

Defining the handheld computer for a first year university student: Is it a 'handy' accessory or an essential learning tool?

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ABSTRACT

The main aim of this research project was to analyse a first year student group's engagement with their handheld computers (also known as Personal Digital Assistants or PDAs) – not only in activities related to their university studies, but in the broader context of their lives – and to reflect on how this impacted on their overall engagement in the learning process. The other objectives were to contextualise the resulting discussion within the findings about the mobile learning behaviours of the wider student group. The communication preferences and practices of the participants as representatives of the larger cohort were also analysed, including whether owning a PDA impacted on these behaviours. The findings reflected that though the students were appreciative of the opportunity to have and explore an unknown device, they judged it to be an accessory, and not an essential component, to their 'digital backpack'. The analysis leads to suggestions for a way forward in engaging students in a highly digitised world.

Author Keywords

Mobile learning, student engagement, first year experience

INTRODUCTION

When a student answered, 'What was the main way you used your PDA over the past few months?' with the response, 'As a desk accessory', he encapsulated the key issue raised in this research project. This issue was to assess whether, in the life of a first year university student, a handheld computer was a valued tool or if it was instead, a 'handy' accessory. Currently, though there is a plethora of research on mobile learning, the significance of context and the variations in student populations around the world, and even within the populations in Australia, mean that the findings of this Western Australian project can complement the discussion about best practice and offer insights into how to engage students of the net generation. In Australia there are 4.5 million Net-genners who were born between 1978 and 1994 (Sheahan 2005). These young people, who can also be referred to as digital natives (Prensky 2001), are naturally conversant with Web 2.0 applications which are "all about moving beyond content delivery to personal publishing, ease of use, interactivity, collaboration, sharing, and customisation" (Cochrane, 2006). As these capabilities exist on mobile devices, it is assumed that these students would exhibit a preference for having them. This paper looks at only one such mobile device, a handheld computer, also known as a Personal Digital Assistant (PDA).

In this research project, the manner in which a group of engineering students mediated their world –explicitly the aspects related to their university studies – with a handheld computer, was observed and interrogated to gain insight into how this device engaged them in the learning process. So, why does a busy, new undergraduate (engineering) student welcome the opportunity to explore such a digital device? *'I was interested to see if it could be handy for my course. I'm pretty interested in gadgets generally.'* This comment from one of the participants in the a mLearning project at Curtin University of Technology exemplifies the attitude of not only the project participants, but rather it represents the attitude of many of our 'digital natives' (Prensky 2001). The project, funded by Hewlett-Packard gave a group of students the opportunity to explore a 'gadget' (the iPAQ 5550) and decide just how 'handy' it could be. The findings raised questions about defining tertiary learning and the role of digital tools in this learning.

PROJECT AIMS AND KEY QUESTIONS

This paper will present the findings based on the interview data from the Perth engineering participants in the context of larger quantitative data obtained from surveying all the first year engineering students in 2005 and again in 2007. The researchers observed and speculated how and why the students positioned the devices in their 'digital backpacks' and integrated them into their studies and into their lives generally. More specifically, it sought to examine whether having a PDA influenced their social and educational communication. These communication experiences could be further deconstructed to include: connection and interaction with other participants – both locally and those in Malaysia; increased knowledge and competence in use of ICT (Information and Communication Technology) tools; and adjustments in their interactions with others and with self.

- In assessing how and why the student participants used the device, these were the key research questions:
- How would the students integrate the PDA into their 'digital backpacks'?
- Would their attitude and use of the PDA change over time?
- Would there be any distinctive changes in their communication behaviour over the time (12 months) of the project?

Background

Handheld computers have been used in higher education for approximately 15 years, however in Australia, the researcher has been unable to find evidence of use apart from in the health sciences (for example at RMIT and at Curtin University of Technology). Oliver & Wright (2002) noted the growing popularity of using handheld computers (PDAs) on North American campuses back in 2002. Contemporary analysis of this phenomenon is complicated by the fact that the merging of several digital devices into one device – for example, the iPhone – makes comparisons and evaluations of any one device – or tool – rather complex. Also, this continual evolution and advancements of digital devices makes labelling one device as a PDA and another as a mobile phone seem a little anachronistic as one can be the other.

