Handheld Computers (PDAs) in Schools

Becta
ICT Research

Contents

This pilot project is beginning to identify real value in the use of small, handheld computing devices for both teachers and pupils in English schools. This report, compiled for the Education Show in March 2003, sets out some insights into the progress made so far, and identifies potential avenues for further investigation and ways in which to ensure that these are worthwhile.

The most positive indicator at this stage shows that PDAs (see box for terminology) have considerable potential for making leadership teams' and teachers' management and presentation of information more efficient, but there are some conditions necessary for this to be successful. The potential of PDAs to help either teachers in their teaching or pupils with their learning is less clear, but some very positive examples are emerging. Both teachers and pupils clearly increase their general capability with ICT, particularly through personal 'ownership' of their device. However, further work is needed to identify the most effective ways of using the devices in the educational context, and to identify suitable specialist applications and develop them for use in English schools.

The characteristics of the PDAs that met universal approval included:

- small size – always with you

- instant-on (no waiting for an operating system to 'boot up')

- much longer battery life than laptops

- the quantity of data they could hold

- the 'up-to-dateness' (currency) of the data

- the ease of synchronisation and sharing of data by infrared 'beaming'

- the price advantage over laptops.

A significant question is whether it is appropriate to provide PDAs instead of computers (desk- or laptop) to either teachers or pupils as their main ICT device, or whether PDAs are only suitable as an adjunct to a fully functional computer. It seems reasonable to consider supplying both to senior management teams who have a greater need for whole-school and up-to-the-minute data and who are desk-based for more of their time, as well as being smaller in numbers – the cost being less overall therefore. To supply all teachers with a PDA might involve significantly lower costs than the provision of laptops but questions remain over the range of necessary functions that teachers can achieve with a PDA.

Handheld computers (PDAs) could bring important benefits to schools by assisting administration, supporting classroom management, and enabling personal and group learning.

At their current state of development, responders suggested the following possible weaknesses:

- small screens

- not rugged enough for school use

- lack of print-out capability (not applicable if networked)

- the time it takes to input data (especially free text)

- the necessity to charge batteries every night (cradles are a must)

- costs of software and accessories

- unstable data storage (but only if the battery is allowed to go flat) leading to lost work.

For pupils, prices of PDAs at the bottom end of the market – with the most limited functionality – are now strikingly low. Retail prices start at around £75 while laptops start at around £600. Questions must focus, therefore, on the cost-effectiveness of devices in relation to the range of uses they offer. Supplying both a PDA and a laptop to pupils is unrealistic except where one is for personal 'ownership' and the other is supplied for specific uses that the owned device cannot support.

However, the value for money, portability and other advantages for pupils using these devices mean that some schools and LEAs are now seriously considering equipping all pupils with them.

This report identifies a series of issues to be addressed to ensure that the greatest possible value is obtained from PDAs where they are appropriate. These include the training and guidance necessary for users, advice on managing PDAs in the school environment, and encouragement to schools to be brave and explore the limits of their potential. Of special note is the fact that nobody has answers to all the questions raised – the only way forward is collaborative development involving partners from within and outside education. In particular, more exploration of potential needs to be carried out to determine the effectiveness to set against costs.

An indication of the potential value for supporting teachers comes from an experienced user:

"I use my PDA regularly… It has become my first, best reference tool, especially with sixth form classes. On one occasion, when discussing the physical properties of elements in the periodic table, I reached for my Palm to find it… missing. I'd left home in such a hurry that I had left it in its cradle. I felt as if I'd lost a limb. With it, I could press three links and have the information in my hand for the class. Without it, it would mean checking through a book and photocopying particular page references – wasting both time and resources. While I fully realise the PDA will never have the range of functions of a laptop or desktop computer, I would never willingly go without one now; it is my instantly accessible encyclopaedia, thesaurus, periodic table, diary, register/mark book, world map and even star chart!"

Mike Rutherford
Durham Johnston School

A Note on the Terminology in 2003

A few years ago the terminology relating to hardware in this area was clear.

A PDA was a personal digital assistant and the only product came from a company called Palm. Known as a Palm Pilot, its main function was as a replacement for the personal organiser such as a 'Filofax' with calendar, address book and other simple data storage applications such as a note pad – which became known as a 'personal information manager' (PIM). They were used one-handed and were small enough to hold in the palm of your hand, so were generically called **palmtops**. Many other manufacturers went on to produce their own versions.

Microsoft at that time produced a cut-down version of Windows known as Windows CE, one version of which ran on miniature laptop-style computers. These had screens about 20cm wide but only about 8cm high with a built-in keyboard – two-handed computers, therefore, and too big for the average pocket or palm but called **handhelds** nonetheless. These ran the handheld CE version of Windows which included cut-down versions of Word, Excel, Access and PowerPoint, as well as a PIM similar to the Palms.

Similar, smaller devices came from the British manufacturer Psion whose Series 3 and 5 were very popular with English teachers.

Since then a version of Windows CE has metamorphosed to be called **PocketPC** and devices have appeared using this system. Some call these generically **pocket PCs**, others call them **handhelds** as that term is more accurate when applied to these rather than the previous versions. One thing is certain – they are miniature computers which rival full-sized laptops in their power and in the range of applications and uses that they offer.

Now we also have, going up in size, sub-laptops, ultra-portables, laptops, and tablet PCs, each of which has its advantages and disadvantages. Also, the smallest – the Palms and pocket PCs – are now merging with mobile phone technology either as phones with PDA facilities or PDAs with phone applications.

The terminology, and the choice for buyers and users, cannot be expected to get any simpler!

Becta has previously referred mostly to 'handheld computers', which it has defined as:

Any small device that provides computing and information storage and retrieval and that can be easily carried and used… often such devices are referred to as personal digital assistants (PDAs).

Becta information sheet, July 2001

As the focus of this project has been tighter than this, the term PDA is used throughout.

The DfES/Becta PDA Project

This is the first detailed report from a project evaluating the use of PDAs in schools which Becta is managing for the DfES. The aim of the project is to evaluate initial issues in the use of PDA-type devices in schools both for managing workload and for supporting teaching and learning. An interim summary report was prepared in December 2002 and distributed at the BETT exhibition in January 2003 – this report builds on the experience so far.

There have been two phases to the project. In the first phase, which began in April 2002, leadership teams in a mixture of 27 schools were equipped with Compaq iPAQs using PocketPC and asked to keep a monthly log of their use. The schools were chosen from those whose headteachers had participated in the pilot of the course, 'The Strategic Leadership of ICT' jointly organised by Becta, NCSL and NAACE. There were 16 primary schools, seven secondaries, two infant, one special and one middle school in this initial phase. Each of these schools was equipped with a set of accessories including detachable keyboards, PC jackets and 'presenter-to-go' attachments for connecting to data projectors.

In the second phase, a further two secondary and two primary schools were selected and equipped with a class set and accessories, with the majority of the teachers being given their own PDA. One secondary and one primary school were given Palm m130s using PalmOS and the other secondary and primary were given iPAQs. These schools were chosen because of existing ICT expertise or involvement with PDAs. Accessories given to these schools included detachable keyboards, 'thumb' keyboards, global positioning system (GPS) devices, datalogging devices, Wi-Fi and Bluetooth wireless network cards, and data projection attachments.

Altogether, more than 150 teachers are using these technologies and there are about 100 devices available to students.

Unfortunately, it was not possible to co-ordinate the equipping of schools and the provision of training. So far, schools have been given literature but nothing else apart from what they have been able to organise themselves. Training for the teachers focused on both strands of the project and has been taking place since January 2003.

