funded by a major Department of Trade and Industry wireless infrastructure project for the city. The new technology should facilitate greater access to educational resources which will revolutionise the way students learn. The campus has also adopted smart classroom tools such as interactive white boards, wireless data projection technology, and plasma screens. The project team considers the tablet PC to be the key to mLearning. By giving the tool to the students, the price of the tool is not an issue, and it is hoped that this will encourage its adoption. The project is in its early stages, and will be reported on further in the future.

## **6. CONCLUSIONS**

Tablet PCs can be seen as part of a paradigm shift in the computing industry: positioned between laptop and notebook computers, and primarily targeted at the business user, their flexibility of form, combined with wireless capability, enables mobile computing. The obvious paradigm in which the tablet PC could sit would

seem to be mLearning, yet many researchers discount (or fail to consider) the role of the tablet PC in discussions of mLearning, often on the (arbitrary) grounds of size. The tablet PC should play a much more prominent role in the field of mLearning, as a mobile and portable device. In contemporary terms, size is no longer a relevant attribute for categorising mobile devices. If the tablet PC is not properly considered as part of the emerging mLearning paradigm, education may miss out on an opportunity to harness new technology which promotes active, social and collaborative learning, already underway in projects such as the large-scale initiative at the University of Ulster, involving students and lecturers, tablet PCs and a wireless campus.

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