Learning Technology

publication of

IEEE Computer Society
Learning Technology Task Force (LTTF)

http://lttf.ieee.org/learn_tech/

Volume 5 Issue 2	ISSN 1438-0625	April 2003
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From the editor ..

Welcome to the April 2003 issue of *Learning Technology*.

This issue is devoted to the theme "Use of mobile technologies in education".

The IEEE International Conference on Advanced Learning Technologies (ICALT 2003), Athens, Greece (July 9-11, 2003) is turning out to be a very high quality conference. The website of the event is http://lttf.ieee.org/icalt2003/. The call for participation is available in this newsletter below.

More related event to this themed issue is the IEEE International Workshop on Mobile Technologies in Education (WMTE 2003), Taiwan (December 8-10, 2003). The deadline for paper submissions is June 16, 2003. You can find further information on the website http://lttf.ieee.org/wmte2003/ or in the call for papers below.

You are also welcome to complete the FREE MEMBERSHIP FORM for Learning Technology Task Force. Please complete the form at: http://lttf.ieee.org/join.htm.

Besides, if you are involved in research and/or implementation of any aspect of advanced learning technologies, I invite you to contribute your own work in progress, project reports, case studies, and events announcements in this newsletter. For more details, please refer author guidelines at http://lttf.ieee.org/learn_tech/authors.html.

Kinshuk
Editor,
Learning Technology Newsletter
kinshuk@massey.ac.nz

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3rd IEEE International Conference on Advanced Learning Technologies (ICALT 2003)
July 9-11, 2003
Athens, Greece
http://lttf.ieee.org/icalt2003/

*** List of accepted papers is now available at the conference website ***

*** Important Dates**

May 30, 2003	Early bird registration deadline

*** Topics of Interest**

Adaptive and Intelligent Applications
Advanced uses of Multimedia and Hypermedia
Ambient Intelligence and Ubiquitous learning
Application of Artificial Intelligence Tools in Learning
Architecture of Learning Technology Systems
Building Learning Communities
Computer Supported Collaborative Learning
Distance Learning
e-Learning for All: Accessibility Issues

Educational Modelling Languages
Evaluation of Learning Technology Systems
Instructional Design Theories
Integrated Learning Environments
Interactive Simulations
Knowledge Testing and Evaluation
Life-Long Learning Paradigms
Learning Styles
Media for Learning in Multicultural Settings
Metadata for Learning Resources
Mobile Learning Applications
Pedagogical and Organisational Frameworks
Practical Uses of Authoring Tools
Robots and Artefacts in Education
Simulation-supported Learning and Instruction
Socially Intelligent Agents
Speech and (Natural) Language Learning
Learning Objects for Personalised Learning
Teaching/Learning Strategies
Technology-facilitated Learning in Complex Domains
Virtual Reality

*** Program Co-Chairs**

- J. Michael Spector, Syracuse University, USA
- Vladan Devedzic, University of Belgrade, Yugoslavia

*** General Co-Chairs**

- Kinshuk, Massey University, New Zealand
- Demetrios G Sampson, CERTH-ITI and University of Piraeus, Greece

*** Conference highlights**

- *Keynote speakers:*
    - Erik Duval, Professor, Katholieke Universiteit Leuven, Belgium
    - Elliot Soloway, Professor, University of Michigan, USA, and Cathleen Norris, Professor, Department of Technology and Cognition, University of North Texas, USA
- *Panel:*
    - International Standardisation for Collaborative Learning Technologies (*Moderator:* Toshio Okamoto, Professor, University of Electro-Communications, Japan)
- *Workshops:*
    - Interoperability Challenges in Learning Technologies (*Organiser:* Prof. Frans Van Assche, EUN)
    - Quality Management in Education (*Organiser:* Dr Jan Pawlowski, U Duisburg-Essen)
    - Tools and techniques for study and evaluation of computer-supported collaborative learning (*Organizers:* Nikos Avouris and Vassilis Komis, U Patras)
    - Adaptive hypermedia - Its role in lifelong learning (*Organizers:* Nikos Mylonakis, and Colin McCullough, CEDEFOP)
    - Can Constructivist Epistemologies be Successfully Applied in Educational Informatics? (*Organizers:* Miguel Baptista Nunes, Maggie McPherson, U Sheffield, UK and Iraklis Paraskakis, City Liberal Studies College, Greece)

*** For general information, please contact:**

ICALT 2003 Administration Office
c/o Mrs Ioanna Veletza
Informatics and Telematics Institute

Centre for Research and Technology - Hellas
42 Arkadias and Taygetou Str., Chalandri, Athens GR-15234
GREECE
Email: icalt2003@iti.gr
Tel.: +30-210-6839916/17
Fax: +30-210-6896082

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2nd IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE 2003)
December 8-10, 2003
Taiwan
http://lttf.ieee.org/wmte2003/

Theme: "Mobile Support for Learning Communities"

*** Proceedings**

The WMTE 2003 proceedings will be published by IEEE Computer Society Press.

*** Important dates**

Submissions due:	June 16, 2003
Notification of acceptance:	August 1, 2003
Final articles due:	September 1, 2003
Author registration deadline:	September 1, 2003
Workshop:	December 8-10, 2003

IEEE WMTE 2003 will be held at National Central University, Taiwan. Taiwan is the world's leading manufacturer of computer technology, and an important center of mobile learning technology research and development in Asia. WMTE 2003 will bring together researchers, academia and industry practitioners who are involved in the design, development and evaluation of Wireless and Mobile Learning Technologies. The event will provide an opportunity to discuss promising directions for lightweight, connected tools that enhance teaching and learning.

Emerging wireless and mobile technologies bring new opportunities for learners to be more intensely connected, either face-to-face or at a distance, and extend one's learning community to friends, teachers, mentors, parents, and beyond. Modern learning theories advocate many social aspects of learning such as discourse, communities of practice, collaborative learning, internalization of social process, participation in joint activity, and situated learning. Thus it becomes natural to ask: How can wireless and mobile connections, sustained over time within a community, intensify the learning process? Conversely, how can ongoing connection with other learners intensify participants' sense of a more extended educational community?

*** Program Co-Chairs**

- Tak-Wai Chan, National Central University, Taiwan
- Jeremy Roschelle, SRI International, USA

*** Program Committee**

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- Barbara Wasson, University of Bergen, Norway
- Wei-Chi Yang, Radford University, USA

*** Topics of Interest**

We invite full papers, works-in-progress, and posters. The program committee will seek to achieve a balance of empirical investigations and design studies, including relevant methodologies from computer science and engineering research as well as cognitive science and educational research. All submitted papers should address mobile and/or wireless technologies and provide new insights relating to their use in teaching and learning.

Topics include (but are not limited to):

- Innovative designs and uses of tools to overcome barriers of learning
- Principles and patterns for learner-centered design
- Design of learning activities supported by mobile devices
- Advances in teaching conceptually difficult topics in school

- Interface designs optimized for small screens or other modes of interaction that fit on mobile devices
- Architectures that support rapid prototyping, reuse, or large-scale test beds
- Techniques of instrumentation devices and networks for research data gathering
- Case studies of teaching and learning
- Surveys of learners that reveal important trends and opportunities
- Analysis of the topology of learning communities
- Evaluation of effectiveness
- Comparisons of alternative designs
- Issues of scaling up to reach large numbers of learners
- Mobile agents for learning

*** Paper submission**

Submissions are invited in the following categories:

- Full papers (maximum 8 pages)
- Works-in-progress (maximum 5 pages)
- Posters (maximum 2 pages)

Details of submission procedure are available at the conference website:
http://lttf.ieee.org/wmte2003/

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Global Public & Private Partnership Platform for Mobile Learning Technologies

A small group of senior researchers, who gathered at the National Central University, Jung-Li, Taiwan, from March 24, 2003 to March 27, 2003, initiated the idea of "Global Public & Private Partnership Platform for Mobile Learning Technologies" or "G4P for Mobile Learning Technologies". These researchers included Marcelo Milrad, Ulrich Hoppe, Kinshuk, Tak-Wai Chan, Jeremy Roschelle, Pierre Dillenbourg, Steve Yang, Roy Pea (via video conference), and Sherry Hsi (via email). The meeting also included Ms Wanfen Chen from Minstry of Economic Affairs Taiwan, Dr. Eugene Hwang from Acer, and Randy Hinrichs from Microsoft Research USA (via email). On March 25, the group exchanged with industry representatives with mobile technologies, especially some major mobile device manufacturers and then on March 27, the group had a press conference in Taipei City to promote the idea of G4P. Next G4P activity will be coupled with IEEE WMTE2003 http://lttf.ieee.org/wmte2003 to be held in National Central University (see above the call for papers for WMTE2003).

The term "mobile learning technologies" here refers to an emerging field of designing and studying how mobile technologies can support for learning. In our view, the long-term goal of mobile learning technologies is to improve the quality and the effectiveness of the educational system, corporate training, and informal learning. More precisely, our research aims to grasp how learning technologies may contribute to this improvement. We develop knowledge through interdisciplinary work, covering computational development, pedagogical design, empirical testing and cognitive analysis. We share a vision of education where the learner is more active than in traditional courses with mobile learning devices serving as tools or mediators to communicate knowledge with others.

We seek opportunities how mobile technologies can be an added-value to the current educational scenarios, extending the scope of interactions in different dimensions, time, space, and scale. Such extensions will make it possible for learners to continue to learn and switch smoothly from one scenario to another without difficulty:

- time: synchronously or asynchronously
- space: classroom, home, outdoors, museum, and other sites; face-to-face or at distance
- scale: individual, small group, class, community from multiple classes to the societal or even global level

We believe that learning will be more natural, interesting, exciting, and demanding with the right support of mobile learning technologies. Through the research process of mobile learning technologies, we shall gain better scientific understanding of learning as well as more knowledge about content, communication, institutions. While we believe that from the economic and educational perspectives, integrating social and mobile technology support for learning will help grow a knowledge economy, we concern about mobile learning technology research in the interest of the society, for example, digital divide, health, law, behavior, etc. induced by such technologies.

G4P fosters the cooperation between, industry, academic research, and application sites to develop and put into practice promising solutions using mobile and wireless technologies in education and creative teamwork as well as international cooperation in the above mentioned field of research and development, including comparative studies of culture-dependent and inter-cultural needs.

The concept of G4P can also be elaborated in Figure 1.

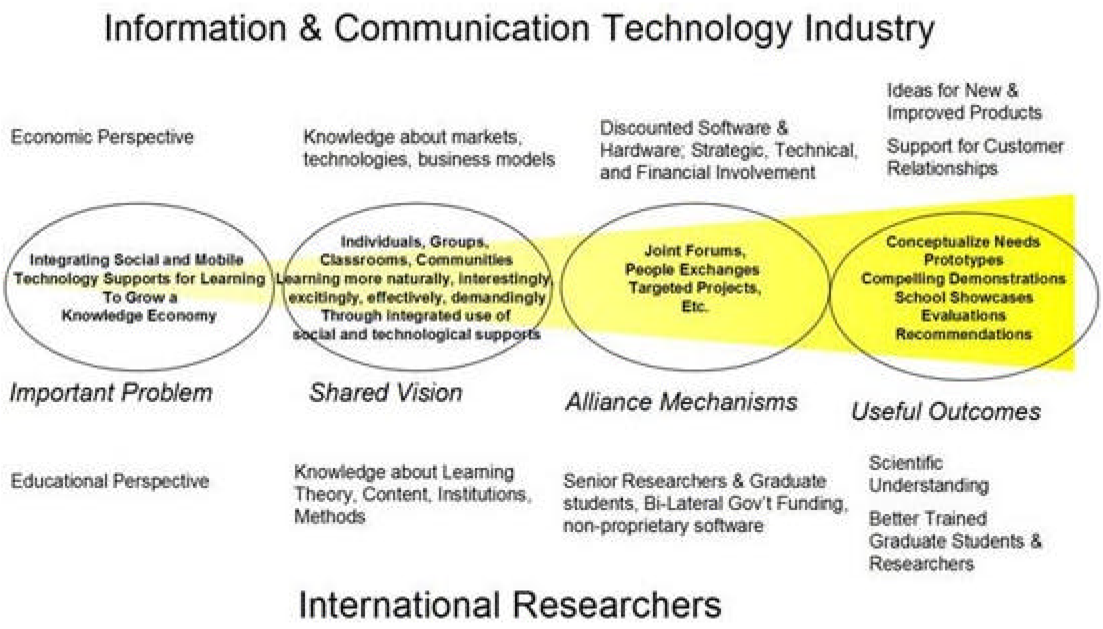

Figure 1. The concept of G4P

There are four dimensions for both academia and industry partners from which to view the future joint efforts in learning technology. For example, in the dimension of “useful outcomes”, the conceptualized needs, prototypes, and compelling demonstrations are shared by both industry and academia. While ideas for new and improved products as well as support for customer relationships are more the concern of the industry, scientific understanding and better-trained graduate students and researchers are what academia aim for.