Research activities were carried out on Becta's behalf by Questions Answered of York. This comprised: desk research to identify other relevant initiatives; an analysis of the project participants' work logs; a telephone survey of PDA users in companies, government and various strands of education; a second telephone survey of Becta project schools; and finally, interviews in selected project schools.

The twin focuses of the project

Schools were asked to focus on one or both of two categories of PDA use:

- managing teachers' workloads
- supporting teaching and learning.

Clearly, 'teachers' workloads' includes much that is closely related to teaching and learning. However, the second focus offers considerably more challenge to the PDA type of device, with their small screens and limited applications when compared to a full-sized laptop or desktop computer. And the inherent demands go well beyond the personal information manager tasks that were originally envisaged as the purpose of PDAs.

It has become immediately clear that the simplest PDA has a great deal to offer, in so far as teachers' needs are similar to those of the business community that PDAs were originally created for. Headteachers and others in senior management teams have generally responded enthusiastically to being provided with a PDA.

By contrast, classroom teachers have revealed more mixed responses, partly for the reason alluded to above but also because the recall of information, and how current it is, is of less concern to them. However, many have extracted good value from their PDAs and are enthusiastic about their further potential (see Appendix A). None have yet exploited anything like the potential that has been identified by visionaries with considerable experience of the technology.

There is much to be done to investigate PDAs further, both when used by teachers and by pupils. Becta's project has included teachers with equivocal attitudes to ICT, to innovation *per se* and the difficulties they find in getting to grips with new facilities. To that extent, it is realistic.

Ultimately, as with any new technology, it will be important to study the extent to which managers, teachers and pupils change their work habits and mind-sets as a result of the technology, but this will take a far more extended commitment and time period using the technology than achieved so far.

Characteristics of the PDAs that met universal approval included:

- small size – always with you
- instant-on (no waiting for an operating system to 'boot up')
- much longer battery life than laptops (especially the Palms)
- the quantity of data they could hold
- the 'up-to-dateness' (currency) of the data
- the ease of synchronisation by infrared ('beaming')
- the price advantage over laptops (especially the Palms).

Widespread dislike was expressed for:

- small screens
- unstable storage leading to lost data (from flat batteries)
- the need for new routines to manage the devices effectively.

Other concerns included:

- whether the PDAs were rugged enough for school use
- the complexity of synchronisation with lap- or desktop machines – at home or networked at school
- the need for more comprehensive training
- the need for technical support
- difficulties with printing.

Managing teachers' work

It is helpful to consider this major subsection of the project in two parts: the work of senior management teams (SMTs); and the professional administrative work of classroom teachers. Their lives differ. SMT members spend more time at their desks and are responsible for school management data of varying sorts (including up-to-the-minute pupil attendance) and for the whole school community.

It has become immediately clear that the simplest PDA has a great deal to offer.

Classroom teachers, by contrast, work largely on their feet and are concerned mostly with just those pupils they teach, but they also have to contribute to, and draw on, central school data from time to time. Examples include looking back at past marks and other records, and reporting attendance, marks and comments on individual pupils.

The [head] stated that he used his PDA on a daily basis for writing documents, speeches and taking meeting notes. He has a keyboard but prefers to use the stylus instead. Additionally, he keeps a list of staff and students on a spreadsheet, which contains contact names and numbers.

In terms of classroom use, [he] explained that he beams examples of good essays and notes for lessons to the students. He can also ask them to make notes on something and beam them to each other, or beam essays to each other.

When asked about the positive aspects of using the equipment, the respondent stated that the PDAs made him more organised:

"I co-ordinate my diary between my personal assistant and myself – I have no paper diary anymore. I have all my tasks on the PDA, they are all under control. I can manage tasks better and can give tasks to staff."

Russell Moon
Philip Morant School

For SMT members to be equipped with both a PDA and a lap- or desktop computer is realistic. This is how PDAs were designed to be used, that is with a heavy reliance on synchronising ('synching' or 'syncing') information created on either device with the other.

So, a deputy head's notes on the condition of the school buildings might be updated on her PDA when out around the school and transferred to the desktop on return to her office. She is responsible for the information and processes it herself, before perhaps passing it on.

Thus far, some class teachers, provided with a PDA and with access to networked desktop computers in their school or with a laptop, have reported some problems in synching. However, this may be because of the software they were using or a simple lack of know-how.

Benefits for headteachers and senior managers

These users approximate most closely to those for whom these devices were originally designed. They have a desk as their base with a networked computer, desk- or laptop, as their main information access device. They move around the school and beyond, attend and have regularly to prepare for more meetings, and are concerned to have access to, and use, information about the school as a whole. They are responsible for inputting information while mobile, usually in freeform note format rather than routine information such as who is present or absent. Many have personal assistants or secretaries who are involved in these aspects of their work. And they are also teachers, so are involved in all the responsibilities of other class teachers. They are, therefore, given the nature of their work, likely to both make more use of a PDA and to use it for a wider range of functions. Some might also argue that they have a greater responsibility to be receptive to the potential benefits of new technologies.

"I am currently using the PDA on a daily basis in conjunction with my laptop.

"All Outlook data is synchronised so that all my timetable data is available to me throughout the day. Pertinent information about cover and meetings can be added to the PDA, then synchronised on return to the laptop… Synchronisation of emails has proven to be of some use in meetings… written notes… notes attached to an appointment… I carried student contact details on the PDA on a school trip… [and make] PowerPoint presentations through the PDA."

Keith Buncle
Assistant Headteacher,
South Bromsgrove High School

In so far as these people have a wider range of potential uses for PDAs, they can be expected to commit more fully to their use and cross the basic competence threshold sooner. It is worth their while to invest time in achieving competence as the pay-back will come sooner.

One headteacher pointed up how inefficient self-training can be, identifying one key to successful use:

"…good training which introduced me/staff to both hardware and software. (I was spending too much time teaching myself from inadequate instructions to get the best from the PDAs.)"

Roger Fell
Headteacher, St Nicolas' School

A number of senior managers in schools mentioned the importance of the information they used being up to date, and also that it should be precisely the same as that which their colleagues were using. In both these respects, information technology has enormous value. PDAs, given their small size and portability, can be carried all the time and, therefore, present information anytime/anywhere as the quotations from senior managers here show.

PDAs, given their small size and portability, can be carried all the time and, therefore, present information anytime/anywhere…

As well as this, two forms of synchronisation offer the currency and conformity of data that is needed: infrared 'beaming' for person-to-person synchronisation or swapping of files; and docking (usually in a purpose-made cradle) to synchronise with the user's main computer. (Wireless communication person-to-person or to a computer via Bluetooth and synchronisation with a network via Wi-Fi is possible, but neither of these methods has been evaluated on this project.) This, of course, can happen in either direction so that data updated while away from the user's desk is transferred to his or her main machine on return, or data held on the school's network can be downloaded to the PDA via the computer for use elsewhere. Users praised the efficiency of the PDAs in ensuring that such simple things as contact lists, diaries and meeting arrangements were kept up to date and fully in

synchronisation across a management team or even the school's whole staff, and the fact that these functions were instantly available.

"[I like] the portability and quick start-up time. It holds charge for a long time under intensive use. I think they are quite robust and have no problems with the size."

