Evaluating trainee doctors' educational use of a personal digital assistant: a pilot study

In recent times, health-care providers in the western world have embraced modern technology to advance patient care. Ease and speed of access to modern technologies has enhanced the quality of medical education and provided a valuable new adjunct to workplace-based learning.

With the immediacy of access to a wide range of current resources, modern technology can be used to enhance and complement more traditional medical education formats and can thereby enable medical treatments to be optimized with on the spot evidence-based decision making (Lindquist, 2008).

The use of the personal digital assistant (PDA) in health-care settings has grown exponentially since the early 1990s, providing doctors with a vast array of reliable and easily accessible clinical resources. More recently, wireless connectivity has enabled mobile transmission to the internet, facilitating access to email and web-based services. The PDA is a small, portable hand-held computer with sufficient storage capacity to hold a wide variety of clinical information sources. With the increasing use of wireless networks in health-care settings, these information sources can be regularly updated remotely.

A number of pilot studies of the benefits of PDA use have been conducted in both the USA and the UK, but many of these have not been thoroughly documented and so the findings are primarily descriptive (Sandars, 2007). This study is one of the largest PDA pilots conducted in the UK which aims to explore the potential benefits of the PDA as a tool to optimize clinical education and governance in addition to seeking to identify the potential barriers to using such technology as a learning resource in the workplace.

Providing trainees with PDAs that contain a wide number of clinical resources can benefit the individual clinician directly, but also allows user activity to be interrogated, thus enabling medical educators to gain valuable audit and research data on the frequency and degree of use.

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Objectives

The study sought to address the research question 'Does a PDA with Medhand Dr Companion resource enhance the provision of "just in time" learning, by providing rapid access to educational resources?'

The aims of this project were three-fold:

1. To explore the potential benefits to trainees of using PDAs as a tool to optimize clinical education and clinical governance
2. To explore the various resources that are accessed by junior doctors for information in the clinical workplace; these include online and paper-based formats, mobile devices and colleagues
3. To explore the extent of trainees' access to and engagement with these information sources, identifying any associated barriers to using technology as a learning resource in the workplace.

Methods

The School of Postgraduate Medical and Dental Education at Cardiff University secured funding from the Wales Postgraduate Deanery, in conjunction with the Welsh Assembly Government, to run a 1-year pilot study evaluation project of junior doctors' use of PDAs in hospital wards in south east Wales. Hewlett-Packard iPAQ 114 Classic mobile devices and a Medhand Secure Digital storage card were used, loaded with 18 textbooks including the *British National Formulary* (BNF), the *Oxford Handbook of Clinical Medicine* and the *Oxford Handbook of the Foundation Programme*. These texts were selected as they formed part of the Medhand's Universal Mobile Library. It was recommended that students initially updated their software at the beginning of use by connecting to an internet-enabled computer. Thereafter, they were informed via email when updates were available.

The study used a mixed methods approach to data collection. A total of 219 foundation year 1 and 2 (FY1 and FY2) trainees across a range of different medical and surgical specialty rotations were purposively sampled, identifying those who were rotating to hospitals with good wireless reception. The Bristol Online Survey was used to collect data at the start and end of the first 4-month attachment. Further copies of the questionnaire were distributed at the end of the second and third 4-month attachment.

The surveys contained both open and closed format questions; details of questions common to all end-of-attachment questionnaires can be obtained from the corresponding author. A Likert-type scale was used to establish trainee perceptions with regard to the utility of the device where 1 = very useful and 10 = not at all useful.

Trainees were informed of the purpose of the study, in writing, at the start and assured that participation was voluntary and that they had the right to withdraw from the study at any time. The confidentiality and anonymity of the data responses were assured and ethical consent for the study gained from Cardiff University. The questionnaires were distributed electronically via email and a follow-up hard copy sent to the home address of any trainee who could not be reached by this method.

At the end of the FY1 year focus group interviews were conducted with two groups of ten trainees who had taken part in the study in order to develop further the themes that had been identified in the questionnaire.