Further information about the G4P for Mobile Learning Technologies can be obtained at http://www.g4p.org.

Tak-Wai Chan
Professor
Graduate Institute of Network Learning Technology
National Central University, Chung-Li
Taiwan
chan@src.ncu.edu.tw
Tel +886-3-4227151 ext. 4800 or 4821 (office)
Fax +886-3-4261931

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Evaluating the effectiveness of using a wirelessly connected PDA to deliver the functionality of a VLE - A pilot study at the University of Bristol

The aim of this article is to disseminate some initial observations from a pilot study which evaluated the effectiveness of using a wirelessly connected personal digital assistant (PDA) to deliver the same functionality as a Virtual Learning Environment (VLE). The pilot study was a face to face taught course in the Department of Economics at the University of Bristol, UK. The wireless connection used a mobile telephone with GRPS.

It is hoped that our experience highlights that at the general level it is relatively easy to achieve and offers the benefits of mobile learning. While, at a more specific level it might stimulate thoughts on how to deliver the material in an efficient and usable form.

The article is divided as follows;

- The aims of the study
- Background to the study
- The initial broad findings
- Conclusions

The aims of the study

The primary aim of the study was to evaluate if the tools and features of a VLE could be delivered to a wireless connected Palm Pilot. In other words, can students access course documents (lecture slides, essay titles, reading lists), participate in discussion boards, communicate through email and share work using an Internet connected palm pilot using a mobile phone in the same manner that they would use a VLE, such as Blackboard.

There was a set of secondary aims that focused on the non-technical aspects of is the project; is it sustainable and scaleable in terms of greater student numbers and courses? What did it add to the students learning experience?

Background to the study

The study was funded by the Technologies Centre (Techlearn), and the Learning Technology Support Service based at the University of Bristol.

The study used low specification palm pilot technology to access the learning materials. This included an entrance level palm pilot (M105) for less than UK£90.00. The driver for using this type of technology was the widening participation agenda and the issue of the digital divide.

The use of low specification palm pilot technology did create a serious constraint as the current generation of web browsers are not sophisticated enough to access the University’s VLE (Blackboard). Therefore, a requirement was to develop an equivalent accessible version for the Palm Pilot. This centred on a web site that used static and dynamic pages.

The study period was from August 2002 to March 2003, and the sample comprised of 13 students, none of which had previously owned or had regular access to a PDA.

Initial Findings

The findings imply that there is not a technical barrier to the use of a wirelessly connected PDA to deliver the same functionality of a VLE through a web site. However, it did raise questions concerning its effectiveness. For instance,

- After the material is converted to an HTML format suitable for a PDA it was found that students could read all course documents, announcements and supporting material.
- The hardware / software configuration meant that it is very difficult to transfer files in Microsoft formats to the palm pilot without the need to hotsync with a PC.
- Students could participate in discussion boards and undertake surveys using their PDAs.

- The VLE allowed you to link to other external web pages
- The students could send and receive email using their University accounts
- Sharing Palm Memo documents via an FTP server and a wireless connected Palm Pilot was achieved.
- The PDA offered a new dimension in the lecture with respect to taking notes and asking questions.

However, the following observations and comments can be made about these findings.

Resources need to focus on maximizing onscreen readability. For instance, material design and a colour screen. While there is also a requirement to either improve the speed of text entry or design the material so that it reduces the need for free text entry. This is particularly important for the use of discussion boards, surveys and online assessment. A usability test on text entry identified it took on average between 1.5 minutes and 3 minutes for the sample group to enter a 78 character sentence including punctuation.

The model involves intervention by a third party to convert the material created by the academic (word/powerpoint) to a suitable web format. Unless the degree of automation is improved it will increase the resource burden of support staff, while slowing the process of releasing material, and further distancing the academic from the ownership process.

A continual problem throughout the study has been to try to balance the need of the lecturer, i.e., publish material as Microsoft PowerPoint or PDF and deliver this to the Palm Pilots. With the needs of students, who found this material relatively unusable on the Palm Pilot as it was difficult to read and could not be easily annotated.

Another comment from students was that the potential for web browsing on the Palm Pilot was relatively low. This was primarily due to usability issues associated with the web browser. This implies that if academics expect students to visit web sites they should spend more time sourcing PDA friendly web sites.

The project also raised the issue that the student needed to improve their management of information. In particular, the students use of email software. This has resource implications in terms of providing more training for students.

The sharing of files worked in principle using Lftp (http://lthaler.free.fr/lftp.htm) and VFS-FTP (http://www.ninelocks.com/vfsftp/vfsftp.html). These offered a means of transferring Palm Memo documents between an FTP server and a wirelessly connected Palm. However, the file type is constrained to Palm Pilot memos.

Conclusions

In conclusion the study did identify that the functions and features of a VLE could be delivered via a phone to a low specification PDA. However, it suggests that the success will depend on how the material is developed, in particular if it meets the requirements of the medium and if it is not resource intensive.

Andy Ramsden
Learning Technology Adviser
Learning Technology Support Service
Institute of Learning and Research Technology
University of Bristol, UK
andy.Ramsden@bristol.ac.uk

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Towards implementing m-learning support for first year students at Kingston University

The Learning Technology Research Group (LTRG) at Kingston University (KU) is currently in the process of implementing m-learning support for first year students, tightly integrated with Learning Management System (LMS – the one in use at Kingston University is Blackboard) and other systems (CAMS, SITS, library systems). This work is being undertaken with The OTHER Media (TOM), a company which came into being through KU activities, contains great deal of expertise in teaching and learning as well as educational technology; i.e. HyperIsland in Sweden (Briggs, 2003), and IPKO Institute in Pristina, Kosovo (IPKO Institute, 2003). The lessons learned by TOM and LTRG research are essential to inform the optimal development of the project - we present a brief summary of a selection of recent activities, as this may assist others undertaking similar work:

- A large-scale experiment (1000 users) was undertaken to explore the degree of complexity and responsiveness which can reasonably be expected in interactive Short Message Service (SMS) applications (Stone & Briggs, 2002). Perhaps the most significant finding was that multi-part dialogues did not appear to reduce respondents' willingness to participate. We also found that mobile users are prepared to co-operate with fairly complex interactions, and supply accurate information in such scenarios. Given the constraints of the current technology in use by the student population (i.e. SMS), we believe this is a useful factor when considering design issues with mobile applications supporting learners, particularly first year university students.
- Research was undertaken on the Isle of Man between LTRG, the School of Geography at Kingston University, and Manx Telecom into 3G telephony, and user perceptions of the technology, cost, and impacts in terms of human and social geographical factors. These are of critical importance when considering the design of mobile technology services to support education. (Stewart, Stone, Livingstone & Lynch, 2003).
- Grounded theory was used in this and other related studies (Stone, Alsop & Tompsett, 2003). At LTRG, we have observerved that this technique seems to have merit as an effective means of obtaining user-centred constructs of the technologies, applications, and services which the m-learning community is developing. It is a very useful tool for formative evaluation and as a user-oriented design feedback mechanism during rapid prototyping.

The principal objective driving this work has been the desire to create autonomous online learners. Research and development within Kingston University has mainly looked at the use of the Blackboard LMS, in terms of use of online forums, community building in the light of increasing student numbers, etc. Work undertaken on both the HyperIsland and IPKO projects has concentrated on how to make learners take charge of their own learning activities and processes.

We believe that mobile technologies have the potential to be an additional driver to support the above processes – we consider the technology to be a catalyst for potential, and mobile learning to be another tool to be used in the suite of technologies and practices which are being implemented in a variety of scenarios where the shared aim is to develop autonomous learning taking place not only online, but is also supported face-to-face and whilst students are mobile. The work taking place at Kingston University to develop mobile learning is on a number of fronts, from both a student-oriented perspective and various angles as far as the university is concerned.

We are in the process of collating research undertaken during the last academic year on students' cost expectations of SMS services to support their time and learning management; a separate but complementary study is also being prepared which considered the extent of interest from students in the potential of m-learning, and their "wish list" of applications and services as requested as part of the interview process.

In parallel to obtaining some initial local user expectations of such a service, meetings with the library have taken place, building upon preliminary research on work already undertaken in this area by existing library systems vendors and other developers (Stone et al, 2002). The placement office has also expressed an interest, requirements analysis being undertaken in the light of previous interviews and how pressures on their services has increased over the last 18 months; this will be an area of future research and development work, based on needs identified in work undertaken before mass use of SMS was even identified as a feasible application (e.g. Stone, 1996)

Development on the above applications and services is in varying stages of progress, but at the time of writing, development tools are being linked to the relevant parts of the university to enable initial user trials to take place at the start of the forthcoming academic year; as such there will be further papers to come in the near future. In the meantime, we invite potential collaborators to get in touch with us if there are others working on similar projects, as there is a plethora of issues which we are all discovering - only by sharing this experience, can we ensure that the more negative side of the "not invented here" syndrome, i.e. "mistakes also made here" syndrome(!), is avoided.

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Andy Stone
Researcher - Learning Technologies Research Group
Room SOP327, Kingston University
Penryhn Road, Kingston Upon Thames
Surrey KT1 2EE, United Kingdom
Tel: +44 20 8547 2000 ext 62838
a.stone@kingston.ac.uk

Jonathan Briggs
j.h.briggs@kingston.ac.uk

Tom Smith
tom@othermedia.com

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Time, Learning, and Collaboration: Issues for Use of a Mobile Wireless Laptop Computer Lab

At the University of Colorado in Boulder, Colorado, the Program for Writing and Rhetoric obtained a grant for approximately $48, 000 to purchase and install wireless connectivity for a mobile wireless lab. The equipment consists of a cart capable of holding 24 laptops, a class set of 18 wireless laptops with dual batteries and interchangeable Zip, floppy and DVD drives, a laser printer, a wireless antenna, security cables, plus the necessary electrical connections. The cart has been in full use for one semester, with limited testing and use during the preceding semester. Three issues concerning teaching as well as student use and learning came to light early in the testing: time for setup; learning the requisite computer skills; and student collaboration with the wireless system. This report addresses faculty and student concerns about these issues.

Time and the Mobile Wireless Laptop Lab

Setup:

When faculty and students first began to use the wireless computers and the electrified cart, it became evident that the setup period before and during class, as well as the time spent putting the laptops back into the cart and connecting them to recharge cords could become a time sink for both the instructors and the students. Because the locked cart, with computers inside, is stored in a closet with electrical connections to enable recharging of the computers overnight, the cart must be retrieved for class, and then brought down the hall to a dedicated classroom with a wireless antenna. Faculty agreed that it would be useful to keep the cart in the classroom all day rather than to move it back and forth between classes, since only writing courses meet in that room. A system of "first and last instructor" was established so that the first instructor each day moves the cart from the storage area to the classroom and connects a bolted and locked security cable to prevent the cart from being removed between classes. The instructor for the final class of the day returns the cart to the storage area. The keys to the cart are kept in a special cabinet to which only faculty teaching with the lab have keys. Instructors report that the moving and connection process takes no more than five minutes before or after class, and that this time is well worth the time savings that occur when students use the equipment. Additional classroom will have wireless antennae in the future, enabling more portability than at present.

The other time delay occurred when the laptops were distributed to and collected from the students. Thanks to a committee of the faculty teaching with the lab and the administration's technology coordinator, student contracts for safe use plus a system for checking out and checking in the computers were established. Each laptop is numbered; each student "owns" a number and signs a contract to provide good care of that computer. A large binder with pages designed for a daily use log was prepared; the binder is stored inside the cart with an attached pen. As students check out the computers, they initial their section on the page; they do the same as they return the laptops to the cart. The instructor is in charge of plugging the computers into the recharging cord between classes and at the end of the day, and for exchanging drives when needed. After two or three days, the students became very efficient so that the process of retrieving and returning the computers to the cart takes no more time than students retrieving texts, notebooks, etc. in a non-computer mediated classroom. And, if the instructor comes to class a few minutes early, the cart can be unlocked, and early-arriving students can pick up their computers even before class begins. The setup and take-down of the wireless laptops seems also to require approximately the same amount of time as using computers in a fixed classroom, plus the mobility and flexibility offered by the cart and the laptops more than makes up for the desktop constraints on discussions and shared work.