Richard Bloodworth
Durham Johnston School

Truancy control is one concern that can benefit from rapid accrual and reporting of data and from being available to key players such as senior managers on the move. Two schools in the Becta scheme have latterly tried some purpose-designed software [http://www.schooltechnologies.co.uk] that enables teachers to record attendance in the first minutes of a lesson and have this in the hands of the head as he or she sets off around the school 10 minutes after the lesson has begun. Any child met around the school, or off the premises, can then be checked immediately. They are registered as in a lesson or shown as having checked in through reception or they are marked as absent. The action taken in response can be appropriate to the realities of the situation with little need for equivocation, thanks to the accuracy and currency of the data. Another senior manager reported this benefit as a prime motivation for his school's move to PDAs, and as preferable to the school's present swipe-card system:

"…we have replaced our ageing swipe-card registration system, which staff had begun to feel disillusioned with, as active ownership for the registration was no longer focused on the classroom teacher but lay in the hands of students and in some circumstances was prone to abuse."

Nigel Pressnell
The Arnewood School

In this instance registration is undertaken using PocketPC PDAs and an off-the-shelf application that required no modification to suit the local environment and which compiles to a dedicated database [http://www.tascsoftware.com/parsql.htm]. This is found to be of particular value later in an academic year when numerous changes to the original class lists have built up. Also, analysis tools can alert staff to patterns of non-attendance and lateness that might otherwise be missed.

Access to the full resources of a school's network from anywhere on the site can be available on a PDA if it includes wireless networking capability (a wireless LAN to 802.11x standards). Some now have this built in, while other PDAs can have this function added through a slot-in card.

One application that there was little evidence of was email. Technologically, it is possible to use the PDAs to enter email at any time, then for this to be automatically sent on synchronisation with the user's main computer or immediately over a wireless network. At the same time, unread mail comes down to the PDA and can be read when anywhere.

Users praised the efficiency of the PDAs in ensuring that such simple things as contact lists, diaries and meeting arrangements were kept up to date and fully in synchronisation across a management team or even the school's whole staff, and the fact that these functions were instantly available.

PDAs with mobile telephone functions, either built in or added through a slot-in card, can send and receive email anytime, anywhere – though this can lead to organisational problems in archiving mail exchanges, unless the user's system is set up carefully and the right habits formed. A school moving to the comprehensive use of email for internal and external communication could find this a boon.

In every circumstance in which electronic means can replace established systems, there are some who find reasons not to adopt a technology. Only time and further experience can tell whether the reasons for resistance are justified or based on an unjustified reaction against change. However, at least one school, having made major progress with laptop computers, expressed a preference for these and paper systems over their PDAs:

"[We use our laptops with] Word, PowerPoint and Excel as teaching and learning tools which we prepare at home or use in the classroom with the children.

Despite this comment, the headteachers and senior managers who were consulted generally had got some value from their PDAs, and recognised that they could extract more once they developed more familiarity and overcame some of the early technical problems. Little doubt remains that schools' senior managers can gain great efficiency benefits from the use of PDAs but whether this would result in a significant reduction in their workloads or simply 'free' them to attend to other matters is unproven. Either way, it could be argued that efficient approaches to the tasks that benefit from PDAs will allow these people to devote time to more important matters.

Benefits for classroom teachers – Managing their work

Classroom teachers, while more subject to the controls of the daily timetable, and spending more of their time in front of classes, still have information handling needs (accessing data and generating it) similar to senior managers. All teachers, for example, share responsibility for which pupils are where and ensuring that the least reliable are where they should be. Accurate lists of classes serve these needs; rich information sets tell them more than simple names, drawing their attention to special needs and considerations for individuals.

In the classroom, all teachers need basic information sets. At the very least this includes class lists with associated assessment records (as per the traditional 'markbook'), and with an ever more mobile population these can be subject to frequent changes and need to come from, or be passed to, central administrative systems. As schools have increased their use of information management systems, this data needs to be in a digital form compatible with the central system and so is most efficiently handled exclusively in digital form on a device that is carried wherever they go. And digitised information includes such things as report comments, not just numerical information.

The current trend is for data no longer to be the preserve of administrators on a separate network but to be dynamic and to permeate the work of the school. Teachers who are well informed about changing patterns of marks given to their pupils by themselves or other teachers can respond much more flexibly to what is revealed. Assessment records are then transformed from being static repositories into guidance for teachers in planning and especially differentiating their planning for different students' needs. However, this requires the information and analyses (or analysis tools) to be readily available to all staff, teachers and non-teaching assistants, and PDAs can be the prime route for this, accessing data when in school and storing it to be worked with when, for example, preparing lessons at home. In this way, among others, teaching and managing responsibilities merge.

At least one school, having made major progress with laptop computers, expressed a preference for these and paper systems over their PDAs.

Teachers also work collaboratively with colleagues: for example, departments plan together in secondary schools and primary school teachers act as, or at least share planning with, subject co-ordinators. Ofsted evidence frequently refers to the coincidence between schools that work as teams and good schools. The question arises, therefore, over the extent to which PDA provision might help teachers collaborate. Almost all PDAs include infrared communication facilities, as do many laptops and some peripherals such as printers. This means of communication for computers is strictly limited to 'line of sight' over a short distance. Despite these limitations, 'beaming' – as respondents almost unanimously refer to it – is a popular feature mentioned frequently as one of the most used 'applications'. While it does not do anything that cannot equally well be done over a school's network (usually through the use of a shared area on a network drive), in common with other aspects of PDAs, their portability means teachers carry them wherever they are, and their informality makes impromptu sharing between individuals, say within the progress of a meeting, very easy.

In 63% of responses from users in and outside of education, Becta researchers report that the PDA has replaced paper. Some 32% say they now perform tasks with the PDA that they simply did not do before. This suggests that for senior managers, a PDA will reduce the time they spend working through making them more efficient. However, we might find that they simply extend the range of tasks that they do.

In the survey, project respondents noted that teachers use PDAs most for similar organisational tasks as undertaken by senior managers – to take notes (69%) and as a diary (63%). These findings are matched in their work logs, where most teachers use the devices exclusively as organisational tools rather than in direct support of, or for, their teaching.

Teaching and learning

Benefits for classroom teachers – Teaching and learning

Mike Rutherford at Durham Johnston School, an experienced PDA user, had after a short time with his Becta-supplied model developed a strong preference for using his PDA for his professional organisation. Unsurprisingly therefore, his PDA has become his main organisational tool. He uses it to:

- download his lesson notes written on his home computer, transferring them to his PDA for easy reference in school

- store activities and background notes for his classes, beaming them with infrared to the front row of a class, who then use the same method to pass them back (using *'Documents to Go'*)

- store web pages downloaded from his home computer for school use.

He had also downloaded and purchased a program (TeachFile[1]) over the web and prepared templates which he was willing to share with other PDA-user staff, though most had not reached a level of competence to take up this offer. Essentially, this teacher was providing his own main computer at home and using his Palm PDA in conjunction with it to provide in-school access to digital material.

> *"The PDA opens up more opportunities for ICT to be placed at the heart of teaching and learning, instead of being an experience many students find devoid of*

[1] [http://www.eddiesoft.com/eddiesoft/products/TeachFile/TeachFileDesc.html].

context and real applications. Too often ICT is taught in a specialist room. The learning environment changes, teachers often find themselves in an alien room with technology they use infrequently. We want ICT in the classroom supporting the subject being taught and available to grab those learning opportunities as and when they arise. The PDA (like a wireless laptop) is then used in context with the lesson. It changes the culture and approach to ICT that we see on a daily basis."

Ron Hinshaw
Hermitage School

"Class use includes beaming test results to the pupils and pupils beaming work to the teacher. This enables the teachers to mark work, monitor the quality and send back results very quickly. Other types of use by pupils includes beaming and receiving information between themselves, recording tasks, note-taking, writing documents and voice recording."