Results and discussion

At the initial stage of the study 219 trainees were assigned to the pilot project. Twenty-five trainees dropped out of the study before the end-of-attachment questionnaire was launched. The principal reason for drop out was because the PDA was unavailable (lost, stolen, sent for repair). Overall 116 doctors returned both the entry and the first end-of-attachment questionnaire, giving a 60% response rate. Of these 46 (40%) were male and 70 (60%) female. This reflected the gender split of the cohort. Fewer questionnaires were returned at the end of the second 4-month attachment (n=80) and third 4-month attachment (n=40).

Of the 116 respondents only 34 (29%) reported having updated their card, while only 26 (22%) had read the Deanery update material on the card. The trainees' use of a variety of different information sources was explored in the end-of-attachment questionnaires. *Table 1* shows the number of trainees who had accessed a given list of resources for educational purposes during their first attachment.

When asked to indicate their use of the PDA for educational purposes during the first attachment, 47% of trainees gave a rating of 6 or more on a 10-point scale (where 1=infrequent and 10=frequent use). Nine per cent gave a rating of 9 or 10, clearly indicating frequent use, and 23% gave a rating of 1 or 2, clearly indicating infrequent use. The most commonly reported usage was between 1 and 5 times a week during an attachment.

Table 1. Information sources accessed by trainees

Resource accessed	Number of trainees who reported using this resource
Seniors	102
Personal digital assistant	99
Internet via computer	98
Text books	96
Peers	87
Library	63
Journals	52
Other	7

The PDA was used to access factual information: specifically, during the first attachment, 80% had accessed information on drug dosage and 27% had accessed research evidence. Other use (indicated by 17%) included accessing anatomical drawings, bleep numbers and teaching materials. Overall, 60% indicated that the usefulness of the PDA for their learning needs during the first attachment was average or below average (as indicated by a rating of 6 to 10 on a 10-point scale where 1=very useful and 10=not useful).

The qualitative data gathered from the open response questions in each of the questionnaires were analysed using a thematic approach to code and categorize the data (Green and Thorogood, 2004). These data provided a more comprehensive account of the level of trainee engagement with the PDAs and highlighted a somewhat mixed profile of workplace learning. These findings, coupled with the data generated from the two focus groups conducted at the end of the year-long pilot, enabled the authors to develop a typology of trainees in respect of their attitudes to and use of these electronic learning resources.

Prensky (2001) identified three categories of users – digital natives, digital immigrants and digital aliens – and differentiated them according to their ages and levels of familiarity with the technology. However, critics of his work such as Bennett et al (2008) contend that these distinctions suggest degrees of rapport with technologies which are not generationally specific. The typologies generated by the current study seem to add credence to the argument that Prensky's account is over-simplistic, given that the research group is of similar ages and educational levels.

The data have led the authors to generate typologies that can be categorized as:

- The engaged learners
- The unconvinced learners
- The disconnected learners.

The engaged learners

These trainees came across as active learners who were keen to embrace these new technologies. They recognized that these tools offered them ready access to a set of resources which could enhance the quality of their workplace experiences and work-based learning. They commented:

'[I was] asked if I wanted to do a lumbar puncture, so wanted to look up how to do it, used the Oxford handbook under practical procedures. It was very easy to use and very quick. It made the procedure a lot easier to understand especially when it shows the pictures.'

'Unclear of dose of a drug on ward round, so I used the BNF on my PDA to look it up and check on interactions / side effects at the same time. I was worried about looking ignorant so pleased to have learnt something new, pleased to be resourceful and confident to prescribe a dose I know is correct from the BNF.'

'I was asked what structure my needle would go through during a spinal anaesthetic and realised my knowledge was not adequate so looked up spinal anatomy on the PDA. It provided an immediate, easily accessible answer to my question.'

It also had an impact on the trainees' levels of confidence especially during their first weeks on the job:

'Whilst medical school provided a basic background in urology, I was frequently asked questions necessitating a higher degree of knowledge. The PDA provided the means to achieve this.'

