Use of Pen-Based Computers in Health Care

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Mobile computing is the next technology frontier for healthcare providers. Nurses, doctors, pharmacists and other healthcare professionals are using pen-based computers for data capture, retrieval and information presentation, and this use is enhancing patient care and improving efficiency. The migration from desktop platforms to mobile platforms will have a significant impact on future healthcare delivery systems. The most important benefits of pen based computing are increased accuracy, portability (which allows usage to be 'anytime and anywhere') and saving paper and time. This paper focuses on the use of pen-based computing in nursing education and health care.

Keywords

Mobile computing, pen based computing, nursing education, health care.

1. INTRODUCTION

Pen-based computers (PBCs) are small tablet-like devices that use a stylus, either an electronic pen or a plastic pen, rather than a keyboard or a mouse as input device. In addition to entering the actual text, commands are given with the pen. Pen-based computers include personal digital assistants (PDAs), Tablet PCs and Mobile PCs. The most important benefit of pen-based computing is portability, which allows usage to be 'anytime and anywhere'. Willetts (1993) states that another reason for using pen-based computing is that our society is time-precious. Pen-based computing offers a quick-to-learn solution that the majority of businesses can take advantage of.

This paper evaluates the use of pen-based computing in nursing education and health care, largely based on a survey of students, lecturers, health professionals and administrators in Auckland. It sets out to answer three research questions:

- How does pen-based computing support Health Care?
- What are the available technologies and their development status?
- What are the communication, performance, security, standards and usability issues?

A quantitative method was used in order to analyse the data collected from a survey and a qualitative method was used to evaluate hardware and software (Lau, 2003). Five sites were selected for the survey: Henderson Healthcare Centre, Auckland; School of Health Science, Unitec; Waitemata District Health Board; Auckland District Health Board; and Middlemore Hospital. The administrations of these sites provided access to their staff or students for the survey. The target groups of the survey were doctors, nurses, clinical administration staff, healthcare students and staff. The scale of the survey was limited to 30 particpants, as many health care departments like to protect their own information and privacy, and declined to participate in the research. For example, some of the departments have only a limited staff and information about their education or nationality could give away their identity.

2. USAGE IN HEALTHCARE

Results showed that 17% of participants had no experience in pen-based computing and 33% of participants had limited experience. Only 10% of participants claimed to be expert in this new technology. In the 50s age group, the average experience of using PBCs was nearly 13 months, which

was the longest of any age group. The 20s age group claimed the highest level of experience in PBCs, even though they had the shortest average time of using PBCs. The 50s age group claimed to have the least experience level, although they had used PBCs longest. This may indicates that younger age participants are quicker to learn and accept the new technology.

Most participants considered that PBC use in healthcare would reduce the consumption of paper and improve efficiency. More participants like to use PBCs for appointment with patients than those who do not. Another statistic was that relatively more females than males prefer not to use appointments scheduled with PBCs. More participants in the 50s age group prefer not to use appointments scheduled with PBCs than in other age groups. This result may indicate that health care professionals in this age group prefer the traditional paper-based diary to make appointment with patients. Tutors were more likely to use PBCs for appointments than other occupation groups.

There is a strong indication that most participants like to obtain medical information from a PBC. Only 19% of participants still preferred the traditional way to obtain medical information via printed material. The groups least likely to obtain medical information from PBCs were administrators, students, English native speakers and participants in their 50's.

Most (74%) of the participants were already using PBCs and nearly 80% of the participants believed PBCs could have significant impact on their work. Students and participants in their 30's and 40's felt most strongly. Most of the participants believed that pen-based computing would help them to improve the accuracy at the first point of care. 42% of female participants and 71% of male participants believed that pen-based computing would improve accuracy, which is a significant difference. Most participants believed it is necessary to set up a standard for the health care software.

Perceived benefits of using PBCs include:

- Reducing staff workload and stress levels
- Improving the accuracy of patient assessment (see also Galt, 2002)
- Increasing efficiencies and effectiveness (see also Wilkerson, 2002)
- More sharing of healthcare information and resources in a workgroup
- Work environment becoming less paper-based (see also Wilson and Fulmer, 1997)
- Providing healthcare professionals with more up-to-date data 'at any time and anywhere'

The two main issues remaining to be resolved are

- A set of standards or management system need to be set up to manage the healthcare software applications in the market
- Patients' private information could be insecure if the security policies are not implemented for PBC use in healthcare

3. HARDWARE AND SOFTWARE

Performance is a very important factor in PBC use in healthcare. Time is critical to PBC user, because they often need to keep up with external activities such as conversations with patient. In future PBCs will be developed with more powerful CPUs, better performance and connectivity, reduced weight, and better quality displays, as well as improved usability; furthermore, the costs of the pen-based are dynamic and becoming more affordable.

