

# Problems For Handheld Computers In Higher Education

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## Abstract

*One of the latest devices to be utilized in education is the handheld computer or PDA. This paper presents experimental results suggesting problems for the device in higher education. Handhelds have been used successfully in K-12 education; however, student and faculty research presented in this paper shows that the PDA's small form factor and other characteristics make the device less useful for college students.*

## Introduction

Handheld computers have been used successfully in K-12 education primarily because of large equipment and software donations by interested vendors. Several higher education institutions have tried to build on this success by experimenting with and requiring students to purchase handhelds. Such experiments have yet to show positive successes similar to those of K-12 education. This paper reports on research that identifies several problems with the use of handheld computers that may place limits on their success in higher education.

During the spring 2003 term, students in a senior level IS class on Computer Supported Cooperative Work were given a Dell handheld computer (PDA) with a wireless network card to experiment with as a potential aid in their college course work. Lectures were given on the successful use of PDAs in K-12 education and their current use in colleges as summarized in Johnson (2002) and Jones (2002). These papers suggest that while PDAs have had moderate success in K-12 education, their success in higher education has yet to be demonstrated.

In addition, students were assigned a group research project to investigate the use of PDAs in education. Students were presented with an overview of the research process, and each group was asked to write a research proposal for their project. This paper provides a review of several of the group research projects and summarizes the experiences of the students in using a PDA to help with their college course work during the term.

## Student Research Projects

Students were divided into groups of four or five to work on a semester-long research project pertaining to the use of handheld computers (PDAs) in education. Projects included "An Investigation of the Extent of PDA Usage in Local Schools"; "A Study of the use of Networked PDAs"; "An Investigation of the use of PDA Software to Support Learning"; and "A Study of the Use of E-content on PDAs and the Retention of Learning." The following subsections briefly describe these studies.

### *PDA Usage in Local Schools*

This study investigated the extent to which handheld computers were being utilized in local K-12 school districts. Each school in the three local school districts was called and the question "Do any of your classrooms use PDAs to support education?" was asked. Only one school in the entire area was found. In 2001 this middle school had been the recipient of a grant from Mindsurf Networks (now ETS) for 35 Compaq iPAQ Pocket PCs with keyboards and wireless Internet capabilities. The computers were used by a single class of gifted students. During the past two years, five of the computers were damaged. In addition, the software supplied has not been reliable,

and the network has had problems so the computers have not been used as much as the teacher would have liked. Such problems suggest that a technologically savvy teacher, or an on-site maintenance person, is required for success. The teacher also suggested that mechanisms for disabling games and restricting MP3 use are necessary in order to prevent distractions.

The results of this study showed that technical difficulties can stand in the way of the successful use of PDAs in education. The key appears to be finding the right teacher to make the use of PDAs successful. The implications for higher education are clear.

#### *Networked PDAs*

The objective of this group was to evaluate existing networking capabilities that would allow PDA-PDA and PDA-Internet communication. In addition, the group held a focus group of PDA users on campus to discuss the value and potential for networked PDAs to support learning. For PDA-PDA communication, the group found infrared beaming not very effective due to the requirements of the devices to be within two-three feet of each other. For PDA-Internet communication, the group utilized the existing 802.11b network. Numerous problems were identified including the difficulty of surfing the Web due to scrolling (most sites are not PDA enabled), problems in receiving and sending email, and the lack of security implemented on the network. One of the biggest networking concerns was the fact that when the network card was operating in the PDA, battery life decreased from two days to four hours.

The results of the focus group indicated that current PDA technology will never replace laptop or desktop PCs. PDAs are inconvenient for data entry without a keyboard. Their small screen size also limits the devices ease of reading for all but short periods. Finally, the focus group found that one of the biggest drawbacks to widespread use of PDAs will be the inability of instructors to adapt to and utilize the technology in their teaching.

#### *PDA Software*

This study investigated the use of PDA software to support learning in the college classroom. Students evaluated the usability, effectiveness, and capabilities of several software packages ranging from PowerPoint presenters to attendance trackers.