METHODOLOGY

First, in February 2005, a survey was done of all the incoming first year engineering students (on Curtin's Perth campus) with another similar survey of the new cohort conducted in 2007. These surveys were reasonably broad as we wanted to gather a picture of the incoming students' digital behaviour. Once we had the 2005 data, we were able to make the purposeful selection of research participants so we could get some rich data. This smaller project was part of a larger Hewlett Packard funded research project. That project involved groups of first year students from Curtin University of Technology's Engineering and Business faculties, in Australia, Africa and Malaysia, from about May 2005 to June 2006, using handheld computers for both structured and informal learning experiences. It was as part of this larger project that 15 first year engineering students on the Curtin's Perth campus were given the PDAs (iPAQ 5550s).

As there were only 15 devices, we chose to use 'maximum variety sampling' (Denzin & Lincoln 1998). The aim was that this would give us an insight into the differences – and commonalities – between the different types of students. The aim was to have participants who ranged from those who had used all the devices and tools to those who had very limited experience. These 15 students were put into groups (see Table 1); two groups consisted of students only from Curtin's Perth campus and the other two groups were a mixture of students from Perth and students from Curtin's campus in Miri, Malaysia. (Fifteen students in Miri were also given PDAs, though these students do not form a part of this study).

This representative sample of students was then interviewed to ascertain how they were using their PDAs.

The interviews

The semi-structured interviews of the 15 Perth based students, in small group settings, during 2005 and 2006 were conducted to not only complement quantitative findings but also to contextualise the findings within the large data about digital practices of the cohort from where these student participants came. Group interviews with more open ended questions (e.g. what are the best things about the PDA?) were held three times during the 12 months of the project to elicit more subtle student perceptions and feelings that may be hidden in the quantitative survey data. The group interviews were recorded and verbatim transcriptions were made of the interview data.

To assess the extent and nature of student use of PDAs and what this all means for student learning and teaching at university. The fluid nature of research in this area means that it is essential to place the findings of this small project within the wider context of the digital behaviour of the participant students' peers.

The qualitative data has been analysed using a grounded theory approach based more on the original Glaser & Strauss (1967, cited in Denzin & Lincoln, 1998). The richness of the conversational data cannot be fully realised through this method (of coding and then creating categories) but it does allow the researcher to give meaning and create connections to the quantitative survey data. This was done maintaining the integrity of the data.

Apart from initial instructions and support on the technical aspects of using the device, the student participants were not given direction about how and when to use the device. Instead, the participants were told to use the device as much and in as many ways as possible. Interviews were held to gauge their usage patterns and to encourage them to explore and share with each other the variety of ways to use the device in their studies and in other areas of their lives. During these interviews, the students were encouraged to overcome any perceived or experienced technical limitations of the device (e.g. problems with wireless capabilities). The researcher also encouraged the students to attempt to find new ways to use the device in their discipline area – engineering. The potential of mobile devices in professional engineering seemed vast so they were told to play and explore now, as pioneering undergraduates, so they could be at the forefront of using handheld devices in the future.

Finally, the devices were to be used in situated learning environments. Whether this was on a construction site, in their faculty computer laboratories or off campus in their bedrooms, students were to use the PDA when they naturally felt that the device could enhance their experiences. Apart from four of the participants, no one had used a PDA before and none of the group owned such a device.

Reasons for methodology

The survey plus the interviews provide the complement of quantitative data from a large group and rich qualitative data from a sample smaller group. There were only fifteen PDAs and though giving them to a group may be labelled as interventionist, the instructions to the participants were to use the devices as much or as little as they wanted to, and in whatever manner they desired. This allows the results to be generalizable to at least other first year Australian engineering students.