Learning:

For all that students are often ahead of instructors in using technology, a surprising number of could not attach a file to email, or open an attachment that did not work automatically. Some students expressed concern that their computer skills were inadequate, and they were afraid of embarrassment in front of peers, or of failure. Since these classes require only basic computer skills and mastery of the laptop operation, learning through instructor and peer support has been effective and took no more time from class than explaining other class functions, such as how to mark peers' text with proofreading marks.

Instructors have found that they need training in the skills and tools necessary for using the mobile technology in the classroom. This training, which typically includes leaning word processing, collaboration, and proofreading tools, research practices for the Web, and using the machinery has been accomplished in short order through in-house workshops. These new skills should both simplify and shorten future class preparation and enhance teaching effectiveness. Today's students rely upon computers and other technologies, and writing with computers is bound to be in their future. Wireless mobile laptop labs provide not only the flexibility most teachers want in their classrooms, but also provide opportunities for guided practice that will be useful in the students' post-collegiate lives.

Collaboration in the Wireless Non-networked Mobile Computer Classroom

The third issue of concern, the ability for students to collaborate, seemed a bit daunting to the faculty at first. In a fixed-computer lab, the computers are typically networked and have some sort of collaboration program "built in" (e.g., First Class, Aspects, etc.). Thus, students can easily work together as a pair or in teams, and usually one student's text can be shown on all students' screens. Because the mobile lab is wireless and not networked, the faculty committee gave special consideration to using the computers for collaborative projects, critiques, and revision.

The University of Colorado makes WebCT, a server-based courseware that contains bulletin board, live chat, email protocol, etc. available to all faculty via a course website, and several mobile lab faculty decided to implement WebCT for their courses. Served by a central server that can be accessed by the wireless laptops, the WebCT functions much as a distance learning network. Students can chat, post assignments, critique and revise assignments by using the Word reviewing tools, and seem to be able to do everything that they could do by computer in a networked classroom. Other faculty opted to try email and listserv protocols rather than WebCT. Ultimately, the assignments and the uses made of the equipment determine which programs work best; in any case, however, the lack of networked computers has not proven to be a problem.

In addition, collaboration skills seem to be increased by discussion supplemented with laptops. The small laptops don't interfere with F2F as fixed desktops do in a networked classroom. So,when students divide into groups, or rotate between those offering critiques and the authors, they can simply get up and take their laptops with them to the corner of the room. Students open assignments as Word documents saved on the desktop, work on writing together, then save it and post it in a WebCT bulletin board forum, or email it to each other. Because the mobility of the cart and the wireless computers add to the flexibility of seating and movement, these computers enhance sharing and recording discussion far beyond what may occur in a traditional non-computer mediated classroom or in a fixed-computer classroom.

Conclusion

Mobile wireless laptop labs are a real bargain in terms of cost and flexibility. They are easy to set up and learn to use, deliver access to the world almost instantaneously, provide flexibility for student collaboration, and take different, but not more, time for various tasks, including retrieval and return, booting up, etc. The authors conclude that, for the money, these wireless mobile labs offer a lot of service and benefits to teaching and learning.

Anne Bliss, Ph.D.
Program for Writing and Rhetoric
317 UCB
University of Colorado at Boulder
Boulder, Colorado USA 80309
Anne.Bliss@Colorado.edu

Anne Heintzman, M.A.
Program for Writing and Rhetoric
317 UCB
University of Colorado at Boulder
Boulder, Colorado USA 80309

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Distance Technology in Preservice Teacher Training

An important concern in preservice teacher training education programs is the preparation of students in the use of technology. Students entering the teaching profession have limited knowledge of distance education technology, lack of skill in teaching with technology as well as a lack of opportunities to the use of technology in students' field experiences. As a result of these limitations, a research study by the International Society for Technology in Education (ISTE) initiated by the Milken Exchange (Moursand & Bielfeldt, 1999) recommends the following changes in teacher education: (1) the integration of educational technology into teaching and learning, (2) the integration of technology across the program rather than in isolated experiences, (3) increased use of technology by student teachers, and (4) faculty implementation of technology in their courses.

In response to this call for the greater use of technology, Purdue University has engaged in a large grant from United States Department of Education as part of the Preparing Tomorrow's Teachers to Use Technology (PT3) grant program. The university initiative is entitled Purdue Program for Preparing Tomorrow's Teachers to use Technology (P3T3). One component of this grant is a distance education field practicum project that includes an experience in an introductory course in our teacher education program at Purdue. We are completing our third year of this alternative field experience which involves partnerships with two elementary schools, one in East Chicago, Indiana and another in Crawfordsville Indiana.

The technology used to connect to these schools is a two-way video/audio conferencing system with station-to-station and computer-to-computer desktop Polycom units that are connected through high-speed internet connections. The equipment that we use comes from a company called Polycom and provides full interactivity over standard Internet connections of 128 Kbps or better.

After only one training session, the students are ready to operate the equipment and begin their weekly field experience.

With the station-to-station units, the university students are able to control both units, the one in the university classroom and the other at the school site. The camera on the unit is powerful enough to allow preservice teachers to view the whole class or zoom in on individual students working at their desks, and even read papers or books they are using. The unit also allows the university students observing the classroom to read what is written on the blackboard, projected onto a screen or taped to a wall. There is also the possibility to hook up a document camera or a computer in order to project images to the receiving end of the connection. When the preservice teachers have opportunities to present material to the students at the far site, they are able to display material through these media to support their lesson.

The desktop computer-based unit requires additional training because of different capabilities of this particular technology. First, this unit is much smaller, allowing enough room for only two or three students to be viewed at one time. The primary difference is that this unit allows for application sharing, such as word processors, Internet browsers, and spreadsheets, among others. Application sharing provides opportunities for both ends of the connection to control a single document with the click of the mouse.

There are several positive implications from our experiences with this technology. First, our students become more proficient in using various types of technology while learning to be teachers. By the end of the semester, all of the students have had sufficient opportunities to gain confidence in operating the technology. They also begin to explore ways of using technology from the perspective of the teacher, opening the preservice teachers' minds to other modes of teaching. For example, one class created a unit on Japanese culture where the document camera and Power Point were connected to the Polycom unit and used to teach parts of the lesson. In another class, individual students were given the opportunity to manipulate a document through the application sharing feature of the desktop computer-based unit. Another benefit is that this technology affords our students the opportunity to see urban classrooms, which they would otherwise not see in our rural community, giving the students exposure to different types of learners. It also may relieve some of the placement pressure on our local schools which are saturated with Purdue preservice teachers due to the size of our program. This technology allows for branching out into other communities, alleviating the difficulty of not finding sufficient teachers in our local area.

There are also drawbacks to this technology. Many of the preservice teachers feel that they are not getting the same experience through this virtual practicum as they would in a regular practicum. The amount of interaction between the preservice teachers and the elementary students is limited. Also, because this experience occurs with groups of ten to twenty students, it is also difficult to provide many individual opportunities to interact with the K-12 students.

There are also difficulties with the technology itself. Internet connections do not always operate correctly, which creates problems with our weekly connection with the schools. For example, because the connection is made through the Internet, Internet traffic can degrade the speed of the connection, which results in a loss of clarity of our video and audio. Also, the audio often picks up a lot of background noise, contributing to the difficulty in understanding the students and the teacher.

In conclusion, this experience clearly demonstrates the potential of this technology. Our students are learning how to use technology and how to implement this technology in an instructional setting. While the limitations to this type of virtual field experience are real, we believe that this technology is helping our teacher education program meet its goals to prepare teachers for a diverse and technologically rich world.

Note: This article was developed under a grant from the U. S. Department of Education. The contents of this paper do not necessarily represent the policy of the Department of Education, and one should not assume endorsement by the U.S. Federal Government.

Dr. Paul Chamness Miller
Dept. of Curriculum & Instruction
Purdue University, 100 N. University St.
Beering Hall of Liberal Arts & Education, Room 4125
West Lafayette, IN 47907 USA
Tel: +1 765-496-3022
Fax: +1 765-496-1622
paul.miller@laposte.net

Jo Ann Phillion

James Lehman

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Pocket University - Mobile Learning in Distance Education

The Virtual University

The University of Hagen was launched about 25 years ago as a pure university of distance education. Today, it looks back on a long tradition of distance teaching with currently more than 55.000 students enrolled in six different departments.

In 1996 our group developed the system *Virtual University*, the first e-learning platform in Germany allowing a university to offer its services by means of the Internet. The key concept of our approach was from the beginning a coherent system integrating all functions necessary while performing e-learning. This comprises, besides other features, providing access to (interactive) study material, providing communication facilities as well as administration services. The Virtual University now forms the platform for the education environment used at our university.

Based on our long experience, not only in developing the Virtual University but also with performing a variety of e-learning courses (such as virtual seminars and practicals), we recently started the project Pocket University, within which we investigate m-learning in teaching and learning scenarios as well as dedicated m-learning tools and systems. The objective is to find out best-practice solutions of performing e-learning. In addition, we are aiming at developing a platform component supporting m-learning coherently similarly to the Virtual University.

Mobile Learning for Distance Students

M-learning is an obvious next step in distance education. An increasing number of our students use mobile devices. They are already experienced with mobile technology, and are keen to to use their devices in e-learning situations. Another argument for m-learning results from the profile of our students. Most of them are already employed while studying part-time. A lot of them have problems to attend virtual events synchronously, or to have access to information and materials while they are on the move (e.g. during business trips). Such problems can be solved by enabling wireless access to the virtual learning space – realizing "anytime, anywhere, any device". For all of our students learning efficiently is the key for successful studying. Therefore, they use idle time whenever possible for their learning tasks, e.g., reading course material while waiting for the train. Such learning activities can be much more effective by introducing m-learning.

Altogether, we found a lot of clues that mobile technology can enhance e-learning for the benefit of our students. The main purpose of the project Pocket University is to enable learning, teaching and collaborating via mobile devices, no matter where the students are located. Currently, we focus on developing m-learning patterns as well as on the implementation of a prototype platform *Pocket University*.

M-Learning Patterns

Work of utmost importance is to find out didactical paradigms for m-learning applications. For this purpose we investigate different scenarios for applying m-learning. Results are intended to be described by means of learning patterns, aiming at the transformation of best-practice knowledge on performing m-learning into the planning of subsequent learning and teaching events. Special attention is directed at the connection of traditional and electronic media (e.g., print material, multimedia content, mobile applications). Research topics in this area are, e. g., didactical and interface design principles, communication behaviour, collaborative learning, user profiling, and added value of mobile applications in general.

Pocket University: Infrastructure supporting M-Learning

The Pocket University is meant to be an additional component that can be integrated in or combined with learning environments, as they exist today. Not only distribution of content but also communication and collaboration features are of utmost importance for our students. Hence, a main part of the project will be the development and the use of mobile CSCL possibilities. On the way towards a mobile university we have to cope with new challenges. The target group, for instance, is highly heterogeneous with respect to the degree of experience with mobile technology. Furthermore, we have to support the diversity of mobile devices (e.g., MDA, Smart phone). Due to the fact, that mobile application is a topic of research crossing a lot of disciplines, developing the Pocket University requires to deal with a lot of interdisciplinary, still open questions. Particularly, communication and interaction are essential in performing m-learning. This concerns not only tools and techniques, but also style, structure and the user interface. Current research topics are, for example, the handling of different interfaces, multimodal user interfaces, ergonomic and linguistic aspects. Similarly the different existing media types, document, and publishing formats as well as communication types are challenging. Conceptual and technical solutions for their integrated handling taking into account different devices have to be worked out.

Real Life Test and Evaluation

Both topics m-learning patterns and infrastructure are highly interrelated. Thus, they have to be investigated considering their interdependency. To face this, we will apply and evaluate different scenarios and developments continuously in real life situations with large-scale user groups. Based on the findings further requirements will be identified for the Pocket University system leading to new components to be used in follow-up m-learning courses and events.

Project Status

Currently, we work on m-learning scenarios and a first prototype of the Pocket University; examples of components currently under implementation are *Teachlets* and *LearningCards*. To provide students in addition to printed study material with simulations or interactive elements (we denote such small applications as teachlets), we are implementing a bundle of teachlets executable on mobile devices. LearningCards is an application which provides electronic cards showing descriptions of course relevant concepts and terms. Students can use these cards to exercise while working on the material or to refresh their mind before the examination.

As we started in January this year with our activities, first results are expected for the winter term 2003/04.

