

USING HANDHELD COMPUTERS TO SUPPORT COLLABORATIVE RESEARCH AND LEARNING: A COURSE EXPERIMENT

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ABSTRACT

Students in a senior level information technology class were loaned handheld computers with wireless network connection to support project collaboration and learning. Results of the experiment indicate that students were able to demonstrate the usefulness of the equipment based upon collaboration models found in the literature. The overall value of the technology, however, was not significant to the students based on the results of a class survey.

Keywords: PDA, handheld computers, collaboration, CSCW

INTRODUCTION

During the Spring 2003 term, students in a senior level information technology (IT) class on Computer Supported Cooperative Work were given a Dell Axim X5 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 (3) and Jones (4). Models for and examples of the use of the computer as a communication and collaboration tool were also presented.

In addition, students were assigned a group research project to investigate the use of PDAs in education and were required to use the PDA to support their groups. Students were presented with an overview of the research process and each group was asked to write a research proposal for their project and to use the PDA as a collaboration tool. After several iterations of the proposals and the approval of the institution's IRB, the student researchers began their projects. Projects included "An Investigation of the Extent of PDA Usage in Local Schools", "A Study of the Use of Networked PDAs", "The Use of PDAs in Medical Education", "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." Students were required to keep a diary in MS Word with entries describing how they were using their PDA during the term.

This paper provides a qualitative description and the results of the collaboration experiment and summarizes the experiences of the students in using a PDA to help with their project work during the term. Finally, the results of a survey of the experience of the students in the college course regarding their use of the PDA to support their learning during the term are presented.

A PROJECT COLLABORATION SUPPORT MODEL

The use of IT to support groups is not new. In fact, much of the research in the computer supported collaborative work (CSCW) and groupware arenas is ten or more years old (2). The dearth of recent literature may be due to the lack of significant findings in the early research, or, as Karsten (5) notes, due to the fact that there is no “collaboration-inducing” model inherent in most IT supporting tools.

The goal of CSCW, according to Pfeifer (7), is to discover ways of using computer technologies to further enhance the group work process through support in the time and place dimensions. McNurlin and Sprague (6) describe a slightly more complex model as shown in Figure 1.

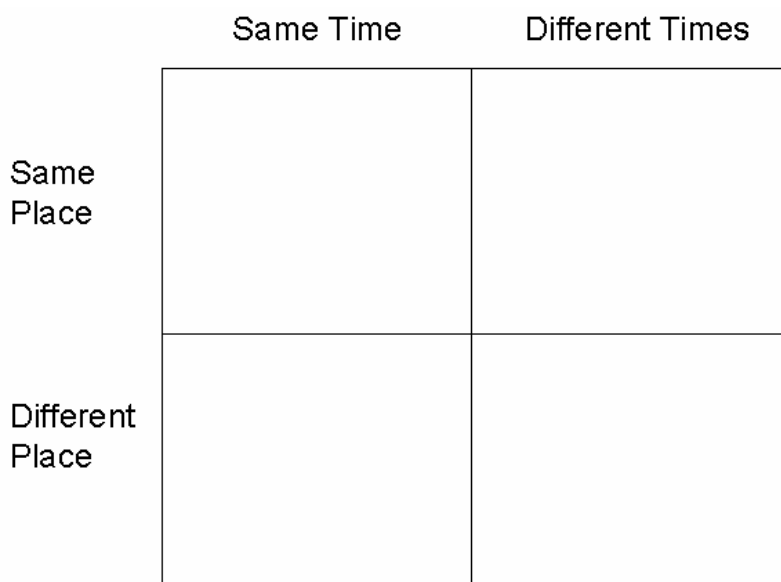


Figure 1

Pfeifer (7) further suggests a number of ways in which IT could help satisfy CSCW goals. These include

- An interactive communication environment (broken down further in Figure 1),
- A personal secretary-like service,
- Time management capabilities,
- Multi media capabilities,, and
- End user programming capabilities.

In addition, Karsten (5) adds the following to the list:

- Document management capabilities, and
- Problem solving support.

STUDENT USE OF PDAS TO SUPPORT PROJECT COLLABORATION

According to Dean (1), PDAs can be utilized as more than just organizers. They can also help in collecting data, checking facts, communicating with other computers, and collaborating on

projects. Soloway et al. (9) and Waslery (11) give examples of such attempts in K-12 education. Young (12) and Ruley (8) predict that the use of handhelds will have similar success stories in higher education.

This section reports the results of such an experiment. As previously indicated, students in a senior level IT class on CSCW were loaned handheld computers with wireless networking cards to use as an aid in their class project work. Their usage of the technology was recorded as part of a required diary assignment. At the end of the term, the diaries were analyzed and usage patterns categorized according to the CSCW models presented in the previous section.