Stow Heath Junior School

The use of a PDA as a data store means that teachers can have at their fingertips the equivalent of a huge encyclopaedia. This might include material downloaded from the web on a prior occasion or live use through a wireless link. Children seeing their teachers using a PDA as a first port of call knowledge bank will be offered a powerful role model.

Their portability means teachers carry them wherever they are, and their informality makes impromptu sharing between individuals, say within the progress of a meeting, very easy.

Teachers' competence and capabilities

Generally, in-classroom PDA use by teachers is revealed as the aspect that needs the most development, as the potential is great, but respondents had made the least progress in this area of use. In part this was due to lack of time, a lack of technical ability and familiarity with the devices, and also a lack of clear vision about what their potential might be. While there is little software that has been developed specifically for English schools, a great

many education-purposed applications exist (mostly from the USA and Australia) which offer potential. Some of this is 'freeware' or 'shareware' that can be downloaded over the web for little or no payment. However, to do this needs new skills as loading and configuring PDAs is different than under the familiar Windows operating system, whether using PalmOS or PocketPC. Higher levels of 'generic' ICT competence in staff undoubtedly transfer into the PDA context, however (see Appendix A).

"In the classroom, [I] use the PDA to transfer HTML script to students by beaming the data."

Philip Morant School

For PDA use in schools to move forward significantly, the identification and implementation of existing applications and the development of new ones will need to be led by technically competent people in collaboration with teachers. Information on current applications should be made available to all user institutions in conjunction with advice and support to get the most out of software for educational purposes.

Enhancing teaching

Some nice examples of inventive uses came from East Herrington Junior School where they used their PDAs while marking books to write reminder notes to refer to when returning books to pupils and found ways to take computing beyond the classroom:

"We went into the school garden with the PDAs and made notes on the colours, sounds and sights of autumn. As we only have 16 computers in our IT room, half of the class then used them to write out their poems with clip art for a class book. The other half typed them into the PDAs and will transfer them to the laptop, adding clip art and print them off. This will be quicker than waiting a week for our next lesson in the IT room.

"I do like the idea of using satellite navigation to find buried treasure as suggested on one [web]site. Maybe I could bury some in our local park!"

Arnewood School decided to provide their PE department with PDAs as they do not teach in classrooms, whereas all other teaching rooms were being provided with a minimum of one computer through which staff could access network resources.

These also became a pupil resource when they were used by PE pupils to monitor body fat at Key Stage 4 and AS-level. They used freeware downloaded through the internet, though they have become aware that more sophisticated packages are available at a price. Their choice of PDA to purchase (they were operating outside the Becta scheme) was influenced by the brightness and, therefore, visibility of the screens when used by PE teachers outdoors as well as wireless networking capability.

Philip Morant School report that they are using their PDAs for a current A-level design project, so they are in use in design and technology five days a week.

The use of a PDA as a data store means that teachers can have at their fingertips the equivalent of a huge encyclopaedia. This might include material downloaded from the web on a prior occasion or live use through a wireless link.

'Real tasks' such as these, be they activities for pupils or time-savers for teachers, are an important area for future development.

However, research among the Becta-funded PDA users showed that there were few users with this level of competence. Unsurprisingly, the amount of time each user had to explore the PDA had a direct impact on the amount of usage and commitment to PDAs. Many low frequency users quoted a lack of training as the main reason for lack of progress.

Adequate levels of competence will not be attained unless users push themselves through the familiarity threshold and providing them with support in doing so is vital for many. However, it also requires that a sensible basic pattern of use is established. In some schools it emerged that different teachers had used the PDAs on a month-by-month basis which is unlikely to take them to sustained use.

Importantly, higher levels of confidence and competence among teachers could lead to better decisions on differentiation of provision for children.

"We know that students have individual learning styles and that many can use ICT effectively to address learning barriers. We plan to target:

- *those boys with low reading ages – there is a wide range of 'ebooks' available on the PDA*

- *those with poor organisation skills*

- *poor attendees*

- *'early adopters' of ICT*

- *those identified as 'gifted and talented'."*

Ron Hinshaw
Hermitage School

Benefits for pupils

Ubiquitous computing?

By ubiquitous computing, we mean 'wherever, whatever, ownership' – carrying a personal computing device with you and using it as a personal, dedicated resource without restrictions. Whether opportunities such as PDA provision could or should be offered to all children or only selected ones is of course an issue, especially when cost factors are counted. As an interim measure, there are many different grounds for selecting which children should be provided with a PDA, as suggested by Hermitage School's targeting shown here. Many believe that ubiquitous computing should be the ultimate goal and that PDAs provide the only realistic opportunity to attain this.

Personal ownership – by which we mean exclusive, full-time use – of any computing device pays dividends in the time required for, and extent of, the competence that users attain. Evidence for this significantly affecting students comes from a number of sources[2]. The DfES 'Computers for Teachers' scheme[3] also reported that teachers having personal computers impacted on their pupils' ICT development. Many less tangible benefits accrue which simply cannot otherwise be attained. These include a sense of belonging with the device, of personal commitment and comfort, as well as very tangible abilities in, for example, file management, computer synchronisation, web connection and downloading, exploring audio/video, and linking to home provision (computer synching, TV and VCR control, etc). Only by becoming engaged with the computer does the user go beyond the necessary

and play with it to explore its potential. Sharing ownership, even on minimal occasions, can confound all this. Furthermore, no one will commit themselves to keeping their personal data on a device unless a number of factors are in place including privacy, reliability and access. They must know they will be able to retrieve their work whenever wanted – and some of this reliability depends on their own competence and familiarity. Every computer develops quirks of its own and every competent user finds 'work-arounds' that avoid repeatedly wasting time and personalise their experience. Also, nothing is so unsettling, especially to the beginner, than entering a screen environment when what usually happens is changed.

Many believe that ubiquitous computing should be the ultimate goal and that PDAs provide the only realistic opportunity to attain this.

All this requires 'ownership'. And this is equally true for pupils.

…50% of pupils in the survey are able to take devices home. There has been little or no loss, theft or damage to devices, beyond scratches and fascias coming off, as revealed in case studies.

PDAs could offer great benefits to the disadvantaged finding themselves living on the wrong side of the so-called 'digital divide'. This is the cheapest way for a school to provide pupils with a computing device which can be taken home and through which they can connect to the internet. The portability of a PDA offers particular advantages to some of these pupils without regular homes to go to, or who are 'parked' at granny's after school, or who live in a care home or caravan.

A further benefit of the small size of PDAs is that they can be accommodated in any classroom on a one-each basis whereas many schools are finding space a problem with increasing numbers of computers.

Most schools have concerns for the feasibility of providing any form of computer to every pupil. This is despite schemes such as Microsoft's 'Anytime, Anywhere Learning' and the government-supported

---

2 See 'What the research says about portable ICT devices in teaching and learning' – [http://www.becta.org.uk/research/].

3 '74% of respondents believe that their personal ownership of a personal computer has a quite substantial or greater impact on their pupils' use of ICT in their schoolwork' – CfT Evaluation of Phase 1, Becta/DfES 2001.

eLearning Foundation which promote full-sized laptops for every child. We must consider the potential of PDAs in this context, if only because new models are available now which cost only as much as five good text books.

Undoubtedly, there is a threshold to cross which requires sufficient immersion in any new technology to reach a point where it is of unquestionable value. As a researcher reported on one school:

The group gets to use the PDAs once or twice a week. At this point the group also talked of some difficulties they were encountering in saving documents, and all had lost part of their work at some point.

