Introduction to the special issue on wireless and mobile technologies in education

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This special issue is a sequel special issue of the same topic in Vol. 19, No. 3, September 2003. This issue features revised and elaborated versions of best papers presented at the two international conferences on mobile learning. The Second IEEE International Workshop in Wireless and Mobile Technologies in Education (WMTE) was held at the National Central University in Chungli, Taiwan, in March 2004 with the theme of mobile support for learning communities. The Third European Conference on Mobile Learning (MLEARN) was at Lake Bracciano, Italy, in July 2004, with the theme of learning anytime, everywhere.

Together, these events presented the considerable progress in research into learning across contexts, through emerging wireless and mobile technologies. They represent distinct though interlinked perspectives: wireless and mobile technologies bring new opportunities for learners to be more intensely connected, either face to face or at a distance, extending one’s learning community to friends, teachers, mentors, parents, and beyond; to enhance learning in an age of mobile technology we must explore and support learning in multiple contexts, across a lifetime of cognitive change and social interaction.

This special issue reveals the productive interaction between new ecologies of learning and wireless and mobile technology. Three of the papers focus on extending learning outside the classroom. We will introduce these first, followed by the four papers that focus on intensifying learning inside the classroom.

Corlett and colleagues evaluated the use of a mobile learning organizer implemented on a personal digital assistant (PDA). Students were given a PDA loaded with tools such as a study timetable, a course manager, and a concept mapper. They used these tools for 10 months. The most striking results are that students changed their usage patterns over time. This is an important reminder that a personal mobile device may grow with the student or fall out of favour after the initial interest wears off. The other main conclusion is that no single tool stood out in helping students to manage their learning, an indication that learning management is a complex process that may best be enhanced by a subtle combination of mobile technologies and human assistance.

Schwabe and colleagues designed and evaluated a mobile game used to orient incoming students to the university campus. They also use a PDA, but whereas Corlett et al. employed the PDA as a tool, Schwabe and colleagues use it to create a mixed reality in which physical space is augmented with contextual information. Their study reveals the technical challenges of implementing location-aware educational applications. They also show that students became more engaged and motivated, especially with map-based and competitive activities. Although the results are preliminary, providing an information and social activity overlay to a university campus appears to be a promising direction for future work.

Of the three outside-classroom applications, Thornton and Houser make the most direct connection to learning. In contrast to the first two papers, they begin with a survey of how Japanese university students are already using mobile devices, finding that 99% send e-mail on their mobile phones and exchange 200 messages per week! They then creatively exploit students’ existing patterns of use to intensify learning: they send students small text and video messages that relate to upcoming English lessons. Students who received mobile e-mail learned more. Their creative
design neatly links informal, asynchronous, casual activity (reading e-mail) with more formal classroom instruction.

Turning to the within-classroom uses, all four papers feature formative assessment as an important application of wireless and mobile technologies. By providing a more rapid and easily interpreted classroom feedback loop, these technologies can intensify learning. Besides formative assessment, two papers by Cortez and Liang with their colleagues demonstrate collaborative learning supported by handheld devices with wireless capability can potentially enhance classroom learning.

Roschelle and colleagues target formative assessment most directly. Their paper features a requirements analysis of what science teachers need by way of formative assessment tools. The central contribution of their paper is the idea that such tools should ‘informate’ rather than merely automate existing classroom practice. By informate, they mean expanding the range of assessment tasks through new representations and communication capabilities, creating new roles for students in expressing what they know and can do, and focusing teacher and student attention on scientific concepts. The paper reminds us that teachers are often ‘in transition’ to desirable practices such as formative assessment. Thus, tools need to meet teachers where they are.

Cortez and colleagues share the results of two experiments, one for supporting students to learn science and one for teacher training, with a formative assessment tool based on principles of computer-supported collaborative learning. They find direct evidence that mobile and wireless support for collaborative activity intensifies learning: both students and teachers learned more with their tools. Their tools enable this by providing a simple but critical coordination functionality, which pushes students to discuss their answers and seek consensus on the correct answer. In conjunction with other work by this group and similar work by other groups, these results suggest that collaborative formative assessment is a powerful genre for mobile and wireless technologies in classrooms.

The paper by Sung and colleagues perhaps is the most technically ambitious paper. They produced an apparatus that instruments the classroom for capture of data from multiple sensors. In the simplest case, their system can replicate formative assessment and polling applications. The richer cases are more interesting. This team attached a variety of sensors to students within a classroom to create a stream of data about their emotional and attentional state. Meanwhile, audio streams are captured. Then the system can automatically detect and replay the highest interest portions of the classroom dialogue. Talk about intensifying the classroom experience! How many years will we wait for the headline ‘MIT graduates first cyborg student’?

Finally, the last paper in this issue, by Liang and colleagues is different from all other papers, providing some diversity in this set of papers. Drawing upon their experience in designing and experimenting in a series of evolving wireless and mobile classroom environments, they describe several design components, including student and teacher’s device, device management system, communication network, classroom server, and classroom shared screen. It should be noted that it is not necessary that a wireless and mobile classroom must consist of all these components. But, each component, if it exists, exhibits a different role in a classroom environment. These evolving systems have been used for experiments in formative assessment, small group collaboration, and recently for peer tutoring and peer question posing. They also describe an EduCart which is a device management system containing wireless LAN access point, student device recharging slots, device storage, and a classroom server. EduCart is a moveable trolley, easily moved from one classroom to another classroom.

In an early paper on wireless and mobile technologies, Roschelle and Pea (2002) suggested that the new capabilities of these platforms might shift computer-supported collaborative learning towards augmented activity spaces, which coupled social and informatic layers of communication. Across these papers, we see that trend blooming. WMTE applications are augmented physical campuses and classrooms, layering learning into existing patterns of communication and tool use, and providing rich instant feedback within social learning processes. Furthermore, a paper from Sharples (2000) indicated that the theory and practice of learning is in a period of intense change, as we come to understand how people blend formal and informal learning and manage their studies across life transitions. One of the examples for this is the recent work of Chan and his colleagues.
They have been working on two areas in parallel, starting from 1998 (Chan et al. 2001). One is building a Web-based learning community, called EduCities, used by more than 1.5 million people, to experiment various learning activity models. The other one is wireless and mobile technology used for outside and inside classrooms. It is now getting clear that the existence of Web-based learning does not mean every student can access it. Yet, Web-based learning is a form of informal learning that will become a part of the formal learning of our education systems. However, if the price of computers continues to drop rapidly, there will be a growing number of classrooms where every student has a wireless-enabled computing device in the future as envisioned by some researchers (see http://www.g1on1.org). At such a time, every student in such a classroom will access Web-based learning as well as wireless and mobile learning. Furthermore, students can switch from one scenario to another scenario seamlessly, for example, from classroom to outdoors or at home, from individual learning to small group collaborative learning or a large network learning community easily and instantly. The papers in this issue show how mobile and wireless technologies can enable learning within and beyond the classroom, to ultimately support a lifetime of personal and social enrichment.

References