Looking for partners

We would like to share our experience, discuss problems and work together with other interested research teams for current and further developments.

Birgit Bomsdorf
University of Hagen
Germany
birgit.bomsdorf@fernuni-hagen.de

Birgit Feldmann
University of Hagen
Germany
birgit.feldmann@fernuni-hagen.de

Gunter Schlageter
University of Hagen
Germany
gunter.schlageter@fernuni-hagen.de

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Field Computing: Deploying Applications Away from the Teaching Labs

Introduction

In the autumn of 2003, students in an introductory database course for second and third year students in an undergraduate CIS program used handheld computers as supplemental tools for their course projects. The fifteen week course has traditionally been taught using a relational database in a PC lab with the goals of providing students an introduction to database design including normalization, entity relationships, integrity constraints and implementation of business rules. The modified course built upon the design approach and added a Palm handheld with a third-party relational database as the deployment component for field computing.

The instructional purposes for handheld integration were threefold:

- to reinforce the issues of database design and deployment
- to introduce students to the issues synchronization and data accuracy
- to familiarize students with the concepts of field computing,
    - restricted screen real estate
    - alternative input models.

The primary faculty goal of the implementation was to test whether handheld computers were sufficiently robust for curriculum integration. Recent conference presentations (Johnson, 2002) have indicated that the handheld is not ready for use beyond its capacity as a personal information manager (Carr, 2002). A secondary goal was to reinforce that students can be technology creators or developers not just consumers of packaged software.

Implementation

The university had received a donation of Palm M105 handhelds (Palm OS 3.5, 8MB RAM, grey scale screen); as such, faculty did not select the platform. Following an evaluation of database products, the faculty chose thinkDB from ThinkingBytes, primarily due to its integration with Access, the core instructional program on the PC. Interestingly, midway through the semester, DataViz purchased the product, made some improvements and repackaged the database as Smart Lists To Go.

The course required the students to develop a project, preferably with a real client, where a field database component would give advantages in efficiency or accuracy or allow for new business processes. The field database component was defined as data operations away from the desktop computer.

Students first used "Tap", a program developed as an arts project by the Dia Foundation, to familiarize themselves with the basic concepts of interacting with the stylus rather than a keyboard or mouse and synchronization features, such as beaming, Besides being a low-key introduction to the Palm, "Tap" also demonstrated some of the graphics capabilities of the device and stimulated discussion of databases that contain information other than text because "Tap" is a collection of dance steps which are replicated by a dancer on the screen.

The majority of students worked in teams of three to develop their projects, although there were a couple of solo projects. A team was designated as the course help desk, whose responsibilities were to assist students with implementation issues, usually related to the mechanics of synchronization or design functions of thinkDb.

Results:

For most students working with portable computing was a new experience. Similarly, they found it revelatory to understand that the installed applications which made the Palm a roaring success – the address book and the date book – are merely databases. Two students owned PDA's (one a Clio the other an IPAQ) but neither had used them for anything other than the installed applications.

Students built their original project in Access or on the Palm then used the conduit, thinkDb Sync, to synchronize the databases. The projects were much richer than those from previous classes. Samples included an IT Technicians database for an IT Help Desk, a long haul trucker's log and manifest, a fleet racing record and computation for a sailing regatta committee, and a management system for hotel cleaning staff. It appears that the requirement of the field component had an influence on causing students to develop projects beyond the usual inventory and collection management systems.

One project, the hotel management system, brought out issues of localization for language. While our geographic region is predominantly speaks English, the cleaning staff for the hotel is exclusively Spanish speaking. The implementation required development of the field component in Spanish and the interface for the master database in English for operation by the hotel manager. Using pick lists, checkboxes and radio button, the student designed a database which could be used by both managers and staff.

Conclusions

An informal survey of the students and anecdotal evidence indicated that the experience of using the Palms was positive. The student who developed the hotel management system has continued to refine the project since the class' end and aims to "shop" it around to local hotels. A second student, and passionate fisherman, borrowed a Palm for the vacation period to develop a fishing log to record his catch, including details of lure, moon phase, climatic conditions, and catch description.

Student projects with a real client were significantly better developed and demonstrated issues that the text and classroom experiences overlooked. In future classes, real clients may be required, largely because the students have had little experience working in organizations and are unaware of the importance of business rules.

The sale of the product to a different vendor came at a critical point in the class. Most of the support material is web based; therefore, not only did the navigation change, but some of the features changed also. At the time of the sale, it was not possible to reinstall the software from the new vendor. This intrusion of reality, however, did allow students to experience the need to adapt to market conditions.

The Pam M105 models, while not the most sophisticated had the advantage of being powered by dry cell batteries and being inexpensive. The battery life is better than many other handhelds. Additionally, the units are relatively inexpensive, so replacement, if a unit is damaged, is not excessively burdensome. During the semester only one unit needed replacement because the screen was damaged.

Finally, while not a mobile application in the sense of being wireless, the field application brought to the fore all the similar issues of screen real estate, synchronization, and field localization. A desired goal would be to move to a central server model so that students could experience multiple updates to the same master database from many locations. The current model did have benefits over the traditional lab based course

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W. Brett McKenzie
Gabelli School of Business
Roger Williams University
Bristol, Rhode Island, USA
+1 401-254-3534
wmckenzie@rwu.edu

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Handhelds - The Wave of the Future

The classroom of the twenty-first century appears much different than the classroom of yesterday. Students carry a small technologically advanced handheld device, used for calculating problems in math, for recording and graphing data in science experiments, for pinpointing exact locations in social studies, for reading textbooks and novels, for note taking in all classes, and for sharing and collaborating with others without the burden of small pieces of paper that are easily lost. Although many school districts have banned the use of cell phones and pagers on school grounds, the handheld computer is viewed as a learning tool in classrooms.

With appropriate software applications or peripherals this single tool can be used for research, as a graphing calculator, as a drill and practice instrument, as a camera to document field trip experiences and science experiments, as a presentation device, as a collection device for behavioral and assessment data, or as a simple organizer.

Handheld computers, sometimes referred to as PDAs (Personal Digital Assistants) are affordable (ranging in price from $100 to $1,000), mobile (can be taken anywhere, anytime), accessible (entire classroom sets can be purchased for the price of three or four laptops), readily available, and hold limitless possibilities. Sharing information and collaborating with others is as simple as beaming information through infrared ports; the immediacy of "beaming" addresses the motivation and focus factor of students. Open the box, take out the handheld, power it up by adding batteries or charging the batteries already included, and begin - no down time for booting, warming up, or training.

Students can easily synchronize data with the desktop computer or share files and programs. Wireless technology is available through the use of Bluetooth application software that also supports voice. Handheld computers access the Internet enabling users to view and send e-mail. Students can search an array of websites for free downloads of application software or purchase commercial software used in all content subject areas. Conversion charts, maps, e-books, word processing, note taking, and reference tools are only a few of the endless possibilities offered by handhelds. By using a handheld for written assignments, students are provided a greater opportunity for cycles of doing and reflecting on their output.

Students with Disabilities

Technology is constantly improving the quality of life for students with disabilities. The PAC Mate, a handheld device with allows the blind to access email in the same way that sighted people do, uses Microsoft technology integrated with a JAWS screen reader to convert objects and text to speech. Blind students can listen to documents, images, and web content or feel graphics such as maps and pictures through a device that connects to their desktop.

Dana, manufactured by AlphaSmart, operates on rechargeable batteries and uses an infrared port to beam text. This keyboard style device is also ideal for reading e-books. MP3 players can be used to record information for students requiring information to be presented orally. Work written on any white dry erase board can be beamed to students who have difficulty taking notes, through a device called e-beam. After the notes have been beamed to a student's handheld the student can again beam the file to an infrared printer and receive a hard copy of the material.

Students with disabilities reported preferring the handheld to the traditional notebook used for recording assignments. Students prefer receiving vocabulary and spelling lists through a beam from their teachers or from other students. They claim that they can always locate the list – it's always in the handheld.

Disadvantages

The use of handhelds in the classroom environment creates several new problems. Two operating systems currently exist for handheld computing. The first is the original Palm OS, found on less expensive devices and simpler to use, but includes less multimedia capabilities. The Pocket OS, created by Microsoft, is more expensive, more complex to use, and includes more functionality including built-in multi-media support.

Guidelines addressing acceptable use policies may need to be adapted to wireless and handheld technology. Students now have the ability to beam answers and share work. Close monitoring of students is more important than ever.

Handheld technology has not existed long enough for conclusive research to be conducted on the effects of student achievement or medical concerns such as carpal tunnel and eye strain due to extended use and screen readability.

The cost of necessary peripherals and software may force the use of these affordable learning tools to become prohibitive. Infrared printers, scientific probes, and digital cameras are all necessary to learning but expensive.

As with any new technology, teacher orientation and professional development training is essential. The comfort level of the teacher with the technology impacts use with students. Teachers need to recognize that paper and pencil is not the only medium in which assignments can be completed, turned in, and graded.

Educational software development is ongoing; however, the software developers and designers are not educators and fail to understand the implementation and importance of scaffolding learning concepts. Some graphic organizer software offers students no guidance in defining a concept and a relationship.

A significant percentage of students have no access to computers outside of school. A handheld outfitted with appropriate software can provide personal access to networked computational resources necessary to support learning.

Self-management and organization have become the ”ultimate goals” in education as students are offered greater independence and more responsibility through the use of self-regulated learning.

Although it is unlikely that each k-12 student will not be provided with a desktop or even a laptop, it is conceivable that students will be provided with an affordable handheld computer at a cost ranging from $100-$300. The use of handheld technology will change the face of education.

Carol Vesh
High School/Transition Special Education Coordinator
PO Drawer 309
Beaufort, SC 29901
USA
cluetzow2@yahoo.com

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Wireless School Network

The architecture of the wireless network consists of 3 main parts. The wireless infrastructure, the connection of the wireless island to the rest network and the interconnection between the neighboring schools a near one participating in the wireless network. The wireless connection supports Point-to-Multipoint technology [3] and uses the frequency band 2,4 Ghz to 2,4835 Ghz. The reserved bandwidth of this wireless LAN is order of magnitude 11 Mbps. In each school the bridge device is connected to a newly equipped Fast Ethernet switch interconnecting the internal schools network to the wireless network. Between the schools a fast Ethernet network is built using copper and Fiber optic cabling. The interconnection of the wireless network upstream to the backbone is achieved with the use of the link between the E.A.O and the local main distribution node of the EDUNET network. This link had to be upgrade because it will carry the traffic from the wireless network too. The selected solution was the VDSL technology by engaging the appropriate modems over a two-wire leased line between the E.A.O and the main node. We have a selected point in each school unit that wireless bridge and antenna will be installed. The wireless bridge must stand near to antenna because long cabling distances will produce noise in the transmission signal. The wireless bridge will be housed at waterproof cabinet, which offers all the necessary specifications for protection and electric feeding. The waterproof cabinet is installed at the antenna pylon.

Fig. 1 represents the system's topology including all the cases of school units that are participate in wireless connection schema. At secondary education administration office, the connection line (2 Mbps) will be replaced by VDSL Modems (10 Mbps). Cabling distance from local EDUNET node to secondary education administration office's building is at most 1,5 Kilometres in order to lock assigned connection speed by VDSL modems. At the secondary education administration office a router with serial connection to VDSL modems and a switch that supports VLAN technology are installed. VLAN will be created at router and switch for office's internal LAN and for wireless bridges which covers two similar areas (east and west side from secondary education administration office). The school's connection mode until implementing wireless connectivity was ISDN Dial-Up or Serial with data rate of 128 Kbps (Bouras [2], 2003). During planning wireless connection we choose as many schools as we can that are collected in same courtyard or same building. In case of zone creation we choose one school building which put up the wireless accoutrements based on some measures such as Line-of-Site and previous connection mode utilising as a backup connection mode in case of wireless malfunction. We install a router and switch which supports VLAN technology in this school. Computers that are in same building with accoutrements will be connected to LAN through several ports at switch device.

During implement this project we encounter many difficulties that tide over. One of these is line-of-site. Line of site means pure visibility between school antenna and central system's antenna. Neither building or trees or wall must obstruct the straight line between two antennas. So we visited the cities in order to guarantee the pure line-of-site between school units and central system unit. All the school units have pure line-of-site All the school units that belong in same zone will be cable inter-connected with the building that antenna is installed. In case of short distance between buildings (less than 100 meters) the cable is UTP otherwise fibber optics including F/O to UTP Fast Ethernet Transceivers. The fibber optics cables will pass underground through schoolyard than airy in order to protect the student's health from pylon falling.