The methodology was based on the basic educational philosophy that learning must be student centred. Learning is also a situated experience and it is a lifelong process. Implicitly then, learning can also be mobile. Sharples, Taylor & Vavoula (2005) claim that as there was no theory of mobile learning, one was required to provide a framework for the highly portable and transitory education that was now intrinsic to the digital world. This gives the researchers a framework in which to discuss the student experiences at the two levels defined: engagement with device and using the device for engagement.

Using a PDA in the learning process captures the essence of student centred learning. The responsibility for the learning process is completely with the person who had the device. This is at the heart of e-learning generally – where engagement in the learning process is driven by the student.

FINDINGS AND DISCUSSION

Relevant findings from the survey data

First, it is helpful to look at overview of the participants who formed the representative sample (Table 1) and also note the demographic of the larger student cohort (Table 2).

Group A	Group B	Group C	Group D
5 students (4 males, 1 female, all under 20 years) Perth only mixed gender group	2 students (2 females; one under 20 years and one under 25 years) These students were matched with 3 students in Malaysia	3 students (3 males under 20 years) These students were matched with 2 students in Malaysia	5 students (male; 4 under 20 years and 1 under 25 years) Perth only group
2 ESL/other language 3 English first language	Both had English as their first language	1 ESL/other language 1 English first language	1 ESL/other language 4 English first language

All of the participants owned mobile phones, had internet access off campus and all frequently used online resources to help them learn. None of the participants owned a PDA.			
3 had laptops	1 had a laptop	1 had a laptop	2 had laptops
1 had used a PDA before	0 had used a PDA	2 had used PDAs	1 had used a PDA before
3 owned iPods or MP3	1 owned an iPod	All 3 owned iPod/MP3	3 owned iPods or MP3
4 used instant messaging	Both used instant messaging	2 used instant messaging	3 used instant messaging
0 blogged or engaged in podcasting	0 blogged or engaged in podcasting	2 blogged and engaged in podcasting	1 blogged 0 engaged in podcasting

Table 1: Curtin Perth campus, summary of engineering student participants in PDA project

		2005	
		n	%
Gender	Female	9	9.4
	Male	87	90.6
First language	English	75	78.1
	Other	21	21.9
Age	<20	76	79.2
	20-25	17	17.7
	26-35	3	3.1

Table 2: Gender, first language and age composition of the larger engineering first year cohort surveyed in 2005

It is also relevant, in this context, to look at the whole student cohort ownership of devices that can commonly be labelled as ‘mobile.’ In 2005, as the survey was conducted for a larger project, both Business and Engineering students were surveyed about their ownership of four devices: laptops, handheld computers (PDAs), mobile phones and music playing devices such as *iPods* and MP3 players. To support the applicability of this project’s findings to the current student cohort, the findings from a 2007 survey of the incoming Engineering students have also been included alongside the data from the 2005 survey. Table 3 shows that a little less than half the students in each cohort owned laptops; very small percentages reported ownership of handhelds (<10%) and the vast majority owned mobile phones (>96%). As was reported in an earlier paper (Oliver & Goerke 2007), there was no difference in ownership levels of these devices for the two cohorts, either when Business students were included or when they were excluded ($p > .05$). That paper also showed that there was a discernable change in the levels of ownership of the music playing devices. ‘In 2005, two fifths of students (40.6%) owned a music playing device; in 2007, over two-thirds of students (70.1%) owned them (chi-square, corrected = 65.296, $df = 2$, $p = .000$)’ (Oliver & Goerke 2007).

	Year	n	Yes	Not sure
Laptop	2005	412	47.6%	0.5%
	2007	290	48.6%	1.4%
Handheld computer	2005	409	8.1%	1.0%
	2007	288	5.6%	1.4%
Mobile phone	2005	412	97.6%	0.2%
	2007	289	96.2%	0.7%
iPod or MP3	2005	409	40.6%	0.2 %
	2007	288	70.1%	1.4%

Table 3: Number and percentage of students who reported owning devices

These results indicate that the ownership of handheld computers has not changed much over the past two years with less than 10% of students owning PDAs.

Findings from the interview data

By uncovering repetition of responses as well as connections to the quantitative data, two divergent themes emerged: enthusiasm for the device and eventual disappointment and resignation at its technical limitations.