One of the packages used to track classes and assignments was given to the entire class to use for two weeks. Following this, an evaluative survey was administered to obtain student reactions to the product. The group found that many of the students did not care for the program because it had basically the same functions as Microsoft Outlook. An interesting observation was the view of students' perception to PDA's before and after the use of the software. Figure 1 is a chart showing the results of the study:

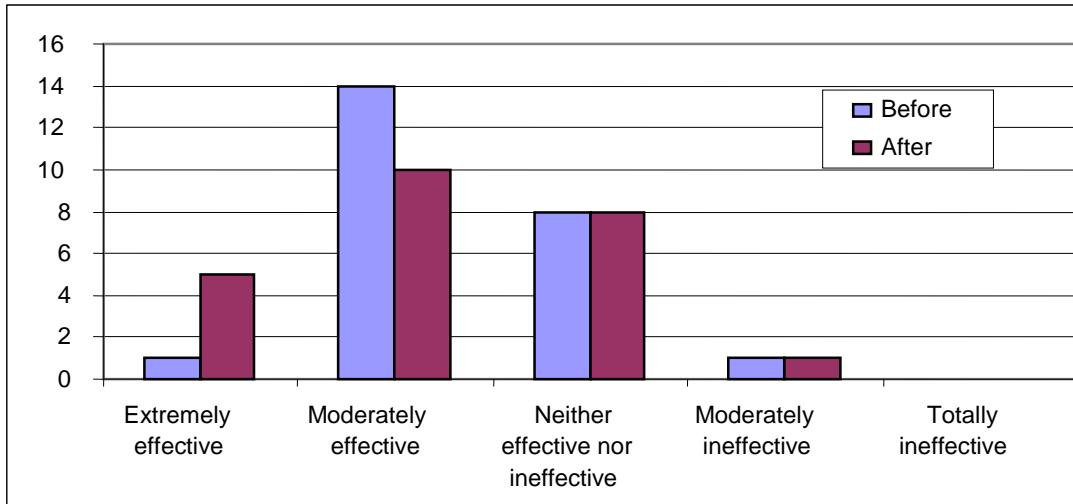
This chart shows that before the use of the software, fourteen students thought that the PDAs were moderately effective, and one student thought the PDAs were extremely effective. After the use of the software, the number of students indicating extremely effective increased by four. Another interesting finding was that most students did not realize that software for tracking assignments even existed. Twenty-five percent of students knew of similar software, while seventy-five percent of the students did not.

The group concluded that this software was a good way to keep track of scheduled items, but was overall not an effective tool for educational purposes. Most of the features of the software were available using Microsoft Outlook, and would be less tedious. Some of the features such as keeping track of books were found to be useless. Half of the class would not recommend the software to another student.

A second software package evaluated was called SlideShow Commander. This software claimed to be able to control and annotate the presentation of PowerPoint slides. Students found using the package to be frustrating

and trying to get the network to connect to the program difficult. Once the program was finally operational, it did not perform as promised. The only feature that worked was the remote control of slide advancement by the PDA.

**Figure 1: Effectiveness of PDA**



The other packages tested by the group included an attendance tracker and a quiz maker program. Both of these were found to be more effort to install and use than they were worth. Overall, the groups' conclusion was that most individual software packages for higher education are not ready to support classroom learning.

*The Use of E-Content on PDAs*

The objective of this study was to explore the effectiveness of using e-text for learning on handheld computers. The hypothesis was that there would be no difference in reading comprehension/retention between using e-text on a PDA and reading the same material on paper. Half of the students in a class were randomly assigned to read certain course material using e-text on a PDA and the other half to read the same material on paper. A brief exam was then administered to test students' reading comprehension and retention. Following the exam, a PDA Usage Survey was administered to those students who had used a PDA in the experiment. Students from three middle school classes, one high school class, and one college class were tested.

The following research questions were addressed. Is there any difference in learning retention and comprehension between traditional printed text and e-text? Are there differences between various educational levels (Jr. High, High School, College) in the use of e-text? And finally, what are students' perceptions of the effectiveness of PDAs in education and how do they differ between levels of education?