This project presents the wireless inter-connection of many schools and one administration unit. We are trying to group as many schools as we can in order to exploit one common wireless connection. The grouping is possible when schools coexist in the same yard or the same building. We sight our project plan to avoid including long distance schools from the central system unit. If one school unit with wireless antenna is out of 11 Mbps distance range, we must increase the transmit power in order to have communication at 11 Mbps [4].

The operation of wireless LAN has many benefits. Increase speed and quality in communication of school units between them and to Internet. In particular schools that belong to same zone will be inter-connected at 100 Mbps. This connection speed gives the ability to students and educators using many services as tele-conference, asynchronous open distance learning, synchronous open distance learning video on demand, voice over IP (Bouras [1], 2000).

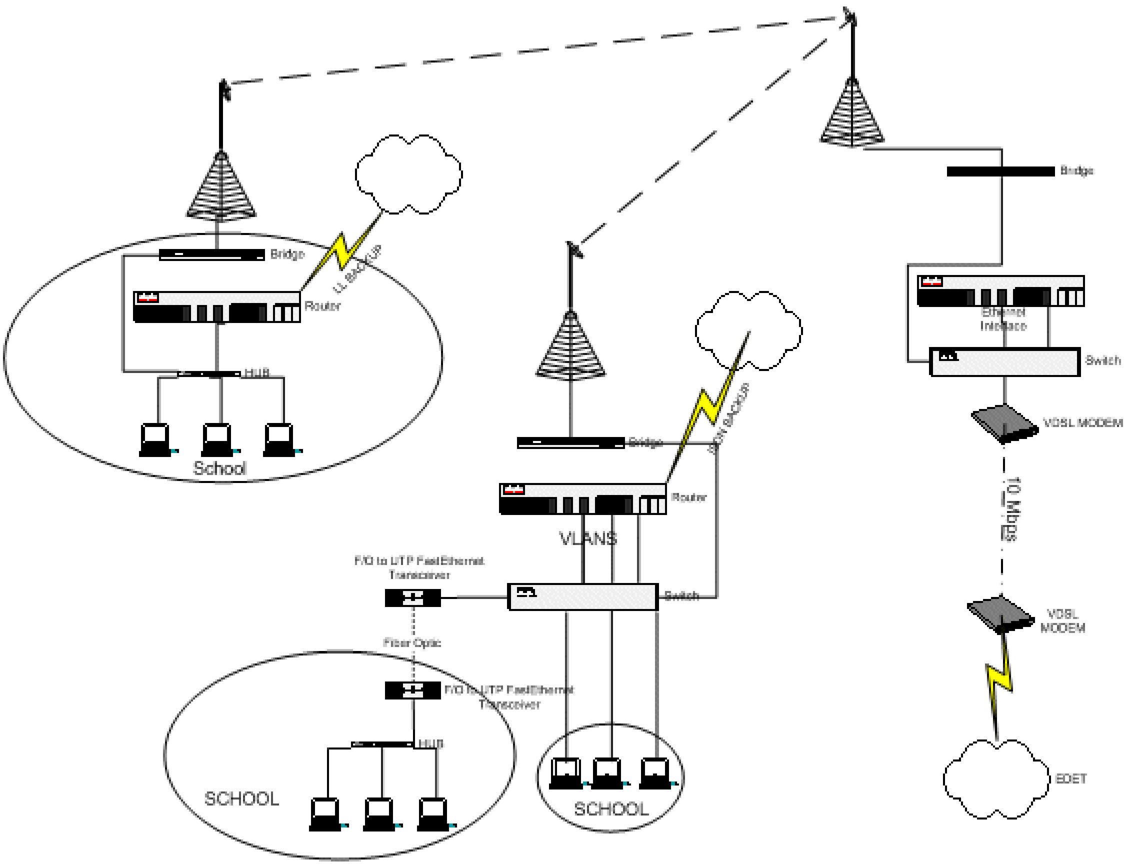

Figure 1. System topology

The connection speed with Internet is order of magnitude 10 Mbps. Even if all the schools at the same zone have traffic activity to internet, the speed will be much higher that was before (128 Kbps). Important decrement of telecommunication tolls considering the precedent topology that each school uses the telephone line in order to have internet access. Implementation of wireless network, we have an independent network from any telecommunication supplier. The school's units netting model is flexible in placement of another new school unit. Whenever a school unit needs wireless network, can be a member of the wireless system buying only terminal unit's accoutrements (wireless bridge and antenna). Data transmit becomes in a specific frequency spectrum with low power level. The school's antennas are directional and in combination with the above proposal, the wireless communication is totally safe for students and educators health. Antenna's size is such considerate that doesn't misquote view of the place. Similar wireless projects with these specifications are very effected in Europe and America. The antennas in our project didn't have any relationship with mobile phone antennas which operates in different frequencies and has high-level transmit power.

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C. Bouras
Department of Computer Engineering and Informatics, University of Patras
and Research Academic Computer Technology Institute
GR-26500 Rion, Patra, Greece
Tel:+30-2610-960375,+30-2610-996314
Fax:+30-2610-996314
bouras@cti.gr ,bouras@ceid.upatras.gr

V. Papoutsis
Research Academic Computer Technology Institute

C. Ntokos
Research Academic Computer Technology Institute
Department of Computer Engineering and Informatics, University of Patras

A. Karaliotas
Research Academic Computer Technology Institute
Department of Computer Engineering and Informatics, University of Patras

M. Paraskevas
Research Academic Computer Technology Institute

N. Drosopoulos
Research Academic Computer Technology Institute

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Wireless by Design: The WSU "Boeing Wireless Classroom of the Future"

Problem

A number of universities have implemented "high-tech" classrooms to support teaching and learning (see "Smarter, Faster, Better," Jan/Feb, 2003, BizEd). Mostly, however, these classrooms rely on the use of information technology to automate fairly traditional approaches to teaching and learning. The focus seems to be about teaching faster, easier, and using technology less obtrusively.

In preparing students for their future careers, it is incumbent upon educational institutions to provide opportunities for them to work not only with the state-of-the-art wireless technologies that they will encounter in the "real world" but also to work and communicate in collaborating teams using these technologies. At the Washington State University College of Business and Economics, the faculty desire contemporary (or new) approaches to teaching that produce learning that is cooperative, collaborative, active versus passive, problem-based, project-based, and/or team-based. It became clear that a traditional classroom with desks and a lecturer's podium was outmoded and incompatible with our vision.

Our approach, via industry partnership

By partnering with The Boeing Company and its Connexion by Boeing, we were able to create a facility that uses wireless and related information technologies to bring life to modern teaching and learning styles. We used a "clean sheet" approach for a classroom that is infinitely reconfigurable into flexible learning stations for groups of students, and that provides them with a variety of mobile computing and other devices that interconnect via a wireless network. After a year of painstaking planning, the "Boeing Wireless Classroom of the Future" opened for business in January 2003.

Three "new" courses operate in the classroom--an MBA strategy class, a graduate accounting class, and an undergraduate information systems strategy class. While the subject matter at its core may be traditional business fare, the style the professors use to teach required re-engineering, and the students have to learn differently. There are not lectures, per se; there are assigned readings, discussions, examples, team-based Internet research, and project presentations. Executives join the students via videoconferencing from the comfort of their offices. Word is out around campus: it's not "business as usual" and everyone from administrators to prospective students stops by to see the energized professors and students in action.

The Technology

Both wired and wireless computing are used. Two PC's in colored acrylic cases (we call them "Red" and "Blue") provide direct-connect computing services. Blue drives the unique Dual Projector System (DPS), and Red provides a wide range of media accessibility (DVD, DVD-R, CD, CDR, SD, Compact Flash, Smart Media, etc) while also running the Electronic Whiteboard. Both are BlueTooth enabled to connect to and share an HP Printer and any other devices that are Bluetooth compatible--laptops, PDAs, and even cell phones.

The DPS is a unique dual video monitor unit that uses two of Sony's latest projection units (VPL-PX15), like someone with a regular PC could use two monitors simultaneously. While their "desktop," extended across two monitors, would be about 15" x 30," our "desktop" covers one entire wall about 10' x 20.' These projectors can function as wireless network devices--each has a Windows CE operating system, 64 megs of RAM, and a PCMCIA card slot for additional storage and networking needs--and can be accessed and controlled from a Web browser. Students could, for example, upload slide presentations from laptops and run them on any projector without cabling. A third projector--another Sony VPL-PX15--drives an electronic whiteboard, part of a simulated wireless "boardroom."

For teleconferencing, we utilize Microsoft's NetMeeting, allowing us to host up to three guest speakers at a time with images of the room available back to them via wall-mounted Web cams. The students can interact with the guests and each of the NetMeeting participants can interact with the others as well as the students; everyone can see and hear each other, share Windows applications, and so on.

Feedback

The untraditional classroom looks like an inviting, large living room. We intended students to feel comfortable to enhance, we hoped, their ability to learn; the warm wall colors, indirect lighting, and moveable furniture (leather sofas, low-slung modern chairs, and even beanbag chairs) would facilitate teamwork. The feedback from students is favorable; they have unanimously reported that they feel much more comfortable in this environment, and are more willing to engage in tasks and work closely with others than they would in more traditional classrooms.

Faculty members are planning more ways to use the facility. The Dean challenged them to re-engineer courses to teach using wireless, multimedia, team-based methods. Many have already risen to that challenge; more report they are exploring possibilities. Time will tell whether faculty other than the "early adopters" can make the adjustment as seamlessly as did the first wave.

Conclusion

Preliminary results suggest that the new environment has been effective. Professors are engaged and trying out new ways to teach. Students are excited about the new facility and very much like having classes in it. Teachers report students' case discussions and team exercises appear to be more intense and engaging than are those happening in traditional classrooms. The facility has literally become a showcase in innovation for the University, and business executives and influential alumni have visited and asked how they might help to enhance and expand the vision for such facilities across campus.

This initiative has shown that change in teaching and learning, and in attitudes on campus, can be affected by including mobile and wireless technologies as part of a pedagogical design change. We plan for this classroom to become the model for innovative teaching and learning in all of the disciplines available in our College, with, of course, our students being the ultimate benefactors. Using wireless technologies, tomorrow's business leaders from WSU are learning--by design.

For more information and details on the Boeing Wireless Classroom, go to http://www.cbe.wsu.edu/wireless .

B. Craig Cumberland
Ph.D. Student
College of Business and Economics
Washington State University
Todd Hall Addition 240E
Pullman, WA 99164-4729 USA
Tel +1 509.335.1715
Fax +1 509.335.4275
craigcu@wsu.edu

Professor Leonard M. Jessup
Dean, College of Business and Economics
Washington State University
Todd Hall Addition 240E
Pullman, WA 99164-4729 USA
Tel +1 509.335.8150
Fax +1509.335.3851
ljessup@wsu.edu

Professor Philip L. Kays
College of Business and Economics
Washington State University
Todd Hall Addition 240E
Pullman, WA 99164-4729 USA

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An Open Abstract Framework for Modeling Interoperability of Mobile Learning Services

Abstract. The MOBIlearn project, co-funded by the European Commission, the National Science Foundation and AU Department of Education, Science and Training, is strategically positioned to provide relevant research outcomes in the field of innovative use of mobile environments to meet the needs of learners, working by themselves and with others. The objectives are achieved by defining a set of mobile services identified and specified through an open abstract framework. This assures proper interoperability between MOBIlearn services themselves and existing services provided by third parties, such as the Open Knowledge Initiative or the IMS Global Learning Consortium. The paper introduces the MOBIlearn project and its underlying approach describing the Open Mobile Access Abstract Framework (OMAF).

Introduction

The integration of new technologies in education and training is in essence a culturally driven process, with the need to bring about change not only in people, but in the entire learning environment. In recent decades political and social progress has emphasised the need for free circulation of knowledge, as the most advanced answer to the increasing needs of new skills related to new technologies and new socio-economic models formed by the Information Society.

The "*e-mobility 2001 EU Information Society*" conference on mobility in the Knowledge Economy [1], convened in Goteborg, highlighted priorities that should be explored: the need to define new work paradigms (e.g., *mobile worker*) together with innovative models for their social, economical, cultural and environmental deployment, while preserving the local nature of content (national and regional) and cultural heritage. At the same event it emerged that the sustainable social and economic deployment of such models within the Information Society of the third millennium will see a key role of new technologies for mobile access to knowledge.