During the early months, the student participants expressed gratefulness, curiosity and enthusiasm to have a mobile device to explore and for the opportunity for extension (to their ICT knowledge). This was true for all the students from those who were already highly skilled (they liked the chance to be experts (teach their peers) and explore and extend the use of the device. The others were all happy to have a 'new' device. Two of the 15 students failed to participate in the follow-up interviews in 2006. The converse theme was resignation and disappointment with the limitations of the device itself and greater blame / disappointment with limitations of the information technology infrastructure at the university generally, and in their faculty area specifically. This was evident even in the early days of the project. Though the students overcame and forgave some of the limitations (such as poor battery life) other issues such as the inability to access the university's online learning system were not forgiven.

One can theorize from this data that students will discard any ICTs that do not make their learning more engaging and more efficient. The students saw little benefit for such a device to be used on an engineering site; they took photos and movies with their mobile phones and used paper for quick notes/sketches later going back to their desktop or laptop computers to finish complete the work. This left the PDA to be either a game device or an organizing tool. Few opted to use it for the latter purpose. In terms of explicit social ICTs, they had their mobile phones, their iPods or MP3 players and either their laptop or desktop computers (for instant messaging) so another device seemed to be superfluous. When asked to define their basic needs versus their 'dream' needs in terms of ICTs this response summarises the group's sentiments: *'The basic needs of an engineering student are a PC with the latest version of Office, printer, and internet connection and a USB thumb drive – plus a mobile phone; the 'dream would be to have a good laptop!'* They all said that if only they had better access to wireless on campus – then they could see the benefit of this accessory – and that is what the PDA was to them; an accessory to their essential 'digital backpacks'.

A PDA and the learning process

This paper sought to emulate Cobcroft et al. (2006) who in their review of mobile learning research papers, aimed to 'synthesise the literature to identify a realistic vision for the application and implementation of embedded m-learning technologies as they become available'. So too, this paper aims to reveal, via the analysis of this small project, a pragmatic vision for the enhancement of teaching and learning that incorporates the model of learning as a mobile experience but that does not necessarily imply that it should

include a specified device. The limitations experienced in this project do not mean the failure of mobile learning to augment the tertiary learning experience at this university but rather this supports Cobcroft et al. (2006) who show that there is a need 'for a formative framework that progresses past the individual case study to a consolidated approach'. The findings in this project have led to the following reflections on student engagement in learning:

Learning is pervasive and constructed

Learning is commonly, and simply, deconstructed to occur at a deep level or at a surface level (Biggs 1987) and in higher education it is expected that we enable as much deep learning to take place as possible. Having to negotiate learning experiences with a mobile device, and even in their navigation of the device itself, encouraged the students to engage in deep learning and thus the PDA, in this context, can be judged to be a suitable accessory for university education.

The constructivist theory of learning maintains that people learn through giving meaning to their experiences by building on their past experiences and by creating new knowledge through compiling bits of information in an individual way; that is, a learner constructs knowledge for themselves. Mobile learning complements this learning theory.

Learning as a mobile activity

Mobile digital devices, such as PDA's, give students the choice to learn away from the desk. 'For the era of mobile technology, we may come to conceive of education as conversation in context, enabled by continual interaction through and with personal and mobile technology' (Sharples, Taylor & Vavoula, 2005). People had always learned 'on the move' but current researchers (for example, Frand (2000), Caruso (2004), Sharples, Taylor & Vavoula, (2005) have identified that students are now intrinsically mobile in their learning and that this calls for different ways to theorise learning. As mobile learners, net-generation students embrace and exploit gadgets that enable this learning.

