Abstract The availability of text reading and editing software for Personal Digital Assistants (PDAs) makes it timely to consider whether PDAs are useful tools for reading learning materials. This paper describes a study that evaluated the use of PDAs for reading by students on a Masters course run by the UK Open University. The evaluation consisted of pre- and post-questionnaires, and follow-up interviews. In addition, students discussed their experiences in a computer-based conference. Findings show that while the portability of the device was welcomed by students, and the electronic format was advantageous, limitations such as the small screen size, navigation difficulties, and slow and error-prone methods for entering text, made it difficult to read and interact with documents on the PDA. The paper recommends that further research consider the value of PDAs as reading devices in the context of other potential ways that PDAs can be used as learning tools.

Keywords Evaluation · Handheld computer · Learning · Palmtop · PDA · Reading

1 Introduction

1.1 Palmtop computers as learning tools

Palmtop computers, also known as Personal Digital Assistants (PDAs), are highly portable and personal computing appliances, which can be carried around and used ‘anytime, anywhere’. They can be used for a variety of functions; for example, to manage work or study schedules, to record and store data, and to access and disseminate information. In addition, the availability of e-book reading and editing software for most PDAs means they can also be used to read and interact with electronic text. As Stonier [1] predicted in 1991, people can now use handheld computers as electronic books. Recently, this increasing functionality of palmtop computers has led several authors to argue that palmtop computers could be usefully exploited as learning tools [2–7].

Studies investigating the potential use of palmtop computers as learning tools have primarily been conducted within school settings [4,8,9], although recent projects in the United States have also begun exploring the use of such devices in college and university settings [10,11]. Fung et al. [2] speak of a ‘paradigm shift’ towards portable computing in education, likening it to the historic shift from reading as an activity that took place only in centres of learning to an activity that became an integral part of everyday life. There is great potential for palmtop computers to provide students with a tool that can support learning in various contexts. Palmtop computers can be used, for example, in field work to record and share data, in libraries and museums, and at home, as well as in the classroom [3].

Sharples [6] proposes that palmtop computers could also be useful lifelong learning tools. He suggests that such tools could accompany learners throughout their lives, and be used to input data and access information whenever the learner feels it is necessary. In this way, portable devices would become lifelong learning tools that release the learner from situational constraints imposed by desktop computers. Similarly, portable computing technologies could be valuable for supporting open and distance education. Distance education students typically have to fit their self-managed learning activities around other tasks, such as work and family commitments [12]. Providing access to learning resources anytime and anywhere, palmtop computers could enable students to make more effective use of time while away from the home or office environment.
1.2 Using electronic text

The use of electronic text on desktop and laptop computers is not new. With the advancement and proliferation of information technologies, including such resources as the Internet and online books, reading is no longer confined to the use of printed text. Using a computer as a medium for reading text can offer advantages such as efficient search strategies, hyperlinks that connect sections of text, and convenient storage of large amounts of information [13–15]. However, people generally prefer reading paper documents to reading text on a computer screen [14,16,17]. In a study that compared the two media, O’Hara and Sellen [16] found that paper offered several advantages over computers. Participants in the study were assigned to either an ‘online’ condition or a ‘paper’ condition. Both groups were asked to read and summarise a 4-page (A4) article. Those in the paper condition were given a printed copy of the article and pen and paper for note-taking and summarisation. Those in the online condition were asked to read the document, take notes, and summarise the paper on Microsoft Word. Therefore, participants used either paper or the computer for all reading, note-taking and summarising tasks. Those is in the paper condition were able to navigate efficiently through the document using their knowledge of the information space and familiarity with the page layout to flick through the pages, jumping easily from one section to another. They were able to do this while simultaneously recording notes on a separate piece of paper. Meanwhile, those using the electronic version found it cumbersome to switch between viewing the document and taking notes, and they were only able to perform these activities serially, rather than simultaneously. These results suggest that using electronic text to read and take notes may be awkward compared with the relative ease of using paper documents.

Other common arguments for the superiority of paper are that paper can be used anywhere, compared with desktop computers that are static and can only be used in an office or desktop environment [14]. Laptops, too, are insufficiently portable, as they cannot be used in the same manner as books. With books, readers can sit anywhere, start reading immediately, change reading positions, and move easily from place to place. In contrast, desktop and laptop computers have many ergonomic constraints, with readers having limited control over the comfort of their reading environment [18]. The portability issue, however, may no longer be relevant, given the increasing availability of handheld e-book devices and the addition of ‘document-reader’ software on palmtop computers such as PDAs [13,19]. Such technologies aim to offer readers the benefits of accessing text electronically (e.g. storing several books on one device) while limiting the difficulties of reading text on a desktop computer. Researchers in this field argue that for such developments to be accepted and successfully integrated into workplace and learning cultures, they need to be designed to support the ways people actually read and use text [20,21].

1.3 E-books and PDAs

E-book devices are dedicated appliances designed specifically for reading electronic text [18]. Research investigating reading behaviours has produced several recommendations for the design of e-book readers. Such research recommends that e-books enable the recording of notes and annotations, offer facilities for searching, navigating and bookmarking, and support flexible and portable use of reading materials [20–23]. Thus, e-book readers are designed to fit in with the existing activity of reading and to support strategies that readers would typically use when interacting with printed text. However, dedicated e-book readers are designed for one task only (i.e. reading); therefore, in an educational context, students who wished to use an e-book reader would be required to purchase a piece of equipment that would only serve one purpose. This may be unrealistic for many students on limited budgets.

It may be, though, that students would use a tool they already owned to read electronic text while on the move. Personal Digital Assistants are general tools, designed initially to support personal information management [24]. They offer features such as a diary, address book and note-taking facilities. It may be that some students in distance education, particularly in disciplines such as business and educational technology, already use a PDA to support their workplace activities. E-book reading software is now widely available for use on PDAs [19]. Therefore, it is timely to consider the benefits and limitations of using PDAs to read study-related texts, and to determine what impact the use of a PDA has upon the activity of reading course materials.

1.4 Possibilities and constraints

The introduction of a new tool into an existing activity, such as reading, will inevitably disrupt and change that activity in some way. Carroll and colleagues refer to this process as the ‘task-artefact cycle’ whereby “an artifact suggests possibilities and introduces constraints that often radically redefine the task for which the artifact was originally developed.” [25, p79]. Thus, the task of reading would be redefined through the possibilities and constraints imposed by a PDA. The primary possibility introduced by a PDA is, of course, portability and, consequently, the ability to have easy access to information stored electronically. The constraints are equally apparent: the portability and palmtop size of the PDA compromise other features such as screen size and text input mechanisms, which may limit the extent to which the tool could be usefully applied in a learning context.

Development of the original PalmPilot involved careful consideration of every pixel used on the interface