"We have been writing poems about months, and I lost December when I tried to save it."

Losing December can be disheartening! But the children recognised the source of the problem and did not blame their PDAs: *"…the group was in agreement that it was because they weren't experienced enough."*

Half-hearted commitment in terms of the equipment provided or skill development can also result in technological absurdities, whereby an expensive item is not used to its full capability but only to a token level.

"When we went to the computer room, we took down the names of the websites on the Celts and wrote them onto the PDA so we could come back again later."

This situation could have been very different if the PDAs had either direct or synchronised (through a computer) access to the web. Even without this, the situation could have been better if the teachers or the children had higher levels of ICT capability and had thought about more efficient 'work-arounds', such as transferring batches of 'Favorites' or standard URLs via the clipboard. Better still, the technology should be fully integrated with the school's main computer network.

"Each PDA user has ActiveSync software installed on their user area. This enables them to log on to a machine and synchronise their PDA to that machine and then in turn to their own home directory on the server. With our Windows 2000 network this seems to be working well. There is no need for users to synchronise to the same machine each time, as each station automatically identifies the installation of the

cradle and brings up that user's desktop with their synchronisation software."

Gavin Hawkins
Stow Heath Junior School

Safety and security

Usually, the second concern, after costs, revealed by our respondents tended to be the safety of children carrying such devices. This seems reasonable when mobile phone crime – especially among children of secondary school age – has reached epidemic proportions. However, the comparison with phones is not as close as it may seem, as PDAs are more easily kept out of sight away from easy access and are not used in the street.

PDAs could offer great benefits to the disadvantaged finding themselves living on the wrong side of the so-called 'digital divide'. This is the cheapest way for a school to provide pupils with a computing device which can be taken home and through which they can connect to the internet.

Ironically, one US school has commented on the value of the cheapest, lowest functionality PDAs in this respect. They suggested that lacking the capability for MP3 music download and play, advanced games and instant messaging meant that these PDAs were much less attractive items for teenagers to steal. And low cost means a smaller loss when there is one of course.

Some participating schools have not as yet allowed their children to take the PDAs home. Others had allowed this but their teachers had not been given this sort of 'ownership' and as a result they complained that their PDAs lost charge (and their data) over the Christmas holidays. Those which kept them in school had to consider security and storage issues, usually locking them away in store-rooms or security cabinets.

Two of the schools in the Becta scheme revealed an interesting contrast in approaches to the question of children's responsibility for loss or damage.

One took the usual school route, namely emphasising the value of the devices and how precious they are, and encouraging the children to be highly responsible in their use, avoiding loss or damage at all costs. The other took a contrasting approach, reassuring their pupils that they would have no penalties placed on them for loss or damage and that the prime concern was to explore the benefits, though they should take all reasonable precautions. The children in the latter school when asked in a focus group whether they were worried about bullying and consequential theft proved more concerned about the number of their co-pupils who wanted to 'have a go' and who kept pestering them for this reason. They were not concerned about threats or theft, but this school was not in a high crime locality.

> *"We got a letter saying that if anything happened to the PDA then we weren't held responsible if it was broken."*
>
> Durham Johnston School pupil

Another safety consideration on which the PDAs score benefits is weight. Many children and adults find laptop computers excessively heavy for carrying any distance. Recently, medical concern has been expressed over the weight of bags carried by pupils and laptops can add significantly to this. PDAs vary in weight considerably and for the heavier ones some consideration must be given to how and where children carry them but they remain the lightest form of truly usable computer.

Learning

Finding ways to use the PDAs in the classroom for direct application to learning tasks has proved to be the slowest development in the Becta project so far, as reported by the researchers:

> *Overall PDAs are being used primarily for administrative or organisational purposes by those in education. This is also the case for the pupils that get to use the PDAs, who seem to use them to record homework deadlines, timetables and so on. While this undoubtedly has a beneficial effect… the actual learning applications of the devices seem to be limited.*

However, some pupils reported a range of other uses in lessons, though these do perhaps remain rather basic.

> *"We use it in science lessons and save things on the memo-pad."*
>
> *"I like to use it in maths, as it's got a calculator, and I like science… the teacher sent us the periodic table [for the PDA]."*
>
> *"In some lessons, if the teacher wants some homework, he can beam it to you, and you can beam it to your friends."*

Many would say that the conclusion that learning applications are limited is premature and that the lack of this use is more the result of the limitations of the time so far given, teachers' skill development, and teachers' confidence and awareness of available applications, not to mention teachers' limits in being able to develop applications themselves. However, as shown by many examples in the USA in particular, there are an enormous number of small, classroom-specific applications available. But it takes a great deal of time and experimentation to find and evaluate them [http://www.palmgear.com/software/index.cfm]. Many would also require 'localisation' to make them useful in English schools.

Another safety consideration on which the PDAs score benefits is weight. Many children and adults find laptop computers excessively heavy for carrying any distance.

This aspect of PDA use is one which will take the most time to embed in educational practice. Experience elsewhere suggests that a combination of teachers, technical experts and educational visionaries is necessary to ensure that opportunities are sought, spotted and developed, and that the resulting applications are appropriate and effective in these schools' context.

Meanwhile, one or two teachers felt that the PDAs "may distract pupils in the classroom", which requires further consideration and discussion with them.

Family learning

Stow Heath Junior School illustrated for us a way in which the PDAs help extend learning opportunities both within and beyond the classroom.

"We have been running a family learning and literacy project for children with their parents for some five years using our ICT suite. We had investigated purchasing laptops for the children and parents to take home but decided against this, because of the possible dangers associated with children having to carry them to and from school. The PDAs are proving to be the perfect answer as the children are able to use them for various literacy tasks, note-taking, reading ebooks, recording, etc, and take them home to continue working on them with their parents."

ICT capability

Almost all the teachers responding to Becta researchers emphasised the general improvement in ICT capability that the PDAs had brought to the children. The children also recognised this, as the quotations from Durham Johnston School below show. The group was asked if they felt that the PDAs had helped them get better at anything and they all felt that they were better at IT in general as a result, and that this would continue beyond the period of the trial.

"[We] did experience some problems, but [we] solved them by trial and error in [the first] two and a half weeks."

"I had a struggle at first, but then me and my mum found the reset button."

"Now that I know what to press, I'm all right!"

"It was a nice experience, learning how to use it."

In some ways being given the PDAs and responsibility for them replicated more closely an adult home ICT user's experience.

"We got the whole box and the instructions of how to use it."

"You have to look after it and charge it yourself and get it working by yourself."

At Philip Morant School, where iPAQs have been in use, and for longer – since before the Becta project – with sixth form pupils, the range of uses suggests more of the potential for the development of pupils' capabilities.

- *Beaming information to each other.*
- *Beaming to and receiving information from the teacher.*

- *Making diary appointments.*
- *Note-taking.*
- *Writing documents.*
- *Surfing the web.*
- *Scientific measurements.*
- *Taking on fieldtrips.*

And interestingly, after two years they report that none of the pupils have lost a device, or had it stolen, the only damage to the devices being worn-out batteries and scratched screens.

The PDAs are proving to be the perfect answer as the children are able to use them for various literacy tasks, note-taking, reading ebooks, recording, etc, and take them home to continue working on them with their parents.