As the pen-based computing and wireless technologies are becoming mature, more applications for small medical practice settings have been developed, as well as for hospital-wide environments. Although the standards of the hardware and operating systems are various and evolving, the advantages of portability and wireless connectivity provide an attractive alternative to the traditional paper and pen of patient data acquisition. Since both Microsoft .NET and Sun Micro Java .NET platforms have become more mature and stable, the lives of the developers are getting easier: not only improving their productivity, but also breaking down the barriers of device compatibility.

4. SECURITY ISSUES

The greatest danger for pen-based computing is the theft or loss of devices with sensitive healthcare data. Encrypting the data on the device or equipping the PBCs with removable data storage are the best options to reduce such security risks. However, many users are reluctant to encrypt their devices because of the inconvenience (Ferrill, 2002).

Therefore, implementing enterprise wide policies that force users to encrypt would avoid this problem, or minimise the risks. Security risks will be reduced in the future when government health care agencies improve security policies and new technologies are developed to improve the data protection and security of wireless and networking for PBCs. Thus more health care information could be available via PBCs, making web-based digital medical records accessible 'at any time and anywhere'

5. COMMUNICATION

According to the survey results, most of the participants have no experience in wireless communication methods and have little experience in the Hot Sync communication method. It may imply that majority of healthcare professionals are using PBCs for Personal Information Management (PIM) rather than using them in an enterprise infrastructure. The 20's age group differed significantly from the 50's age group in having more experience with Hot Sync and Wireless communication methods. This may imply that younger health care professionals are more accepting of pen-based computing technology.

6. INPUT/OUTPUT

Most of the survey participants liked to use an in-built keyboard or transcript input method; voice input was least liked. There are two common techniques to resolve the problems created by the limited screen size: Tab Screen and Scroll Screen. Survey data indicated that the Multi-Tab style of interface was favoured by the healthcare professionals. 75% indicated their preference for a graphical interface, only 11% of participants were in favour of plain text and 14% of participants gave a neutral answer. Most (55%) of the participants liked the matching scale small screen button; 21% of participants were not concerned about the size and 24% of participants liked to have a larger push button on the screen. Overall slightly more participants preferred larger font size, although the 40's age group favoured smaller font size.

7. DATA STORAGE

Data storage is one of the important factors in pen-based computing, because PBCs can lose data if they crash or lose battery power or if the whole unit is lost. Therefore the users need to pay attention to the necessity of frequently backing up their valuable data. The survey data indicated that slightly more of the participants believed that valuable and private data should be stored in a server; so that users can download the data when necessary. There was a significant difference between participants with a native language other than English and native English speakers for the choice of data storage location: native English speakers preferred that valuable and private data should be stored in the server. Administrators were more likely to store valuable data locally while tutors were more likely to store valuable data in a server.

8. HUMAN LIMITATIONS

Some survey participants had no experience and felt they lacked confidence in some areas, e.g. wireless communication. Therefore, there is an issue of mixed abilities of users that should be taken into account when planing a new PBC project for healthcare. A tiny screen and small font size with no enlargement facility could cause problems for some users. Human error is another important factor to be considered in the design of PBC systems (McManus, 2000).

9. CONCLUSIONS

This study confirmed the findings of earlier studies that adopting pen-based computing technology for physicians might reduce errors caused by the lack of appropriate prescribing information at the point of care, reduce paper consumption and improve efficiency and health care quality. The study has analysed data of usability from technology, interface and health care aspects. Both health care professionals and developers may benefit from knowing more details in some of the areas, such as the gender and age issues. These aspects may be important for the decision making when planning a new project, and should not be ignored.

In conclusion, this study has suggested that pen-based computing will play an important role in health care in the near future, because it has advantages of mobility and connectivity. Pen-based computing could be the next wave of computing, after mainframe computing, networking computing and personal computing. This study may bring understanding to health care professionals about the benefits and issues if they adopt PBCs in health care.

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