On these social and technological premises, the MOBIlearn project [2] aims to improve access to knowledge for selected target users, giving them ubiquitous access to appropriate, contextualised and personalised, learning objects, by linking to the Internet via mobile connections and devices, according to innovative paradigms and interfaces.

The Goteborg Conference [1] also underlined the need for pilot experimentations and applications for the fast spread and uptake of envisaged models and related services to preserve Europe's leadership in the exploitation and innovation of mobile technologies. The need for this is becoming urgent. Thus, the MOBIlearn project is justified in two ways: its pioneering research and development directly targets priority areas for the knowledge society, and its exploitation directly addresses the need for Europe to stay dominant in the important area of mobile applications.

To deliver these crucial results, the MOBIlearn project will exploit a partnership that is truly international, capable and influential, including well-known Universities with a large user-base (such as, not exhaustively, the Open University and the University of Birmingham), and calling on expertise from two US World-level academic institutions (Stanford University and OKI/Massachusetts Institute of Technology). The project consortium also involves mobile operators from four countries (Telefónica, Cosmote, Deutsche Telekom, Telecom Italia), European-leading commercial organisations (Space Hellas, GIUNTI Ricerca, Emblaze Systems, University for Industry) and World-class mobile devices manufacturers (Hewlett-Packard, Nokia), and Australian on line learning content providers (education.au). The partners bring a real cross-disciplinary know-how, with expertise in pedagogy, adaptive interfaces, collaborative learning, context awareness, business modeling and e-learning technologies.

The scope includes studies of conceptual models and new methodologies, with prototypes to implement them. These will be evaluated in trial application fields set up and managed by international partners participating within the MOBIlearn project. The objective is to improve the knowledge level of individuals through cost and time optimisation of learning processes. This maximises the opportunities of three representative groups [3]:

- *Workers*, to meet their job requirements and to update their knowledge continually;
- *Citizens as members of a culture*, to improve their learning experience while visiting a cultural city and its museums;
- *Citizens as family members*, to have simple medical information for everyday needs.

MOBIlearn Expected Results

The MOBIlearn project has international relevance by proposing the conception, development, experimentation, and exploitation of new models of learning, via next-generation mobile networks, through:

- creation of pedagogical paradigms to support learning in a mobile environment, such as collaborative learning, organisational learning, dynamic knowledge creation in a group;
- definition of a new open abstract framework suitable to develop and implement interoperable services, such as the delivery and tracking of learning contents, location-dependence, personalization, context awareness;
- selection and adaptation of existing e-learning contents for mobile devices, enabling automatic multi channel and multi device versioning;
- realization of new business models, based on existing success-cases (e.g., DoCoMo iMode), for self sustainability and deployment of the conceived solutions beyond the research timeframe.

The goal of the MOBIlearn project is the creation of a virtual network for the diffusion of knowledge and learning via a mobile environment where, through common themes, it will be possible to demonstrate the convergence and merging of learning supported by new technology, knowledge management, and new forms of mobile communication. A subsidiary goal is to develop deeper understandings of the social processes and interactions that arise when connectivity reaches a critical point, to be alert for the possible emergence of "ambient intelligence" [4] equivalents of the widespread take-up by users of Short Messaging System (SMS).

Best Practices of Abstract Frameworks for Learning

To achieve the project objectives described in the previous chapter, a set of mobile interoperable services has to be identified and specified through an open abstract framework. Of course, the approach is based on an extensive study of existing best practices, among which the Open Knowledge Initiative (OKI) and IMS Abstract Learning Framework (ALF). One of the MOBIlearn objectives is to build upon such models, conceived for 'traditional' campus-based e-learning systems, in order to extend them towards learners' mobility.

The Open Knowledge Initiative (OKI)

The Open Knowledge Initiative [5] is defining an open and extensible architecture for learning technology, specifically targeted to the needs of the higher education community. OKI provides detailed specifications for interfaces among components of a learning management environment, and open source examples of how these interfaces work. The OKI architecture (fig. 1) is intended to be used both by commercial product vendors and by higher education product developers. It provides a stable, scalable base that supports the flexibility needed by higher education as learning technology is increasingly integrated into the education process.

The interface methods defined by OKI support the ongoing integration of three general categories of software:

- *learning applications* ranging from individual quizzing, authoring, and collaboration tools to suites of such tools that include course management and learning management capabilities;
- *central administrative systems* such as student information, human resource, and directory management;
- *academic systems* including library information systems, digital repositories of research and educational materials.

Once this architecture is fully adopted by the education market, new components may be plugged into the learning infrastructure using OKI's tightly defined and standardized application programming interfaces (APIs).

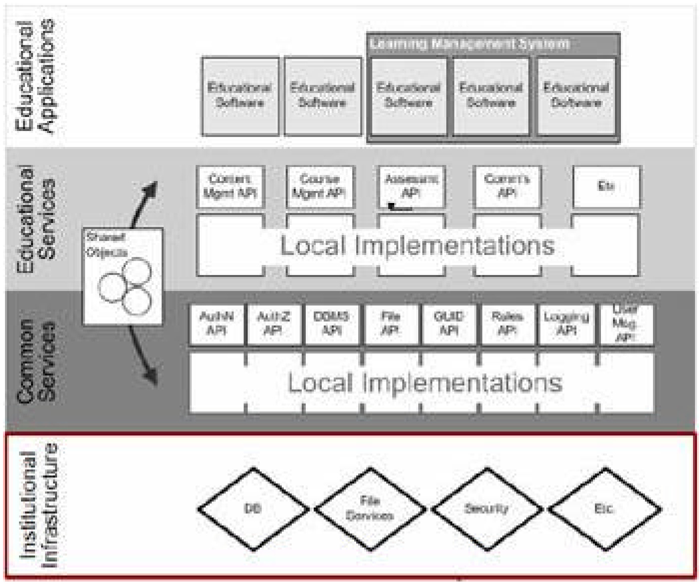

Figure 1. The Open Knowledge Initiative Architecture (courtesy of OKI) [5]

IMS Abstract Learning Framework (ALF)

IMS is developing an Abstract Learning Framework [6] which will guide the creation of future specifications. Specifications are guidelines and suggestions for implementing something. They are a tool to help the developer, implementer, or administrator making decisions. Specifications, unlike standards, capture rough consensus and evolve rapidly.

During the past 30 months the IMS has released a unique set of interoperability specifications within the e-learning technology community. The IMS Abstract Learning Framework (ALF), presented at the EDUCAUSE 2002 conference [7], is a device to enable the IMS to describe the context within which it will continue to develop its e-learning technology specifications. This framework is not an attempt to define the IMS architecture, rather it is a mechanism to define the set of interfaces for which IMS may or may not produce a set of interoperability specifications. In the cases where IMS does not produce a specification then every effort will be made to adopt or recommend a suitable specification from another organization. It is the intention of IMS that this Abstract Learning Framework and the associated IMS specifications produced to realise the exchange of information between the identified services will be adopted in a manner suitable for a particular system requirement.

Summarising, the IMS Abstract Learning Framework is:

- an abstract representation of the services and their interfaces that are used to construct an e-learning system in its broadest sense;
- focused on the support of distributed electronic learning systems;
- a framework that covers the possible range of e-learning architectures that could be constructed from the set of defined services and interfaces.

The MOBIlearn Open Mobile Access Abstract Framework (OMAF)

The MOBIlearn project targets to develop an Open Mobile Access Abstract Framework (OMAF) based on layers of infrastructure and application profiles, instead of targeting a single vertical architectural implementation [8]. The OMAF does not need to be 'implementable' in detail, since its purpose is to drive project developments focusing on the interfaces between layers to ensure services interoperability, i.e. the capability to communicate, execute programs, or transfer data among various functional services. On the basis of this Abstract Framework concept, a goal is set to create specifications of the different services, according to the 'open architecture' approach. OMAF will help also to exploit reusability of software according to the object oriented software development approach (fig. 2).

Following the User Centred Design [9] and the UML frameworks [10] methodologies, OMAF will address the conceptual layout of services to access knowledge and learning in a mobile environment, for example, via collaborative spaces, context aware and location based. In fact these are examples of possible services to be implemented in MOBIlearn. These represent also possible implementations of the conceptual framework specifications, but, the real value resides in the latter. Nevertheless, as described in chapter one, an instantiation of OMAF will be actually developed and tested in real users trials.

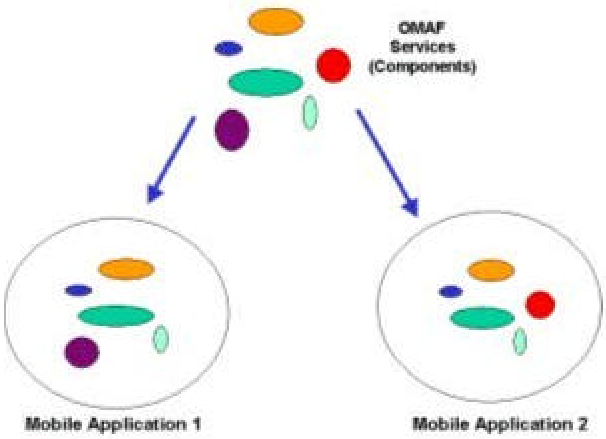

Figure 2. From single re-usable services to different mobile applications

The OMAF Layered-model

The multi-layer model of OMAF [10], depicted in figure 3, is composed by the following layers:

- *The Mobile Meta-Applications Layer (MmAL)*: the set of systems, tools and applications obtained as a combination/integration of two or more mobile applications, to provide extended and more complex functionalities to users.
- *The Mobile Applications Layer (MAL)*: the set of systems, tools and applications specifically designed and implemented to provide a particular mobile functionality. They are built starting from the suite of mobile services and common services.
- *The Mobile Services Layer (MSL)*: the set of components able to provide mobile specific services, which are used by the mobile applications.
- *The Generic Services Layer (GSL)*: the set of components that provide generic services to be used by the application services.
- *The Infrastructure Services Layer (ISL)*: the underlying services that enable to exchange data in terms of communications, messaging and transactions.
- *The Service Access Points (SAP)*: interface to the corresponding service. Each SAP provides access to one service capability. SAPs will be implemented through APIs (Application Programming Interfaces)
- *The Components Store (CS)*: a set of components that has to be specified to support the Generic and Mobile services. For instance, it will be possible to find in the BSC the data models for images (BMP, GIF, etc.), user

profile and location, geographical coordinates of objects, etc.

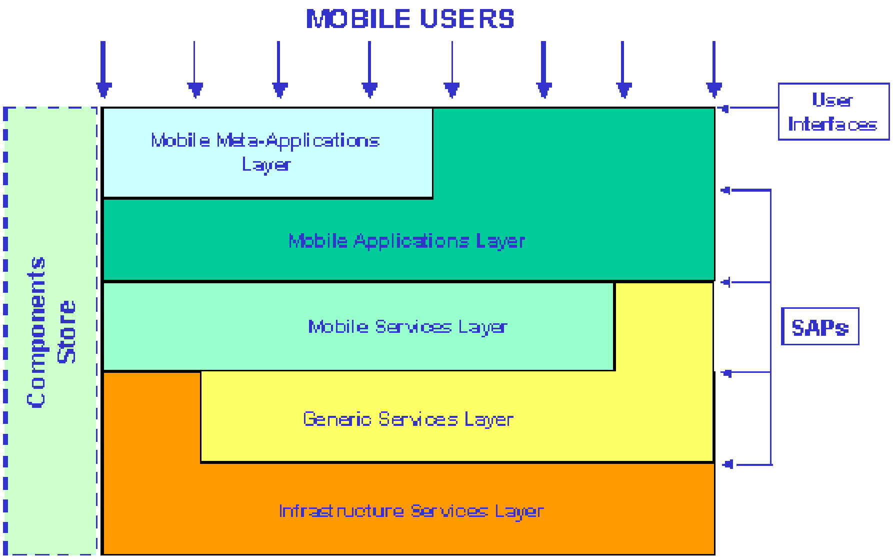

Figure 3. The OMAF layered-model

The services will be described using the UML package diagrams [11]. These graphical representations are suitable to map a complex system as a function, which is then broken down into sub-functions that can be further broken down into sub-sub-functions and so forth.

Conclusions

Once defined the OMAF model, the next MOBIlearn activities will consist in services identification, within each layer, and their functionalities and interfaces specification. After a review of the existing technologies for mobile applications, MOBIlearn team will identify the most suitable solutions for developing the OMAF instantiation, to be used in real users trials scheduled for year 2004.