Motivation

One aspect that the project's schools are unanimous about is that their pupils were excited and highly motivated when they got their hands on the PDAs. This reflects reports from a wide range of projects[4] which have given children access to smaller computing devices in particular. Comparisons have been made with children's enthusiasm for mobile phones. Observers have speculated on the 'toy' effect, the quasi-adult effect, and, more prosaically, on the appropriateness of the size of the items and their interface to children. (A negative correlation with this is that many older adults certainly find PDA screens less than wholly appropriate for their diminishing eyesight and clumsy fingers!)

Whatever does it, giving children a PDA lights up their enthusiasm, though whether this will always be the case, whether they might tire of them in time, or whether PDAs will eventually become 'yesterday's news', remains to be seen. In the meantime, there is potential here to be exploited by, for example, targeting disaffected boys.

4 One of the earliest studies to concentrate on motivation was: *The Effects of Information Technology on Students' Motivation,* Margaret Cox, NCET/Kings College, London 1997.

"I thought it was a bit boring when it was just an organiser… when I found out people were beaming stuff, I was very interested."

"When I found out there were games I was happy!"

"When I first started school I hated it… but then I got the PDA and it doesn't bother me now."

"When we don't have the PDAs any more, I think I'll still be more interested in computers."

"It's a very full hour… time flies with the PDAs as you are having fun."

One teacher reported that his pupils' response to the PDAs was *"very positive, enhancing motivation and focus, and benefiting them specifically in regards to research."*

Responsibility and personal organisation

Researchers reported that all the members of one school's pupil group felt that the PDAs had helped them learn better organisation, especially of homework, and that it was superior to their paper planner-book:

"I'm getting better at looking after things… and remember to put the PDA in the cradle at night."

"If I didn't have the PDA, I'd probably forget my work."

"There is more room to write what the homework is in the PDA than there is in the planner, so you write better notes."

"People don't always bring their homework planner, but no one ever forgets their PDA."

"I'm not very good with my homework, but when I put it into the PDA and turn it on when I get home, it's telling me to do my homework."

Clearly some of these responses are conditioned by the novelty value of the PDAs but the dedicated functionality of a PDA memo application replicates technologically what the school is trying to do by providing pupils with a paper personal planner. This suggests that it fits with what is proven to work – but with added glamour. It might be fair to assume that habituating children to referring to their PDA for organisational matters will improve their general organisational ability, not just in respect of their homework.

Another school saw an opportunity to give two pupils considerable responsibility:

"Luckily I have two excellent pupils (aged nine) who are in charge of the PDAs. They delete all unnecessary data, they make sure they are charged up and they lock them away at night. One even spent all his birthday money on buying one for himself, and delights in teaching me something I don't already know. (We have always had a policy of student helpers in school who help staff and pupils alike.)

"I then let the members of my maths group teach the rest of my class how to use the menu, etc. This provided an excellent speaking and listening activity!"

East Herrington Junior School

Collaboration

Many schools commented on the value of the PDAs in promoting collaboration between pupils, and this has been seen many times in reports from other projects. The researchers reported:

In the survey, 50% of pupils undertake collaborative learning when using PDAs. The case studies show that this is appreciated by pupils and teachers, as is the beaming of work for instant marking, allowing the learning to be instant. Pupils like the communication benefits of collaborative working, and the general excitement of the devices… [These respondents] were asked to explain what takes place. The five respondents gave answers covering the displaying of one pupil's work to a group, the beaming of information between pupils, paired learning of IT skills and writing collaborative poems.

It is possible that this is one reason for the absence of significant gender bias comments from respondents as the general pattern of ICT in English schools has shown that what might loosely be called 'human-

Giving children a PDA lights up their enthusiasm . . .

centred' ICT activities encourage involvement by girls. In one pupil focus group, two girls illustrated the part played by their PDAs in breaking down the 'IT is for boys' syndrome by being very responsive and very committed:

"We have two PCs at home. One used to be in my room but my brother has it now as I just use [my PDA] all the time."

"I just play 'Sims' on the computer, I do more on these [PDAs]."

"I still find IT quite boring. I'm more interested in this [PDA] than the computer [but] I didn't really want one at first."

In at least one focus group it was evident how communal the pupils were in developing their PDA usage. For example, one boy, already emerging as an eager adopter, was downloading material from the internet at home and then sharing it in-school using the infrared 'beaming' facility. This sort of collaborative help was not unusual.

Pupils were working on a 'drill and practice' program generating examples of sums which were all of the same type but with random numbers inserted. Because they were unable to give each other the answer to the problems, they spontaneously started to discuss the method for solving them.

The technology was able to generate many random examples for them to work on and their situation in their normal classroom environment encouraged their collaborative discussion, promoting their acting as peer tutors to each other.

One school reported using the electronic form of the game Battleships to introduce children to the interactive nature of their PDAs, 'beaming' each person's move to the other.

No example of collaboration with other schools was reported but it must be borne in mind that some schools were not able to connect to the internet with their PDAs.

Ambitions

When they were asked whether using the PDA had changed their plans for the future, seven out of 10 in one group of pupils said that using a PDA had made them change their ambitions. The common answer was to make more use of ICT in their future jobs.

"I wanted to be an actress, but now I want to be a teacher and use PDAs."

"I want to be a footballer, but now I want to be into computers, in case it doesn't work out."

"If you're already good at ICT now, you'll work on it and get better at it… then you can have a career."

"I'll want to do more IT at high school."

"I'll do IT at primary school, then at senior school, then I'd go to university and do IT, but you've got to do hard work."

Families

A particular advantage of PDAs is that their size makes them highly suitable for children to take home. We have written above about both 'ubiquitous computing' and pupils taking responsibility but the following quotations from children to Becta researchers reveal something of the potential for this to redefine families' attitudes to learning:

"The group were asked what they would use a PDA for at home. Although around half mentioned games first, the group agreed that they would do the same kind of work as they do in school. Interestingly, all felt that they would show their parents how to use the PDA. The group was unanimous that they knew more about IT than their parents, and adults in general. Two members stated that they often helped the staff overcome problems."

East Herrington Junior School

Some schools have ambitions to bridge between school and home through their PDAs. In the context of national statistics showing that 78.1% of primary school pupils and 84.8% of secondary school pupils have access to a computer at home[5], this may be quite realistic for a secondary school at least.

One boy, already emerging as an eager adopter, was downloading material from the internet at home and then sharing it in-school using the infrared 'beaming' facility.

Furthermore, computer penetration in all households in England has risen to at least 44%[6].

"It was felt that the PDA could also be used to develop home-school links. Many households now have access to a PC. The PDA can be linked to a PC and information uploaded. Students can then carry on with tasks they have been doing in school as well as parents having access to staff comments, notes, etc. The PDA can also be used by parents to log comments, notes, tasks and reminders. We found parents were very keen to develop their understanding of the

[5] *The Independent*, 26 February 2001.
[6] *Trends in ICT Access and Use*, Taylor Nelson Sofres, June 2002, HMSO.

equipment and have greater opportunities to work with their children. The students were also very keen to teach their parents – strengthening the link."

Ron Hinshaw
Hermitage School

Barriers to use?

In the survey of participating schools, the main barriers to PDA use that emerge are cost, lack of support and training, printing and battery problems. Other barriers include the limited software and the ambivalent attitude of some staff in schools to PDAs.

So far as the hardware itself was concerned, at its current state of development, responders suggested the following possible weaknesses:

• small screens

• not rugged enough for school use

• lack of print-out capability (not applicable if networked)

• the time it takes to input data (especially free text)

• the necessity to charge batteries every night

• costs of software and accessories

• unstable data storage (on battery exhaustion) leading to lost work.