The issue to consider is whether the university's ICT infrastructure will enable the easy – and quality – wireless connection of these mobile devices. Interviews with students who had PDAs in 2005 revealed that it was the lack of easy access to and poor quality of the wireless connections that restricted their use of the device. They all said that they would have used the device more if they could have accessed the Internet more easily. *'This whole wireless issue has reminded me why I put a 16 port WIRED network in my home. It's wonderful that these Pocket PC's can do so much but without wireless internet they lose most of there functionality. I've had to put mine down and take some deep breaths because it's getting a little frustrating. I'm basically experiencing the same issues as P.[I] hope that M is right and the problem will be corrected soon. I'm trying hard to not complain because this [iPAQ] is Free'*. In addition, supporting synchronous and especially asynchronous e-learning formats gives students more choice in how they learn and it also supports the concept that learning is a lifelong process (Singh, 2003). It does not just happen at any one time and it allows students to self pace their learning as they have instant 'start up' on the PDA whenever they wish.

Learning through engagement

When asking questions about engagement one must consider whether the students were integrating the devices into the process of their learning. Simply, were the students accessing anything via their devices that enhanced their learning experiences? Were the devices themselves providing engagement? Did they enable interaction with self, others or the environment and did they support dialectic between the student and these entities?

The PDAs provide the students with learning experiences at two distinct levels: 1. The students were challenged to learn about the device itself and see how and when to use it so they could be more engaged in their lifelong learning – not just in their classroom learning, and 2. The students were challenged to use what they had learnt using the device as a mediator with their world. Could this device reveal or translate information for them in a different way to that provided via other tools or devices?

The researchers support the notion that teachers must be creative and challenge the learning styles and mores of their students. Teachers are challenged to create engaging learning environments and this should not involve adapting to the available technology but vice versa (Hoppe et. al 2003). So even though PDA ownership is small, if teachers are aware of their potential as learning tools, they can suggest, instruct and model good practice – and, as has already been suggested by these researchers, 'use students' mobile devices and social software applications, and challenge them to go beyond their use purely for social ends,

and use them to be participative constructors of knowledge in engaging learning experiences' (Oliver & Goerke 2007).

Learning though disengagement

If convenience, connection and control are claimed to be the factors driving the Net Generation's take-up of information and communication technologies (Caruso, 2004), then this explains why the participants gave up on their PDAs which became inconvenient: *'We [three students] tried to use it in lectures for recording things but it didn't work well. It was good for recording five minute bits but it's not good like a MP3 player that I use for recording lectures'*; disconnected: *'I finally got the wireless internet working at a friend's house. It is very slow and probably not really worth the effort,'* and over which they had poor control: *'The stylus annoys me because it always needs to be taken out. I wish I could use my hand to touch the screen without ruining it,'* and another response, *'the handwriting recognition doesn't work well – you have to revert to the [screen] keyboard every time. The best way of using it I think is to use that fold-out keyboard. I don't yet have one but I want one'.* Another aspect of 'control is 'creativity' as it was evident that these members of the net generation wanted to use tools that allowed them to generate their own unique version of information – and even of identity – but the device proved to be limited here also: *'I did take it with me [on site] but it wasn't useful. It was much easier to use conventional paper'.* The final disengaging factor was that the cost was prohibitive. Though these devices were given to them for a trial, the students saw the PDA as nonessential items: *'that's another thing: everything is too expensive for it. It's like having another computer. It's the same worry as having another laptop and losing it!'*

Learning to blog – or not to blog

The PDA project was used as a reason to introduce web-logging or blogging into the participants' course. The aim was to provide the opportunity for the research participants in Perth and those in Miri (Malaysia) to create and maintain a group blog where they could exchange thoughts about their experience in the project and communicate in whatever way they wished, and, as is the nature of blogging, invite responses from anyone in the blogosphere. Most significantly, the aim was that the HP students could engage in mobile blogging – connecting and engaging with each other and the web whenever and wherever they wanted to. This desire to connect the project participants, was the impetus to extend the requirement to blog (via group blogging) to all the students in first year engineering by making blogging an assessment requirement in the communication skills unit they were all enrolled in.

The 2005 survey findings in this project had found that 70.2% had never engaged in blogging and this was similar to Kennedy et al. (2006) who found that 65.5% had never blogged. Even the follow-up survey of the new incoming students in 2007 failed to show a significant increase in blogging with only 29.8% of students stating that they had ever read or posted to a blog. Coupled with these findings was the fact that the wireless infrastructure failed to enable easy Internet connection so none of the participants attempted mobile blogging. The aims of the project to enable students to connect with their peers in another country via their mobile devices failed. These difficulties in achieving and maintaining any wireless internet access led to students using their laptops and desktops to connect with each other. However, even this was contrived and had no reason to exist apart from the assessment requirements. This overall reaction against blogging will be explored in a later paper.