In conclusion, as it is perceived today, the OMAF approach could bring to data extensions (such as mobile/location aware learning objects, with geographical references included in their metadata structure) and new services definition, possibly sitting on top of the infrastructure and learning services, under definition within IMS ALF and OKI initiatives.

Acknowledgements

MOBIlearn is a 30-month, 8 MEURO, Research and Development (RTD) project co-funded by the European Commission (DG Information Society D/3-Education and Training), under the contract IST-2001-37187, within the Information Society Technologies (IST) programme of the Fifth Framework Programme of RTD. The participation of US partners (MIT and Stanford) is funded by US National Science Foundation (NSF), and its implementing arrangement between the European Commission and the NSF, specifically addressing co-operative activities in the field of e-learning. The participation of AU partners is funded by AU Department of Education, Science and Training.

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Giorgio DaBormida
Coordinator of the MOBIlearn Consortium
GIUNTI Interactive Labs S.r.l., Via Portobello, Abbaziadell'Annunziata
16039 SestriLevante, Italy
g.dabormida@giuntilabs.it

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Are you a laptop school?

Mobile computing has only just recently made it to k-12 education. As Technology Director of a preschool-12 grade co-educational, Catholic, independent school in Northern California, I have seen mobile computing usage expand tremendously throughout our campus in the last four years. And the use of laptops in the classroom has doubled nearly every year. Our campus consists of approximately 1000 students and 200+ faculty. Laptop integration in our school began slowly but we now have nearly 100 laptops accessible to our students at various grade levels and within different disciplines. However, we still grapple with the question of whether to become a "laptop school". I think the notion of a "laptop school" is something that has now become subject to interpretation. Isn't every school that uses laptops in the curriculum a "laptop school"? Why not? I have come to believe that we are a "laptop school" – we're just doing it our own way.

It was once considered a luxury to have a laptop in k-12 education. In the 1980's and early 1990's laptop computers were very expensive, not to mention still a bit bulky. In the late 1990's laptops became more accessible to faculty on our campus. In 1996 I wrote a matching grant to the Edward E. Ford Foundation to fund a professional development program we wanted to begin at our school. Faculty would receive laptops and participate in required training over three years. After that three-year period, the laptop was theirs to keep. They would also use the laptop at their desk everyday – this at a time when very few teachers had computers for their personal use. At this same time, many schools were just getting networked and hooked up with "high-speed" Internet access for the first time. It was a time with many changes in the area of technology and education. So this was our first foray into mobile computing on a large scale. It was a popular program that still survives today.

The idea of students and laptops did not really come to the forefront until about 1998. And it was truly by necessity. Our schools were set up like most in that we had computer labs for classes, a bank of computers in the library for research and a few classrooms with computers that were used like stations. Most teachers that wanted to use computers with their classes, scheduled time in a computer lab. The science department in the high school felt that the time had come for them to invest in technology for their labs. The network and the Internet were great but they had specialized needs and they had software and probes and other peripherals that they wanted to use in their labs on a regular basis. The school was very supportive but we did not have enough funding at the time to put computers in three science labs. So laptops became a way to have the necessary technology and still be able to accommodate three science classrooms. We had a locking cart, a projector, and plastic containers with CDs, probes, and any other needed peripherals for each of the 10 Micron laptop computers. All labeled and ready to go. Laser printers were stationed in each lab and we even re-wired some of the labs to facilitate the laptop usage. We only needed ten because the science department wanted students to work in teams and encouraged collaboration on projects and experiments. It was win-win situation all around.

Well, that was then and this is now. Now, six years later, we have nearly 100 wireless laptops for students to use on our campus. In the year 2000 we began seeing situations where a bank of laptops would really facilitate a new learning opportunity in the classroom that going to the computer lab would not. And the computer labs were over scheduled – we just could not accommodate every class and we had no room for another computer lab, or the staff to maintain it and schedule it. So another cart was added in the middle school. And then another and another were added. Each year this is what the teachers were requesting. We have them in science, for language arts, the humanities, and drama – everyone was using them. And all the while wireless technology was becoming accessible to us as well. We had a solid network infrastructure and by adding wireless access points to every network closet on campus and a few antennae in between – we were able to make the laptops even easier to utilize and now any location on campus became network ready – park the cart where you want to be and class begins. The students retrieve their own laptops from the cart, they are trained on how to use them and we have very few incidents or issues.

As time goes on and faculty and students become more comfortable with using mobile technology in the classroom and within the curriculum, scheduling the carts is becoming more difficult. Often now in our technology committee meetings, we come around to the question of whether or not we need to consider becoming a "laptop school". And then the questions about logistics surface – some buildings have classes on three floors – students couldn't carry the laptop and their books up flights of stairs and to multiple buildings and what about when it's raining… The support staff needed for such a change would be too great… We have ongoing discussions about the pros and cons. But what seems to be happening here is that we are putting laptop carts in place for shared areas – disciplines or grade levels that don't need to have them everyday and can maintain a schedule for them themselves. What I foresee in the future is that the faculty that utilize computers everyday will find ways to justify their own laptop cart in their classroom or possibly shared within a department or grade level. They have truly embedded the technology into their curriculum and their teaching demands spontaneous access. This has become our version of a "laptop school". So now when people ask, as they often do these days, "Are you a laptop school?" - I say, yes we are!

Jamie Sullivan
Technology Director
Sacred Heart Schools in Atherton
California
USA

Doctoral student, Pepperdine University
jsullivan@shschools.org

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The Project of Electronic Schoolbags in Hong Kong

Who wants to carry a bulky bag to school? Not children. Nobody wants one shoulder to be lower than the other, and paining too. In Hong Kong, most of us would look at the reduction of textbooks as a way out. Therefore, the Hong Kong Education Department is currently conducting a pilot scheme on electronic schoolbags in 10 primary and secondary schools at all class levels to test the technical viability of integrating notebook computers and PDA with wireless LAN, and their feasibility of replacing schoolbags. The ten pilot schools are as follow:

- Fung Kai Primary School
- E.L.C.H.K. Hung Hom Lutheran Primary School
- Shak Chung Shan Memorial Catholic Primary School
- Po Leung Kuk Wong Wing Shu Primary School
- Po Leung Kuk Chan Yat Primary School
- PLK Chee Jing Yin Primary School

- SRBCEPSA Lee Yat Ngok Memorial School
- Lai Chack Middle School
- Buddhist Wong Cho Sum School
- Ju Ching Chu Secondary School

The pilot scheme consists of three phases. In the first phase (May-August 2002), the related equipments were purchased, installed, and tested according to the pilot schools' own situation. A typical electronic schoolbag system consists of hardware such as Personal Digital Assistant (PDA) or notebook computer together with a wireless connection to the Local Area Network (LAN) of the school and the Internet. Related trainings were also provided to the teachers and students. In the second phase (2002-2003 academic year), the pilot schools implement their own teaching plan and do the evaluation. In the pilot scheme, educational resources provided by the Hong Kong EducationCity, the commercial sector (e.g. education publishers) and schools' self-developed resources are used to test the various modes of electronic schoolbags. In the last phase (June-August 2003), share conferences will be held to share the experience of electronic schoolbags implementation by the pilot schools.

Here are examples of the wireless network infrastructure installed in some pilot schools. For the 4 pilot schools, Buddhist Wong Cho Sum School, PLK Wong Wing Shu Primary School, Ju Ching Chu Secondary School and PLK Chee Jing Yin Primary School, ASL (Automated Systems Holdings Ltd) has supplied and installed IntelPRO/ Wireless 2011B LAN Access Points in playground, hall, classrooms, staff room and general office of the schools. Notebooks and handheld devices with different specifications are also provided. Shak Chung Chan Primary School purchased 38 iBook computers, each equipped with an AirPort Wireless Card and a Wacom pressure-sensitive drawing tablet, and the Mac OS in Chinese. Eighteen AirPort Base Stations are strategically placed around the school, including four units in the art room, four in the multifunction room, and three on the playground.

Electronic schoolbags is a good idea, as it not only reduces the weight of schoolbags but also provide teachers and students with an expandable repository of electronic learning resources. Actually, many small-scale pilot schemes have been, or will be, launched shortly around the world like the Mainland China, Taiwan, Singapore, USA, France and Malaysia, etc., however, no schools have successfully replaced all traditional textbooks by electronic schoolbags. The fact is that there are a lot of problems to be solved before the dream comes true. To collect different points of view about electronic schoolbag, we had held meetings with different people including parents, teacher, and principals of primary schools (e.g. PLK Stanley Ho Sau Nan Primary School, SKH Kam Tin St Joseph's Primary School, Kei Wai Primary School, etc). The followings are the main concerns collected in the meeting.

- In Hong Kong, the student's table in the classroom is so small. When putting a notebook on the table, there is no more space to put other teaching materials like worksheets and do any writing. On the other hand, since the children are so careless, the PDAs/notebooks are so easy falling down to the floor and damaged.
- Instead of requesting every student to bring back a PDA/notebook to school, it is better to use the classroom computer, projector, and speakers to present the teaching materials to the students in the class. It is even much more attractive for the students. The homework can also be downloaded from Internet at home with the home computer.
- It is so bad for the children's eyes if the children look at the PDA/notebook screen all the time in the school and even at home. In the case of primary students, since the lecture notes, quizzes, and homework assignments are supposed to be stored in the PDA/notebook, it is so inconvenience for their parents to teach their children at home.
- There are so many different publishers in Hong Kong providing textbooks for different subjects in primary and secondary education. That is a problem if not all the publishers can provide the electronic version for all textbooks.
- Discipline control is very important when all the students using computer in the classroom. That is why most of the primary school has installed a hardware or software control system in the wired-network environment. Therefore, the same problem will happen in a wireless network environment.
- Emergency plans have to be done by school regarding the students forget to bring the PDA/notebook to the class; the PDA/notebook out of battery; and the PDA/notebook out of order.
- The most important one is that who should play for the PDA/notebook.

The pilot scheme on electronic schoolbags will be completed in August 2003, after which the Hong Kong Government will review the scheme and consider whether the scheme should be extended to all schools. Even though there are problems as mentioned before, we hope that the scheme would shed light on the direction for the development of relevant teaching resources and operation mode. More importantly, it explores ways to utilize such technology to enhance students' learning, including collaboration learning and self-learning.

Dr. Li Kei Chun
Department of Information and Applied Technology

Hong King Institute of Education
danielli@ied.edu.hk

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Are mobile technologies an integral part of learning culture?

Introduction

It has been pointed out that access to technology makes technology an integral part of daily learning (Soloway 2001). It has often been suggested that access on its own will not fulfil the promise which many have meant lies in the use of ICT in school (Bransford et al 2000), but where several criteria for the successful integration of ICT play a role (Dwyer 1993). Integral refers to being "necessary to the completeness or integrity of the whole; forming an intrinsic portion or element, as distinguished from an adjunct or appendage" (Oxford English Dictionary 1989, 2nd edition), which here means used when needed and in context, seamlessly.

The paper draws on preliminary findings from a pilot study at a 6th grade class, a Hi-CE (Center for Highly Interactive Computers in Education at the University of Michigan, USA, http://www.handheld.hice-dev.org/), the Center for Highly Interactive Computing in Education at the University of Michigan, project class. The pupils in this study are twelve years old (using PalmTM III, at an Intermediate School in Michigan; USA), the teacher has been using the handhelds in teaching for three years; the pupils started using their handhelds at the beginning of the school year in September 002.. Classroom observations and interviews with pupils and teachers (informal interviews) were undertaken during the visit. The pupils were also asked to draw a concept-map depicting where, what and why they used their handheld computer. Hi-CE, is currently working with schools in Michigan to integrate Palm handheld computers in the classrooms (Concept-mapping was used as a means of expressing ideas quickly, and to provide evidence from each of the pupils. According to the ImpaCT2 study, concept maps "consist of putting words that represent concepts in boxes and linking these by means of words or phrases, so that the connections can be read. The study refers to Novak and Gowin's 1984 work, where they found that this approach gave researchers more accurate insights into pupils' thinking than traditional methods of testing, or in the notion of a mind map.). Hi-CE is also developing and researching, a collection of applications for the classroom - "the Cool Dozen" - based on Palm OS, along with instructions for each.