'My PDA allowed me to look up some information shortly before the patient arrived [in clinic] and clarified some of the questions I had. I could ask more informed questions, which put the patient at ease.'

For this group of trainees the PDA, with its ready access to a number of different resources, proved a useful learning tool to support them in their roles in the workplace. In a number of instances they indicated how they were encouraged to seek further information on the topic because of the ease of access afforded them by the PDA.

'This experience has prompted me to look into lymphoma in more detail, particularly its presentation, investigations and details.'

These examples of active learning where the trainee takes a positive role in embracing new technologies in order to expand his/her knowledge are a powerful demonstration of situated learning (Lave and Wenger, 1991). This enables trainees to maximize the opportunities to develop their professional skills such that they can accommodate their change in role from one of peripheral contribution to central participation.

The unconvinced learners

Although aware of the potential learning opportunities which the tools might afford them, these trainees were not persuaded to engage with the PDAs and the technology in order to enhance their learning experiences. Rather, they identified and then focused on the minor problems associated with the devices, such as their lack of familiarity with the interface and the potential for the device to be lost or stolen. Attention to such minutiae overshadowed the perceived educational benefits to be derived from engagement with the devices and blocked their engagement with the learning potential which the PDAs afforded them.

'Quite easy to navigate, but it's a bit frustrating because you have to back track if it takes you down the wrong route. Maybe investing time in learning how to navigate the PDA would be helpful.'

'I probably have not made full use of the PDA due to my fear of losing it on the ward. Since I have found a way to attach it to myself without pockets then I have used it more, especially on calls.'

There was a sense that while this group of trainees could acknowledge the usefulness of the PDA, the need to familiarize themselves with the functionality of the device and the potential inconvenience of its portability was off-putting in terms of their ability to gain educational benefit. In consequence opportunities for more in-depth 'on the job' learning were sometimes missed. This was recognized in some instances as this quote illustrates:

'I'm a bit annoyed that I haven't really tried with it for the past month, after the teaching sessions last week. I'm also a little embarrassed at our attitude as a group as a lot of work has been put into the pilot and we all just came up with a load of complaints rather than very much positive.'

It can be argued that for this group the pressures and demands of the job mean that they adopt a pragmatic approach, feeling that they are concentrating their time on learning the job, and what needs to be done in their new roles. The additional and, as they see it, onerous task of familiarizing themselves with this new device is something that is not considered a priority for them. They attempt to manage their workload and learning in the most efficient way they can and overlook the potential benefits that engagement with these devices offers.

The disconnected learners

These trainees presented as a rather concerning group who were generally resistant to seeking information from sources other than their colleagues.

'It's quicker to discuss things with colleagues.'

'I could have forced myself to use it, but seniors and peers often offer a better, more rounded practical answer to a question.'

They also focused on the negatives:

'I feel I could carry it more regularly, I could spend time getting to know the features of it, I could download the updates, but for now I do not think I'll be doing anything.'

'The PDA crashes when looking up drugs in the BNF section. It wasted more time than looking for a hard copy.'

Perhaps of particular concern were comments from a few which suggested a certain over-confidence or arrogance regarding the status of their own knowledge:

'After a month or so, I stopped using the PDA as I became familiar with common conditions and practice and the effort of carrying the PDA began to outweigh its usefulness.'

'I think that in the past 4 months, I have become more confident as a doctor. This means that I don't need to review as much information from sources such as the Oxford Handbook or the BNF… I've been lucky to work with a superb team during this rotation, so have very experienced and approachable doctors, pharmacists and nursing staff to aid my education. I do not feel that I have missed my PDA at all.'

This group of trainees are an interesting subset and one which is worthy of much more in-depth study. They indicate a worrying trend of an over-reliance on others to provide them with new knowledge. If this notion of learning from others is conducted in the spirit of learning through instructional practices (Sandars, 2007) then clearly this is a positive trend and one that has a long history through the apprenticeship model. However, given the changes in both the working patterns of trainees and the clinical settings themselves, such perceived passivity to learning 'on the job' requires further exploration. It may have worrying implications for continuing professional development if learners are unwilling to adopt a proactive approach to acquiring new knowledge and are either unwilling or unable to engage with modern technological learning aides.