The last of these can be a serious concern. While we should aim to increase the ability of both staff and pupils to manage their technologies, it is inevitable that data will be lost at times – just as school books are.

"If their PDA breaks down, a student is disabled."

"There is a reliance on software. If there are any failures, this is more drastic than losing a book!"

Philip Morant School

This points up the importance of routine back-up procedures suitable for schools, which may of course be taken care of through regular synchronisation with the school's network.

All the pilot schools consulted by researchers found positive uses for the PDAs and one stated that the use of PDAs had a direct and positive link to pupil achievement. This is difficult to quantify or even prove at present but the responses from these

schools match closely those from other schools investigating PDA use, as shown by this summary of advantages from the USA[7]:

• *Scaled-down nature.*

• *Minimal energy requirements.*

• *Reasonable price.*

• *Small dimensions and weight.*

• *Easy collaboration.*

• *In-the-field learning.*

• *Personal experience that resonates with students.*

Issues

Training and support

Many respondents – almost all – complained about the minimal (in some cases no) training they had received. At worst, this suggested a 'dependency culture' as those in other communities, including the business sector, who had been surveyed reported similar, short introductory sessions and then being left to explore the device by themselves. However, as with other computer technologies, schools are expected to exploit the whole range of functions these devices offer – in a range of contexts from teachers' information management to scientific datalogging, etc. This is far more demanding than the limited range of functions appropriate to many other jobs so specialist training and dissemination of good practice is undoubtedly necessary.

Some schools have ambitions to bridge between school and home through their PDAs.

Where does the appropriate expertise reside? The answer must be largely within schools, though the potential for external expert users as mentors could be considerable. These might include business users – particularly appropriate for schools' senior managers or higher education users – exploring the potential of their business approaches for schools.

However, pioneering work is needed and support needs to be given to teachers to develop their ideas and disseminate them.

[7] *A Report Card on Handheld Computing,* Jean Shields and Amy Poftak, TechLearning US Resource for Education Technology Leaders.

Are PDAs the device of the future?

Every school should have ambitions to equip its staff and pupils adequately with computer facilities and for many this will extend to portable computing for access at home as well as at school, or even the 'ubiquitous computing' described above. The cost of doing this is likely to be the biggest obstacle so the place of PDAs in meeting these ambitions is an important consideration.

At the time of writing, it is notable that the retail prices of PDAs range from about £75 to £550, which means the most expensive PDAs represented in this project are priced at about the level of a bottom-of-the-range laptop.

Harris School experimented for a term with PDAs for registration with one year group's tutors. They liked the dedicated system but had reservations over the PDAs, mainly because they were also in the process of equipping as many of their staff as possible with full-sized laptops. They were veering toward a preference for the latter as they see laptops as being useful for a wide range of tasks: writing reports; creating lesson plans; storing every digital asset they want; and connecting to Curriculum Online via the internet. They expect 100% provision to teaching staff to be achievable soon with the school supplementing those provided under central government direct funding. So what of the PDAs? For pupils, above all else they see the value of these as portable science devices, with other uses to ensure that they get full value from them. They also see them being provided for senior managers alongside laptops for the reasons given in this report.

Another school (Dunraven Lambeth) reported elsewhere on the unsuitability of laptops for network-linked class registration. They found it undesirable, if not entirely unworkable, for every teacher at the beginning of every class to have to have their laptop available, start it up, and only then be able to register their pupils. This caused problems for PE teachers, for supply cover teachers, for those teaching in a situation where the laptop was not otherwise needed (but perhaps a large pile of books had to be carried in), and for those worried about their laptop's safety in the course of the lesson. PDAs answer all these objections.

Other schools were adamant that PDAs wouldn't replace computers. The key reservation expressed regarding PDAs for universal provision is that even

the most sophisticated are not yet suitable for all of a school's mobile computing needs. However, the selected supply of PDAs to identified groups, for example staff, disadvantaged children, or those with special needs that might be ameliorated by PDA provision, is an option.

When considering providing PDAs for children, it will not be easy to choose between the minimal functionality, low-cost models and those with a much greater range of functions and a much heftier price tag. In some cases where the functions appear to be like a computer, it seems that the similarity provokes over-expectations, whereas low-cost devices are only expected to provide electronic organiser functions.

Other products – Existing or emerging

There are other related products in use in schools now which offer alternatives to PDAs. Most familiar of these have probably been the Psion pocket computers, series 3, 5 and 7/netBook.

New products will be continually forthcoming and, as pointed out at the beginning of this report, the convergence of mobile phones, digital cameras and PDAs will be the most immediate change – which even raises questions as to who might cover the costs. Also, manufacturers such as Casio and TI are expanding the facilities of their graphical calculator products to include organiser functions.

As an alternative scenario, the recently launched tablet PCs could be regarded as a convergence of the laptop and the PDA. They do not suffer the limitations of small screens and some even have both pen and keyboard input choices. Some schools may decide that these advantages make tablets preferable despite the greater portability of PDAs.

Other schools are investigating Webpads which sit somewhere between the tablet PC and PDAs and can provide full connectivity – to the school's network direct or the internet when in school, at home or even elsewhere (through GPRS, GSM or landline phones). For a summary of these devices see [http://www.educause.edu/ir/library/pdf/DEC0107.pdf].

Other matters remaining on the agenda

There is much work to be done to both investigate the real potential of PDAs in schools and to provide guidance on using them effectively and efficiently. Among other matters we have become aware of the need for more guidance on:

- ebooks and their value in schools
- the relationship between pupils' PDAs and their home computers
- acceptable/appropriate use policies
- the potential of PDAs in response to children's special needs in mainstream and special schools
- technical support provision: from whom; what is needed; how best to provide it; how much may be delivered online?
- managing the hardware: labelling PDAs and providing network IDs; asset registers; synchronisation and charging methods and routines; how to back up and where to; storage and security
- the significance of wireless networking
- the potential of PDAs for use by children not in regular school – hospital schools, the sick at home, etc.

Further work is needed on both the main focuses of the project but most particularly on use of PDAs by children for learning activities in the classroom and beyond the school.

Indications of the development of a pedagogy which includes such devices can be found in the use of graphical calculators in the mathematics and science classroom. The convergence of such devices with PDAs provides another area of development and research.

We are aware of the 'Cybiko' product and can see unique potential in its automatic 'mesh networking' capability, which could even provide free wireless communication between members of a school community, but we have been unable to investigate this as yet.

Indications of the development of a pedagogy which includes such devices can be found in the use of graphical calculators in the mathematics and science classroom.

A final thought

As with mobile phones some years ago, schools will find increasingly that pupils own their own PDA – if only a parental cast-off – and will have to decide how to respond if these are brought into school. Are they to be encouraged, or banned?

"I wonder why we missed an opportunity to increase the learning potential of mobile phones. We would not have any problem convincing the students to use them. The PDA could go the same way. The potential for it to be a multi-functional device that students can take total ownership of and which has endless 'communication' applications is surely something we want?"

