Using Handhelds to Support Collaborative Learning

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ABSTRACT

Research suggests that collaborative classroom activities offer many benefits for learning. To collaborate successfully, students need adequate tools to share ideas and resources, develop and support arguments, and cooperate to solve problems. Handheld computers are emerging as a flexible and portable solution that provides students with "ready to hand" support to engage in collaborative activities anytime, anywhere. Handhelds can also be coordinated with desktops to support small group collaboration when larger workspaces are needed.

Keywords

Handheld computers, collaborative learning, wireless Internet, concept maps.

INTRODUCTION

While traditional K-12 education models focus on individual learning, abundant research has led to an emerging understanding of the benefits of collaborative learning. By cooperatively completing shared tasks, students can generate ideas, explore concepts, share resources, and construct arguments to build deeper understanding. In order to participate fully in collaborative activities, students must have access to a wide variety of information, understand the processes and skills required by the task, and become proficient in new terminology and content materials. One way to address these needs is to use a Scaffolded Work Environment, or SWEts (Luchini, Oehler, Quintana, & Soloway, 2001). While desktop SWEts like Symphony (Quintana, Eng, Carra, Wu, & Soloway, 1999) and Belvedere (Suthers, Toth, & Weiner, 1997) are powerful tools for learners, too often desktops in schools are confined to labs and libraries and the student-to-computer ratio is too high to allows students regular access to the machines. Handheld devices (such as Palms and PocketPCs) offer the opportunity to provide each student with their own computer. The mobility, flexibility and instant access of handheld devices means that they are "ready to hand," allowing students to engage in highly collaborative activities anywhere, anytime (Soloway et al., 2001). To help students use handheld devices as learning tools, the Center for Highly Interactive Computing in Education (hi-ce) at the University of Michigan has developed several educational applications designed specifically to take advantage of the mobility, flexibility, and easy collaboration engendered by handheld computers. Yet, desktop and projected workspaces will still play an important role in group activities, providing additional workspace that enables students to compare their work while also benefiting from the scaffolding of SWEts. In this paper we introduce some of of our handheld applications and describe an activity scenario for coordinated use of handheld and desktop educational applications. This scenario will be simulated in the conference interactive session.

EDUCATIONAL APPLICATIONS FOR PALM DEVICES

Hi-ce has developed a number of educational applications for use on Palm devices (Table 1). These programs have been used successfully in a number of classrooms in Michigan, and hundreds of copies have been distributed to educators across the country. The applications provide a wide range of features, and are designed to be both educational and academically flexible. These programs are available free of charge at http://www.hi-ce.org/palms.

Table 1: Educational Applications for Palm Devices

Application	**Description**
PiCoMap	Allows students to create, share, and explore concept maps consisting of nodes connected by directed arcs.
Fling-It	Allows students to instantaneously "fling" websites from a desktop computer to their handheld devices for off-line reading to build a personal library of websites with reference materials, news, reading materials, etc.
Go 'n Tell	Combines the Kodak PalmPix camera and a Palm computer to allow students to take pictures, annotate them, share the resulting "scrapbook pages" with each other, and instantly create a website displaying their work.
Cooties	A virus-transfer simulation. Teachers determine parameters for "coodles"—Cooties characters that "live" on students' Palm devices. Coodles meet each other via beaming, and some coodles will become "sick". Students then collaborate to determine which coodles were initial carriers and trace the virus transmission path.

CLASSROOM EXPERIENCES

During the 2001-2002 school year, hi-ce is working with two eighth grade science classes at Greenhills School in Ann Arbor, Michigan, to study how students can use handheld devices to collaborate. We provided each student with a Compaq iPAQ running Windows CE. The handhelds have a wireless network card for Internet access, and can "beam" data using infrared technology. We wrote a concept mapping tool for the iPAQs called Pocket PiCoMap, which allows students to build collections of nodes indicating main ideas and directed arcs connecting them (Figure 1). The teacher asked the class to make individual concept maps, exchange maps with a partner (by beaming), and then write comments about their partner's map using the "Map Notes" feature and beam the annotated map back to its owner. The collaborative activity of exchanging and critiquing each others' work led many students to discuss various ideas and revise their own maps to include additional information or different perspectives.

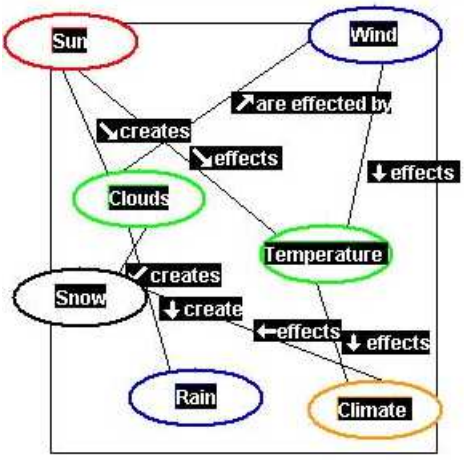

Figure 19: Student's Weather Concept Map

COORDINATING DESKTOP AND HANDHELD APPLICATIONS

Hi-ce and the Laboratory for Interactive Learning Technologies of the University Hawai`i at Manoa are working together to explore the synergy between handheld and desktop tools for helping students collaborate. While handheld computers can offer each student access to personal computing, the limited screen space of handheld devices suggests a remaining role for desktop systems to support group work, where the higher student-to-computer ratio is not an issue. In our CSCL 2002 interactive session we will explore an activity scenario in which individual work done on handhelds is transferred to the desktop for small group and full group manipulation and discussion of the knowledge artifacts. Individual concept maps are first constructed on handhelds and refined by pairwise collaborations using infrared networking as described above. Then these maps are uploaded to a PC into a version of Belvedere (Suthers, Toth & Weiner, 1997) designed to support comparative concept mapping. Small groups of learners display their concept maps side by side and merge them into a consensual knowledge artifact. The juxtaposition of individual work confronts students with alternate conceptions and prompts the justification of their own choices (activities known to improve learning), while the visual representations also help coordinate and ground their conversations. In classrooms with projection devices the resulting group maps might then be merged into a class-wide concept map. Grounded in this hands-on experience, interactive session participants will discuss strategies for maximizing the potential of both handheld and desktop devices for education.

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