Same Time – Same Place Usage

On the day their project team was formed, students were able to use their PDA to beam their contact information to team members. Since each team had at least one keyboard, they were able to take meeting notes/minutes on the PDA and beam the file to each member at the close of the meeting. Most of the students did their writing assignments on their PC at home and then downloaded the MS Word file to their PDA while syncing. They then used the document transfer capabilities of the Dell to beam their work-in-process documents to the team leader. One of the teams utilized the PDA as a data collection device by entering survey data into Excel at remote sites.

By using the network card, students also were able to transfer files from the main FTP area, search the Internet to answer questions during the meetings, and search their email folders to find specific messages.

Different Time – Same Place Usage

One team required each member to complete a portion of the literature review at the library. By sharing the keyboard, they were able to take notes on articles they read from the current periodical shelves. By going in sequence, each member was able to see what the previous person had found and add to the review with new articles.

Same Time – Different Place Usage

Three of the teams figured out how to use MS Instant Messenger on their PDA. Since several of the team members had a wireless home network connected to the Internet, they were able to hold several chat sessions between themselves and other team members who were at school. One of the team members, who used AOL, even spent the \$19.95 to download the AOL IM client for his PDA. Another enterprising student figured out how to use his PDA and Remote Terminal Services to control his computer at home in addition to the one at work.

Probably the most ingenious communication involved a team who was holding a meeting with one person absent. Not having access to a phone, they were able to use the wireless network to access the Web for the carrier of the absent person to send a text message to his cell phone. The absent member soon arrived, although somewhat embarrassed.

Different Time – Different Place Usage

Not surprisingly, the biggest use of the technology in this dimension was the use of email. Each team utilized email for keeping in touch and sharing documents. One team attempted to use a Web-based bulletin board system on their handhelds with little success. Several students did utilize the PDA as a document reader, storing reading assignments and then utilizing spare minutes during the day as well as while traveling to read the documents.

A Personal Secretary-like Service

Several characteristics of a handheld computer seem to fit this role. In fact, this area was probably the most widely used by the students. Keeping their contact lists, meeting/calendar lists, and to-do lists showed that they were using the device as a personal organizer. Being able to sync their PDA with their home and work computers was also important. However, far from thinking of the device as a personal secretary, many of the students felt more like the PDA was a young child that needed special care. There were constant worries that the device would be damaged or stolen.

Time Management Capabilities

This category is somewhat like the preceding one. One of the most important features of the PDA that comes into play here is its use of alarms to remind students of meetings. Also mentioned was the ability of the device to prioritize tasks, thus helping students to focus on the most pressing items first.

Document Management Capabilities

The fact that MS Word was available on the handheld computers provided many opportunities. While creating documents without a keyboard proved to be a problem, transferring documents created on a PC while syncing was widely used. These documents were then beamed to team members for review. Several individuals also found that printing documents using the infrared port was convenient.

Multi Media Capabilities

Many of the students found the audio recording capabilities of the PDA to be useful. Recording voice reminders and lists for future entry proved easier than entering the data directly into the device at the time. Surfing the Web was also a common occurrence. Students experienced problems with sites requiring the use of Flash animations. One student found a Flash plug in for Internet Explorer on the PDA, however it did not operate properly. The biggest use of multi media, however, turned out to be game playing and MP3 playing. While these uses would appear to have little to do with collaboration, they did allow for frequent breaks from the grind of school and project work. One of the students even reported that a game helped keep her child quiet while she worked on her project.

Problem Solving Support

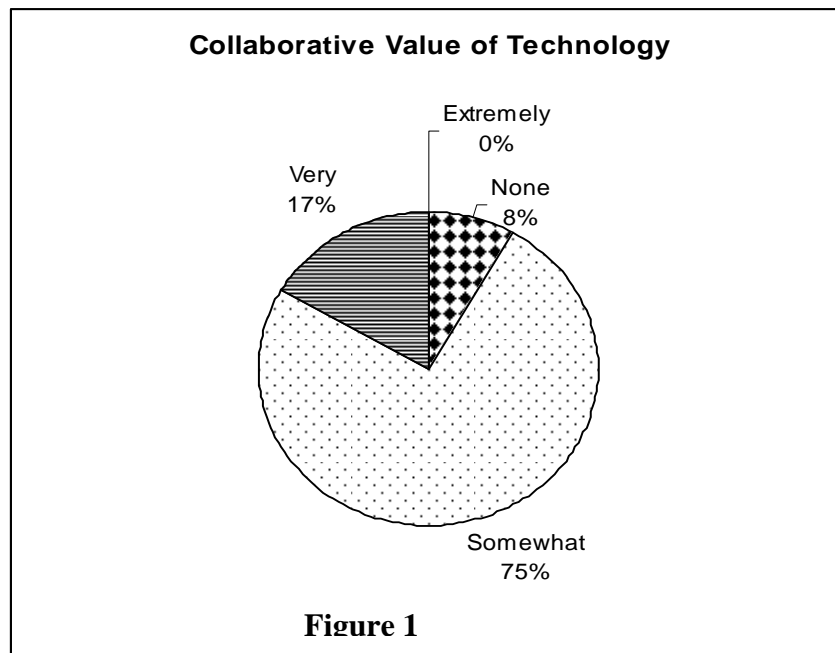
The biggest use of the technology in this area was the use of downloading tutorials and information from the web or local FTP server for studying. One team attempted to use Excel on the PDA but found the features too limited.