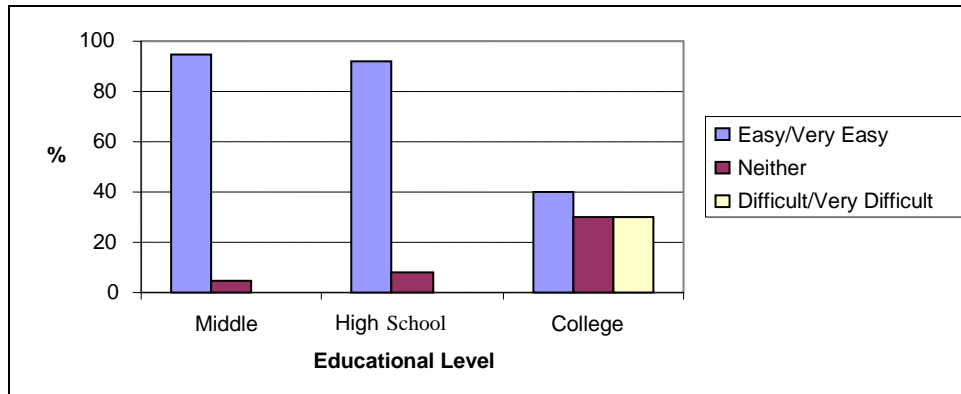
Excel was utilized for data storage and analysis. Basic statistics for the exam scores from the three schools showed very little difference in the mean scores between the PDA readers and the paper readers. The college class was the only one where the mean score for PDA readers was higher than that for paper readers, although the medians were equal. To test for statistically significant differences, several t-tests assuming equal variances and again assuming unequal variances were performed. In all the tests there were no statistically significant differences indicated at the alpha=.05 level. These results supported the group's hypothesis that there is no difference in reading comprehension and retention between using e-text on a PDA and using a traditional paper book.

In addition to the exam scores, data was also collected using a survey for PDA readers at the three schools. The purpose of the survey was to learn more about the students' feelings and experience from using a PDA and to

assess any differences between the various educational levels. The questions dealt with the ease of using and learning with the PDA, the likelihood of PDA use and problems in education, and the value of various PDA software. What follows are summaries of several of the questions showing the most interesting results.

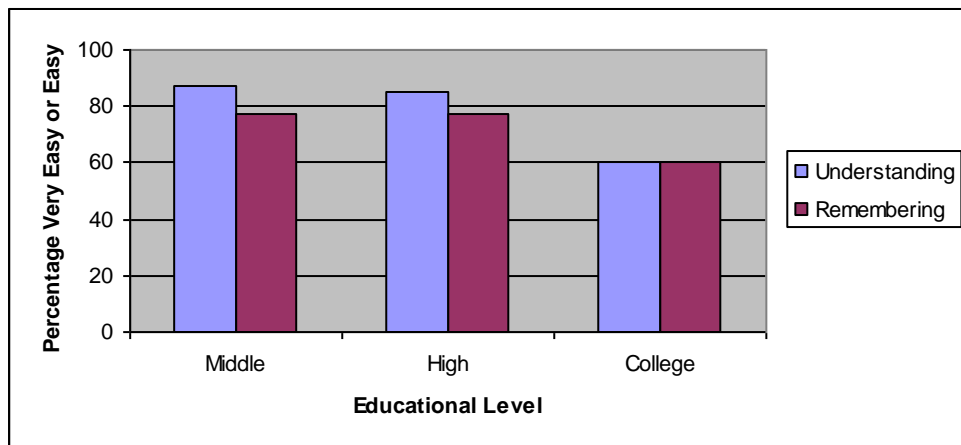
The first question involved “Easy of reading the document”. Figure 2 shows a comparison across the educational levels of students responding that using e-text on a PDA was either “easy” or “very easy.” Notice that the middle school at 95 percent and high school at 92 percent both agreed that documents were easy to read on the PDA. On the other hand, only 40 percent of the college students felt that it was easy to read the PDA documents and 60 percent split evenly between difficult and neither.