Learning with, and in spite of, technical limitations

The already mentioned failure of the campus wireless network was unforeseen as was the fact that WebCT, this university's student learning system, could not be accessed via the mobile device. All of the students' units had components of their course in this system and students were required to access it very regularly. Such things as lecture notes, recorded lectures or discussion boards could not be used on the PDA and this was seen as a deficiency by the research group. The other issues (such as small screen and synchronisation issues) that relate to the limitations of mobile devices were named at various times by the participants but none of these alone were insurmountable.

However, the effectiveness of an mLearning experience is inextricably linked to the infrastructure into which it is introduced. Not only must the students, teachers and curriculum be ready to hold the technology, but without the essential technical support – in this case, a working wireless network and someone always on call to answer any question any time – the students chose the easiest option which was to leave the PDA in its cradle. Technical ICT support that is easily accessed and readily available must be provided to both teaching staff and students who are expected to use ICTs. The development of student and staff technoliteracy is essential in any successful collaborative learning using ICTs (Kimber, Pillay & Richards, 2007). For if the

students are enabled and supported in how they use ICTs in an educative environment, it is not only they who will develop their technoliteracy, but so, inevitably, will their teachers.

RESEARCH LIMITATIONS

The comparative empirical data was gathered from a small sample of students from a single discipline – engineering – therefore this constrains the generalizability of the findings. Another limitation of this study is that it only assessed the ICT behaviour of new university students over approximately 12 months. It would be helpful to conduct a longitudinal study to evaluate whether these same students change their ICT habits over the course of their whole degree and whether their behaviour can be linked to this early exposure to the PDAs. Even accounting for these limitations, students participating in this project provided valuable insights into current tertiary student digital behaviour.

CONCLUSIONS

It can be surmised that, for these students, the device was judged to be an accessory and not an essential – or even highly desirable – component of their ‘digital backpack’. Labelling the PDA as an accessory is not in itself a comment about its deficiencies. As was noted by Jones et al. (2006) the ‘coolness’ of a mobile device is a motivating factor for using it. Young people like to accessorise. Jones et al. also noted more generally that ‘affective factors play a strong role (both positive and negative) in harnessing technology for learning’. These attitudes were evident in the interview responses – and in the interactions observed between the participants at the group meetings; from observing the nods and other indications of initial consensus among the students that a ‘new toy’ is fun, to comments from some group members that they would be changing how they used the device based on ideas and feedback from others in the group.

Student participants were grateful for the chance to have and explore a device none of them had ever owned before. However, after their initial enthusiasm, the participants appeared to minimise the potential of the device because of the various technical inconveniences that thwarted their efforts. These devices could be labelled as ‘first generation’ PDAs and thus the problems were to be expected. Changes in the students’ interactions over the time of the project could not be directly linked to the device, but as one student said *‘I got to know more people and learn more stuff about blogging.’* This project’s findings concur with those of Jones et al. (2004) who found that PDAs were used primarily as ‘personal technology’ rather than as ‘educational technology’ and in this environment, the difference between the two spheres was confirmed in the student behaviour.

Finally, the efficacy of a PDA in such an unstructured learning environment is highly dependent on the motivations of the individual student. Unless there is support and explicit modelling of how to use the PDA, it will remain a nonessential device. Though this project group was unable to arrive at the ‘tipping point’ referred to by Cobcroft et al. (2006) where a clear decision had to be made as to whether to encourage and invest in mobile technology (specifically here, for engineering students at Curtin), it can be concluded that further exploration of mobile devices within this discipline area with full support from the university, should be encouraged. Mobile devices that initially, to the digital immigrant, may seem more like a social or organisational tool can also clearly be helpful learning tools, adding significant value to the educative experience of our students.

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