End-user Programming Capabilities

Several students indicated that they would have liked to learn how to program the PDA as part of the class but time limitations prevented this. What the student did do, however, was to download various software packages from the Web and test them as part of the experiment. Most diary entries, however, showed that such software had numerous problems and little value.

Student Assessment of Value

At the conclusion of the term, students were asked to evaluate the collaborative value to their team of the handheld computer with network connection. The chart in Figure 1 shows that, although the students found some degree of value, it was not overwhelming.



STUDENT USE OF PDAS TO SUPPORT LEARNING

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 course work. 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 appointments, maintaining contact lists, and keeping to-do lists were cited as most beneficial. Only two of the students used the PDA for taking class 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. 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.

CONCLUSION

This paper has described the results of a class experiment in the use of handheld computers with wireless network cards to support project collaboration and learning. Students were required to record their use of the technology. Their diaries were analyzed and entries categorized into a computer supported cooperative work model suggested in the literature.

Results show that most of the students were able to use the technology to support collaboration in all the dimensions of the model. This suggests that handheld computers are indeed a useful tool for collaboration. Further analysis of the diaries, however, suggests that the usage appears to be more superficial than substantial, that is, not a consistent thing. In fact, based on a survey administered at the end of class, only 17 percent of the students felt that the technology was “very beneficial” while none of them felt that it was “extremely beneficial” for collaboration. This is supported by additional survey data showing that only 36 percent of the students “agreed” or “strongly agreed” that the PDA was a valuable tool in helping with their coursework while forty percent were neutral. Part of this may be due to the fact that the handheld computers were only loaned to the students, thus limiting effort and commitment (several diary entries support this). Additional evidence is also seen in the fact that many students had a difficult time entering data into and reading from the small form-factor technology. Further experimentation in an environment where the technology is owned by the students who are accustomed to the form-factor will help to control these factors.

REFERENCES

1. Dean, Katie (2002). Study: PDAs Good for Education, *Wired News*, Nov. 12, Retrieved 2/23/04 from <http://www.wired.com/news/school/0,1383,56297,00.html>
2. Grudin, J., (1994). Computer-Supported Cooperative Work: Its History and Participation. *IEEE Computer*, 27, 5, 19-26.
3. Johnson, D.W., Jones, C.G., & Cold, S.J. (2002). Handheld computers: Ready for prime-time in the college classroom? In the refereed *Proceedings of the 2002 Americas Conference on Information Systems (AMCIS)*, Dallas, TX. Association for Information Systems.
4. Jones, C.G., Johnson, D.W., & Cold, S.J. (2002). M-education: Mobile computing enters the classroom. *Issues in Information Systems*, 3, 309-315.
5. Karsten, Helena (1998). Colloboration and Collaborative Information Technology: What is the Nature of Their Relationship?, *Proceedings of IFIP Working groups 8.2 and 8.6 Joint Working Conference On Information Systems: Current Issues and Future Changes*, pg. 231
6. McNurlin, B. & Sprague, R. (2004), *Information Systems Management in Practice*, Pearson Education, Inc. Upper Saddle River, NJ
7. Pfeifer (1995). The Domain and Goals of CSCW, Retrieved 2/23/04 from http://ksi.cpsc.ucalgary.ca/courses/547-95/pfeifer/cscw_domain.html
8. Ruley, John D. (2002). PDAs in Education. *Windows & .Net Magazine*, Oct. 3
9. Soloway, E., Grant, W., Tinger, R., Roschelle, J., Mills, M., Resnick, M., Berg, R., and Eisenberg, M. (1999) Science in the Palms of Their Hands. *Communications of the ACM* (42:8), August 1999, pp. 21-26.
10. Spring, M & Vathanophas, V. (2003). Peripheral Social Awareness Information in Collaborative Work, *Journal of the American Society for Information Science and Technology*, Vol. 54, Issue 11
11. Waslery, Darrell (2003). District 230 Students Make Use of Handheld Computers. *PDA.com*, Retrieved 2/23/04 from <http://www.pdaed.com/features/district230.xml>
12. Young, J. (2001). Administrator Predicts That Handheld Computers Will Be Big on Campus, *The Chronicle of Higher Education*, July 5