Figure 2 – Ease of Reading E-text on a PDA



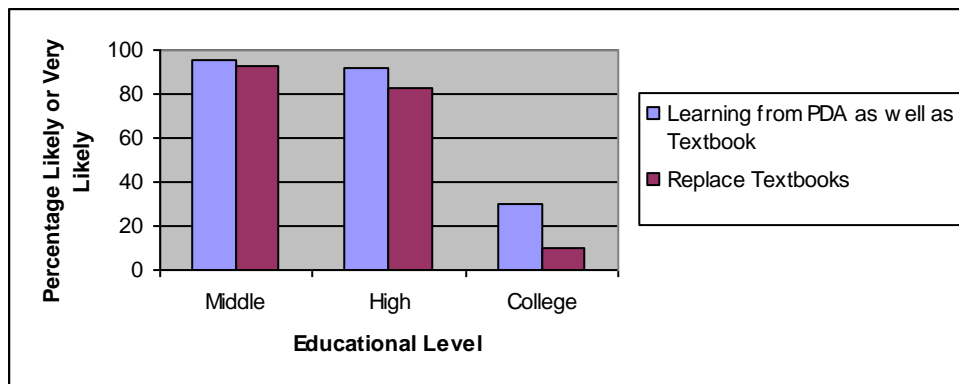
The next questions involved, “Ease of remembering and understanding what you read”. Figure 3 shows the percentages of students answering “easy” or “very easy” to the two questions. Middle school and high school students responded approximately the same. Once again, college students felt less sure of their understanding and remembering what they read on the PDA. This is undoubtedly caused by their difficulties in reading the e-text as indicated in Figure 2.

Figure 3: Ease of Understanding and Remembering E-text on a PDA



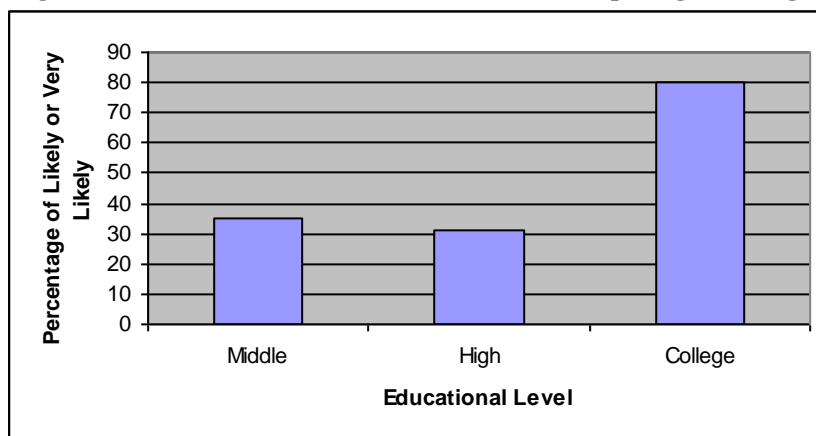
Following this, the questions “How likely can you learn as well with a PDA as with a textbook?” and “How likely will the PDA replace textbooks in education?” were analyzed. Figure 4 shows the percentage of students responding either likely or very likely to each of these questions. Notice that both middle school at 96 percent and high school at 92 percent feel that they could learn as well using a PDA as with textbooks. The college students, however, disagree with only 30% favoring the PDA. The contrast is even greater for the thought of PDAs replacing textbooks. The middle school at 93 percent and high school at 85 percent both agree that in the future there is a place for PDAs in the school system. The college students feel drastically different with only 10 percent of college students believing that PDAs will replace textbooks.

Figure 4: E-text on PDA vs. Textbooks



Finally, the issue of PDAs impeding the learning process was addressed. Figure 5 shows the percentage of “likely” and “very likely” responses to the question “How likely are games and the Internet on a PDA to impede your learning?” While only 30 percent of middle and high school students perceive a problem, 80 percent of the college class do. It should be noted, however, that the college class had been using PDAs for several months and could comment first-hand on the potential distraction of games and Internet browsing. This may also be due to the more highly structured learning environment in K-12.