Based on a review of the open comments (n=178) provided in response to the final reflective question on each of the questionnaires issued at the end-of-attachment, the distribution across the three categories in the typology was approximately 40% engaged, 25% unconvinced and 35% disconnected. The distribution of responses varied across the three end-of-attachment questionnaires and suggested that for some, the longer they had the PDAs, the less they used them. Thirty four individuals provided written reflective comments on at least two end-of-attachment questionnaires. Of these, five remained consistently engaged with the PDA, seven remained consistently disconnected, three remained unconvinced, four of the unconvinced became disconnected, ten engaged became either disconnected or unconvinced and three fluctuated between disconnected and engaged. This suggests both that a number of trainees did not remain stable in their response and that most of these became less engaged or convinced over the course of three attachments. Further work is needed to establish the robustness of this typology and to explore trainees' response over time.

Conclusions

This pilot study has provided some interesting insights into the level and nature of trainee engagement with PDAs as tools to optimize learning. Much has been written about generation X and the term digital native has been coined to refer to those for whom technologies are a part and parcel of their every day lives (Sandars, 2007). There has been a suggestion that these group members experience a familiarity with digital technologies and indeed a degree of complacency regarding their routine engagements with them. Therefore it is somewhat alarming to see that this study has highlighted the extent of technological illiteracy that persists (Bennett et al, 2008).

While the majority of those studied could be classified as comprising those in the 'net generation', having grown up in an age of internet technology and computer expansion, there are a number of students for whom even basic computer interactions are challenging and for whom the preferred strategy is avoidance, rather than engagement. In the USA only one in five undergraduates used mobile devices regularly (Crowe, 1998) and in the UK figures are even more surprising, with two thirds of undergraduate medical students reporting that they have only low levels of computer literacy. However, much of the literature on this area dates quickly and is simply reporting on the use of technologies in a social context, as part of a lifestyle choice; little attention has been focused on the educational implications of such disinterest.

Lessons have been learned by the research team. Assumptions about the ease of PDA use have been challenged. Greater attention will be devoted to providing a more structured induction programme to ensure that all participants are fully familiar with the range of functions and learning opportunities afforded them by these devices and their applications.

The team has successfully gained further funding from the Deanery and the Welsh Assembly Government for a second project across Wales with some modifications. The PDAs have been replaced with a smartphone device, the HTC Ty Tn 11. This is intended to increase trainees' engagement with the study by offering free email, text messaging, phone calls and internet calls between trainees and their supervisors. It will also enable interactive educational activities to be incorporated including access to learning portfolios and logbooks. It is hoped that these additions will increase user engagement, particularly if records of assessments can be managed via this process. It is recommended that all users ensure their personal home contents insurance policy or additional policies cover the potential for loss or theft of the device. This is not covered by the deanery.

This new study will provide valuable quantifiable user data through the Medhand server. This will chart levels of user engagement, such as the frequency of use and most accessed resources. It is vital that throughout this and other studies the educational value of these mobile devices is not subsumed by their technological artistry. They are intended to be used as a tool to aid learning and this potential needs to be fully explored in order to maximize their utility. The clinical workplace is a rapidly changing environment and medical educators are making enormous efforts to ensure that trainees are equipped to deal with the challenges facing them in the 21st century. We need to evaluate how best to harness modern technologies to aid learning, maximize patient safety and optimize patient care. **BJHM**

Conflict of interest: none.

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KEY POINTS

- Modern technology can help advance patient care.
- The use of the personal digital assistant has grown in health care.
- Use of a personal digital assistant can help improve patient care.
- Use of a personal digital assistant can allow medical educators to gain valuable audit and research data.
- This can allow interesting insights into the level and nature of trainee engagement.