Ron Hinshaw
Hermitage School

Further information

Becta Information Sheet on Handheld Computers – July 2001 A summary of desk research on portable ICT devices with links to Handheld Computers in Schools – Managing your Work; Multimedia Portables for Teachers Projects; and What the research says: A succinct summary of research into portable computers in schools including PDAs with further references – December 2002	http://www.becta.org.uk/technology/infosheets/index.html http://www.becta.org.uk/research/reports/portableict.cfm http://www.becta.org.uk/research/reports/docs/wtrs_porticts.pdf	UK
TES *'Handheld Ways to Improve Literacy'* – September 2002 *'Take the Tablets'* – September 2002 *'Glasgow Handheld Pilot Proves a Hit'* – October 2001 *'Palm PCs to Replace Laptops'* – July 2001	http://www.tes.co.uk	UK
'Getting a Handle on Handhelds' – 2001	http://www.electronic-school.com http://www.electronic-school.com/2001/06/0601handhelds.html	US
Reports from Techlearn PDAs in Higher Education Usability and Accessibility of PDAs in Education	http://www.techlearn.ac.uk/ http://www.techdis.ac.uk/PDA/	UK
PDA project at Philip Morant School, Essex	http://www.microsoft.com/resources/casestudies/CaseStudy.asp?CaseStudyID=13087	UK
Palm Education	http://www.palm.com/education/	US
SRI International Report Palm Education Pioneers Programme – March 2002 Evaluation Report	http://www.palmgrants.sri.com/	US
Adapting PDAs for people with impaired speech	http://www.bostock.com/IconSpeakInternational.htm	UK
Education Week on the Web *'Handheld Computing: New Best Tech Tool, or Just a Fad?'* – September 2001	http://www.edweek.org/	US
TechLearning *'A Report Card on Handheld Computing'* – Jean Shields and Amy Poftak	http://www.techlearning.com	US

A project champion's view – Andy Squires, Netherhall School, Cambridge

A short rundown of the successes:

1. **Agenda Fusion** – This has helped all those using their iPAQs view all their information on one screen and manage their time more effectively.

2. **Tube Map** – I have used the tube map of London while on day trips and conferences there. It not only displays the tube map but also plans a route. Very useful. Although I am not sure how safe it would be to wander round the underground with this in your hand?

3. **Presenter-to-go** – Again, extremely useful. I have now used this to address a group of 20 middle managers and also lead NQT seminars. The nice touch is the remote control, although I have not really tested this over a larger distance yet.

4. **Targus Keyboard** – This has been invaluable. I fold this up and carry it with me everywhere in my jacket pocket. I have been using this at every opportunity, ie cover lessons, etc, to complete work on my NPQH reflective journal. It is also very useful for taking notes/minutes at meetings, etc. Very good bit of kit. If it were just a little more rigid, it would sit on my knees and be even more useful.

5. **Infrared** – This is a little problematic. I decided to enable this function to sync and ever since it keeps scanning every few minutes and then reports an error message – this is annoying. Also it is a little slower than the USB sync. I can now leave the cradle on the desk at school though and sync at home. The cradle is not the easiest of things to transport around.

6. **Internet** – I have not yet managed to wireless network the iPAQ. This would be the next logical step. For this I would need a transmitter and also a wireless card. I cannot afford either of these bits of kit as yet, but would like to be able to collect email, etc, on the iPAQ.

7. **Acrobat Reader** – I have used this very successfully to read and store important documents in pdf format, eg Ofsted reports, the PANDA, etc. These are all good to refer to at times and since they are on the iPAQ, I can read them wherever I want. I have also 'beamed' them to colleagues, etc.

8. **Contacts** – Again, very useful, but probably easier to enter via the computer and then search and view through the iPAQ. Again no more business cards – you can just beam the contact to someone else and there it is. I used this at a recent conference in Manchester.

9. **Excel** – I now have all my registers and also test and base data entered onto Excel. This helps me calculate attendance percentages, averages, etc. The only thing I miss is the graphing function. As I teach A-level biology, it would really be useful to enter data and graph the results then and there for the pupils to see. This would then help in repeating results, etc, in the time left of the lesson.

10. **Media Player** – I have at times had the odd tune on the iPAQ but at about 5MB each they do take up quite a lot of room, nevertheless it's quite a cute function. I have also tried to play video but with less success.

11. **Real Player** – I downloaded this (free) to try and play the video but this also refused to work.

12. **Microphone** – This feature is extremely useful and has become part of my daily routine. When I am on my way home in the car, I will use this as a dictating machine and record messages and tasks as I think of them. Then when I get home, I transfer them to the task element of Agenda Fusion.

Appendix B

Insights from higher education in the USA

The following are clips from a report *Personal Digital Assistants (PDAs) in Education* by Ted Smith from Techlearn [http://www.techlearn.ac.uk/] which seem pertinent to this context. A draft copy of the full report is on [http://www.techlearn.ac.uk/NewDocs/PDAs%20in%20Education.doc]. Some of them may prompt ideas for application in our schools but many are salutary warnings to us not to expect too much too soon, especially given the relative funding and back-up resource differences between higher education in the US and schools in England.

■ ■

XXX University is using PocketPC systems in the classroom in physics, French, chemistry, health and exercise, and sociology. In particular, tutors are using an in-house software system (ClassInHand) which turns the tutor's handheld into a web server [http://classinhand.wfu.edu/]. By this means, the tutor can, through wireless communications, make information available to students as a class progresses, and use the website to poll for instantaneous student feedback.

■ ■

Because class time is limited and thus valuable, instructors have little tolerance for technology that doesn't work immediately and quickly abandon it for traditional methods if any problem arises.

PDAs cannot replace laptops, but are a worthwhile supplement in many cases.

■ ■

The students pay $200 per semester for four semesters and own the devices themselves. They are responsible for loss and damage. The Computer Service configures the PDA with campus-specific settings and applications, trains the students on use, provides web-based and hard copy documentation, and provides a repair/maintenance/contract management service. The College is focusing on the (*sic*) providing course-specific instructional software on the PDAs.

■ ■

The Department of Computer Science has been very active in the programme. They found very little

educational software available commercially for the PDA and so chose to develop some 80 small software applications, including:

- interactive reference documents
- interactive exercises
- explanatory documents
- annotated exercises
- interactive quizzes.

Students with visual or physical impairments found the PDAs difficult to use – more detail on accessibility issues can be found at [http://www.techdis.ac.uk/PDA/].

■ ■

In terms of technical support, the university provided 40 'synching' stations around campus that provided infrared connections to the campus infrastructure. The Computer Service undertook all first year warranty work.

- Connectivity and distribution of content was a problem – because there was no central server solution (they used Avantgo).
- Faculty [staff] roundtables were introduced to share experiences.
- The change came from the top-down and was seen as probably the best way to get things moving quickly.
- Not as much software in the private sector was available as they thought they (*sic*) would be, and hence they realised they were at the bleeding edge.

Participating schools

Cams Lane Primary

St Peter's Collegiate School

Ashcombe School

Charlton School

Middlemarch Junior School

St Francis Primary School

St James CE Junior School

New Earswick Primary School

St Nicolas' CE Primary School

The Redway School

Soar Valley Community College

Nightingale School

St Bedes RC Middle School

Priory School

Furze Platt Infant School

Monkwearmouth School

Falconers Hill Junior School

South Bromsgrove High School

Roche County Primary School

Fawcett Primary School

Walmley Infant School

Old Earth Primary School

The Netherhall School and Sixth Form Centre

Our Lady of Mt Carmell RC First School

Whitehills Lower School

Stow Heath Junior School

Philip Morant School and College

East Herrington Junior School

The Benjamin Britten High School

The Wildern School

Durham Johnston School

Contributing schools

The Arnewood School

Hermitage School

Harris School

Dunraven Lambeth School

Becta
ICT Research

British Educational Communications and Technology Agency
Millburn Hill Road, Science Park, Coventry CV4 7JJ

Tel: 024 7641 6994 Fax: 024 7641 1418
Email: becta@becta.org.uk URL: www.becta.org.uk