Figure 5: Likelihood of PDA Games and Internet Impeding Learning



### **Conclusions from Student Research Projects**

Students experimented with the use of PDAs to support education. PDA software purchased as individual packages was found to be inadequate for classroom use. Integrated software purchased from vendors was better suited to the classroom but still had many technical problems requiring frequent help from the vendors.

Current wireless networking (802.11b) has adequate capabilities for PDA-Internet communication if security issues can be addressed. Web browsing, however, will be problematic on the small PDA screen until more sites become PDA enabled. PDA-PDA communication using infrared beaming, while sounding exciting, is severely limited by line of sight and short distances.

When comparing reading retention, no difference in retention rates in reading from a PDA compared to reading from paper across all educational levels studied was found. These results would indicate that a PDA with e-books can be a useful tool in education. On the other hand, survey results showed major roadblocks to the successful use of PDAs and e-books in college. College students found it difficult to read text on a PDA's small screen and were less confident in their ability to comprehend and remember content read from a PDA. In addition, the survey data suggests that college students are prone to distractions from schoolwork such as game playing or Internet surfing on the PDA. These factors suggest that the use of PDAs by college students will be limited.

### **College Students' Experiences Using a PDA**

As discussed in the Introduction, a class of 25 IS students was given a Dell PDA with a wireless network card to use during the Spring-2003 term. A limited number of keyboards were also available for students to share. Following a discussion of current PDA educational usage reported in the literature, students were asked to use the equipment during the term to help with their course work as well as for personal use. For the most part, students were left to experiment with the device on their own with few required assignments. At the end of the term, students were given a brief survey to help quantify their experiences.

Overall, only 36 percent of the students agreed or strongly agreed that the PDA was a valuable tool in helping with their coursework. Forty percent were neutral. Those that disagreed were students that had only minimally used the equipment or were already using a laptop computer. The typical PDA functions of scheduling, contact lists, and to do lists were cited as most beneficial. Only two of the students used the PDA for taking notes. Four students indicated that the downloading of course content and its availability electronically was an important factor. The biggest drawback cited (36 percent) was the small screen size. This was followed by difficulties in input using the stylus (20 percent). Students were divided on the value of the wireless network. Fifty-six percent indicated that wireless access was important; however, a nearly equal number (44 percent) indicated that the wireless network had little value to them. Problems cited included web browsing on the small screen (most web sites are not PDA enabled) and problems with email. While portability of the device was cited as important (25 percent), students also indicated that carrying and caring for the equipment was a concern (20 percent).

Most of the students did enjoy experimenting with the PDA (Agree: 72 percent; Strongly Agree: 16 percent; Neutral: 12 percent). However, when asked if they planned to use a PDA in their future schooling or work only 52 percent agreed or strongly agreed and 48 percent disagreed or were neutral. Finally, when asked if all faculty and students at the college should be required to use a PDA, 32 percent disagreed or strongly disagreed, 52 percent were neutral, and only 16 percent agreed.

### **Summary**

This paper has explored the use of handheld computers or PDAs in education. The literature abounds in anecdotal examples of the successful use of PDAs in K-12 education, mostly generated by the donation of equipment by the PDA vendors. Financial and maintenance concerns may limit the wide-spread duplication of these success stories in K-12 education. The success of PDAs in higher education, however, is yet to be determined.

Faculty and student research described in this paper suggests that there are serious roadblocks to a successful college career for PDAs. Hardware and software problems currently limit success. While experiments show that there is no statistical difference in the comprehension and retention of content read from paper documents vs. read from e-text on a PDA across educational levels, survey data suggests that college students have a harder time reading e-content on a PDA than do middle or high schools students. Furthermore, college students are more prone to be distracted from schoolwork by the use of PDA games and Internet surfing than K-12 students. Overall, college students are much more pessimistic about the successful use of PDAs than are K-12 students.

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Notes