Learning Culture

It has been pointed out that school learning is characterized by memorization and reproduction of school texts, and where teacher talk dominates and students' activity is largely limited to answering questions formulated by the teacher (Miettinen 1999). In such a learning culture, drawing on examples of mobile telephony in classrooms, one can say that their role can be regarded as that of an "intruder" in the learning culture, a disturbance (Mifsud 2002), and as such a *disruptive technology*. One can speculate whether the transition from disruptive to integral is through a change in the learning culture, and through "letting go of some of the control", which also requires familiarisation with the technology. As the teacher pointed out, she did not

"*…fully integrate until she became more familiar with the many ways to use the Palm… it just sort of came natural as I became more knowledgeable…*"

Teachers in the Palm Education Pioneer report (2002) also indicated that handheld computers were more easily integrated with the flow of learning activities than desktop computers. This appears to be supported by the observations at the Hi-CE project school, where it appeared that the handheld computers were an integral part the daily flow of school and classroom activities. The teacher did not always ask the students to use the handhelds, although she did sometimes make suggestions as to what programs could be used; it was up to the students to find what they deemed to be the best way of achieving the task at hand, whether this meant using technology or role-play.

Inkpen (1999) points out that handheld computer technology for children is not a new idea. She further points out that one of the main advantages of these handheld electronic devices is their ease of integration into a child's world and that the products themselves become a part of the children's culture. From the concept-maps that the students drew it is clear that *all* the pupils in the study showed that they used the handheld in arenas other than school, such as home and in the car, with games hitting most scores, in situations which the pupils described as potentially "boring". The handhelds were also used whenever the students had free time in class, mostly for playing games – the deal in this particular classroom was that games were allowed as long as the pupils had finished the tasks they were set to do. The animation program

Sketchy was also used as the pupils appeared to find this amusing. Students in the pilot study who had a long way to school also reported using their handheld on their way to school, both for finishing assignments and games

Being Selective

In one of the lessons observed, the students were working on a project on medieval castles, – the students were also building castles from old milk cartons and aluminium foil, paint. The desktop PC used for online browsing, with the information that the pupils found relevant downloaded to their handheld - offline browser. Their handheld does not have unlimited memory, in this case 8MB, so the pupils have to be selective in what they choose to download, the amount of pictures and links. In this case some of the students decided that they needed a depth of three links as well as pictures. The OECD report (2001) points out that "in a world with easy access to huge stores of information, the skills of accessing... more important than the ability to recall in detail ever greater amounts across many fields of knowledge". From this perspective having limited computational power, can be seen as positive - one can say that the students are also forced to establish a set of criteria for making their choice. While it is too early to conclude, there seem to be indications that the pupils learn, to pick and choose the websites which they need, and their relevance to the task at hand.

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Louise Mifsud
Agder University College
School of Management
Dept. of Information Systems
Service Box 422
4604 Kristiansand
Norway
Louise.Mifsud@hia.no

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mLearning - Mobile learning applications in language learning and history education

Background

Learning may happen in different and various ways. People learn in classrooms but they also learn through their personal and everyday experience. Traditionally knowledge is thought as something stored whereas learning is considered as the process of acquiring knowledge from books, classrooms and lectures. However modern pedagogical theories support the idea that knowledge is something active and learning is contextual in its nature. In this framework knowledge should be considered as something that happens rather than something that is stored and consequently any experience, any involvement may be considered as a learning opportunity. This approach is reflected in the pedagogical theory of contextual learning [1,2,3].

In the insight of the contextual learning theory learning activities may take place outside the classroom, in the real world, where technology and especially mobile technology has a dominant role. The idea of contextual learning is fully supported in the framework of m- learning application. In the word *m-learning* "m" stands for "mobile", representing the back- stage mobile delivery technology It is obvious that for the expansion of the idea of learning and the creation of learning schemes that are based on the effective use of motivation that arises when a student is faced with the stimuli, mobile devices with Internet access can offer significant advantages. Mobile technology actually offers the appropriate educational environment to assist learning activities both inside and outside the classroom [4]. Opposite to the limitations of working and learning only in the classroom or in the lab, mobile technology offers access to learning material regardless of location and time. In this framework mobile learning is translated into flexibility in accessing learning materials but also classmates and teachers anytime, anywhere. As *Paul Harris* in *Goin' mobile* states mobile learning is *the ability to enjoy an educational moment from a cell phone or a personal digital assistant* [5].

Language learning and **history education** are among the disciplines that offer the appropriate framework as well as the motives for the introduction of mlearning applications in education.

Language learning independent of time and location: The Ad-Hoc.com project

The Ad-Hoc.com project's [6] develops an innovative advanced multimedia language learning system that allows travellers (for business, leisure or educational purposes) to access the web through the advanced new communication applications (PDA applications, GPRS and UMTS) and acquire certain language information in order to communicate with locals in the country of their destination (The AD-HOC project is a European cooperation project (2000-2002), co-financed by the European Commission, DG Education and Culture, SOCRATES Programme, Lingua2 Action). These new applications allow for fast transfer of data (text, sound, picture and video) through the mobile device (phone, palmtop) of the user. The Ad-Hoc.com system serves users regardless of time and location. The system is presenting linguistic content embedded in its cultural context furthering the understanding of European's cultural and multilingual diversity, as it is proven that the mutual understanding in the communication process depends not only on linguistic competence but also on the awareness and perception of cultural behaviour, cultural differences and similarities. The Ad-hoc.com project is mainly focused on two axes: PDA's multimedia capabilities and short-range wireless communications technologies.Using tools like Embedded Visual Basic 3.0 and Embedded Visual C++ testing applications are being developed from scratch, to take full advantage not only of the mobility of the device but mainly of the exploitation of all multimedia capabilities, like download and reproduce audio and video files.

The approach, which has been adopted in the framework of the project, is the scenario design method [7] as a means of defining suitable educational applications of the mobile technology. In the framework of the Ad-Hoc.com project a series of scenarios have been developed describing real life situations (Visit to a museum, at the library, at the restaurant, at the bank, during the break at the conference, admission, at the beach, at the hotel, business meeting, at the multimedia lab). Language learning information is presented through **written text**, **audio** and **video**. The piloting of the application is taking place in repeated cycles of learner-centered trials [8] in Greece, Italy, Austria and Germany. Each cycle includes the design, the development, the trials and the evaluation, which is the input for the next cycle in the product's development approach.The in-situ trials are not only meant for evaluation purposes but involve both students and teachers offering them the chance to provide feedback to the project and its technical and pedagogical aspects.

History education through mobile devices: The MoTFAL project

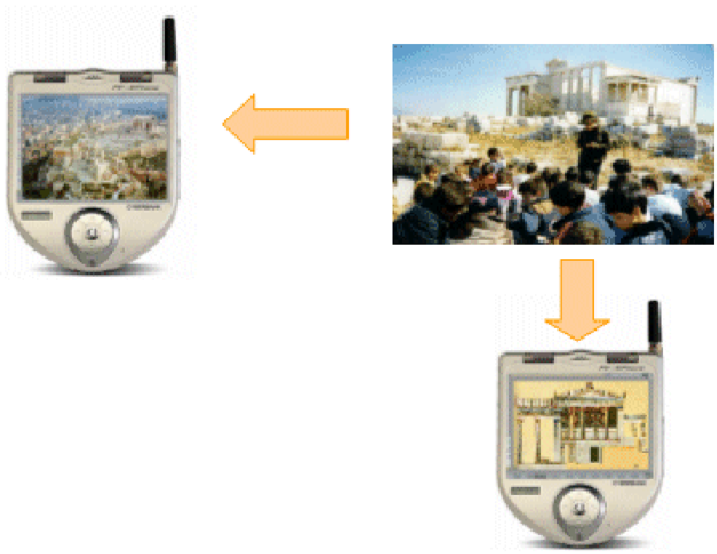
The project **MoTFAL- Mobile Technologies for Ad-Hoc Learning-** [9] is a joint initiative of pedagogical, technological experts, educators, and psychologists to research the possibilities of using mobile platforms with Internet access for educational purposes at school level (The MoTFAL project is a European cooperation project (2002- 2004), co-financed by the European Commission, DG Education and Culture, SOCRATES Programme, Minerva Action). The partnership develops, tests and evaluates learning schemes that are implemented on a handheld learning environment based on emerging technology that facilitate in situ learning. The project engages mlearning applications in the field of **history** and **science education**.

The **MoTFAL** learning environment includes full access to digital resources, cognitive tools, knowledge visualizations, software mentors to help with learning to use devices such as digital cameras, organise and recall images and sounds of people and situations, knowledge sharing between students in different environments, contextual personal tools that change their behaviour based on where they are and the activity in progress. Students have the chance to be linked to video clips, PDF articles, and Websites.

The project includes an extended period of school-centred work. The aim is to help both teachers and students to actively participate in the development of the **MoTFAL** platform by giving their input and contributions. Furthermore the project proposes a student-centred approach in order to assure the maximal usability of the new tools as well as a realistic evaluation of the pedagogical effects.

In the framework of the MoTFAL project the pedagogical theory of contextual learning as well as the scenario design method gives the guidelines for the development of the educational material and the design of the educational process. In the partnership's vision the contextual learning in history education and the scenario design method offer a different approach and perspective to history teaching and learning.

mLearning applications in history education in high school: a scenario example.



The teacher of a high school class takes the students to a field trip Parthenon for example. As they are visiting the monument the students are requested to connect to the specific area of the platform where the teacher has already uploaded the selected material concerning the history of the monument. Students are able to see pictures of the monument during the time, to see drawings of the monument. They can also have access to a video presenting how the monuments were and how it was related to the everyday life of the people living at that time. They can even find sound and video recordings of remarkable events of this specific period. Furthermore students are able to capture moments of their visit with the camera of the device and upload them to the server for future reference and also to add their comments and to continue their research by accessing web-sites.

Conclusions

Today's ICT has significantly extended the scope for learning anywhere, anytime and the term mLearning has gained serious strength and influence in describing the future of education [10]. It is widely believed *that technologies in the hand* will engage young people in learning activities, start to change their attitude to learning and thereby contribute to improving their skills, opportunities and lives.

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S. Savvas
Reaserch and Development Department
Ellinogermaniki Agogi
Athens - Greece
Tel: +302106032550
Fax: +302106032554

S. Sotirou
Reaserch and Development Department
Ellinogermaniki Agogi
Athens - Greece

E. Malliou
Reaserch and Development Department
Ellinogermaniki Agogi
Athens - Greece
malliou@ea.gr

Ellinogermaniki Agogi
Reaserch and Development Department
Ellinogermaniki Agogi
Athens - Greece

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Byte-Sized Learning: Handhelds in K-12 Classrooms

Current research shows that computer use and student learning gains are "closely associated with having computers accessible in teachers' own classrooms" (Becker, Ravitz, and Wong 1999; see also Marx, et al., 2000; Norris & Soloway, 2001; Soloway, Norris, Blumenfeld, Fishman, Krajcik, & Marx, 2001), and that a 1:1 student to computer ratio is needed to make computing in schools truly personal. For many school districts, especially the larger and poorer ones, attaining this ratio is a financial impossibility (see Norris & Soloway, 2001). Handheld computers, which cost a fraction of the price of desktop and laptop computers, can fill this gap. This technology may provide schools a more realistic alternative for integrating technology into the classroom and meeting the challenges of improving student achievement.

In 2001, SRI International awarded nine Palm Education Pioneer (PEP) research hub grants to provide handheld computers to teachers and students and to evaluate their uses in K-12 classrooms. The Research Center for Educational Technology (RCET) at Kent State University was designated as one of these research hubs. RCET researchers conducted a preliminary investigation of the implementation of 280 handhelds in K-12 classrooms by participating teachers. The teachers who took part taught grades 1-12 in a variety of content areas including computer science, math, language arts, integrated curriculum, and special education.

The following research questions were used:

- How can handheld computers in the classroom improve teaching and learning?
- What educational activities do handhelds make possible?
- Just as important, what is missing in this new technology?
- How can handhelds be adapted to harness their full potential in the classroom?

To answer these questions, researchers administered surveys to teachers and students at the end of the 2002 school year. Nine teacher and 217 student surveys were used in the analysis.

Overall, student surveys indicated that the majority had never used a handheld computer before (84%), and use during the school year was evenly divided between "almost every day," one-two times a week, and three-four times a week. The handhelds were mostly used in the classroom (99%) or at home (73%). At school, Palms were used for calculations (90%), beaming (84%), drawing (73%), and organizational purposes (70-75%). In addition, 89% of students mentioned game playing while at school. Handheld use at home included calculator use (84%), drawing (74%), organization (64-68%), and beaming (39%). Almost all students (98%) said they played games at home.

Students agreed that handheld computers were fun and easy to use, and motivated them to learn. The majority thought Palms helped them to learn (93%) and be more organized (87%), and about two-thirds of all students stated handhelds made them better students. In contrast, major issues in handheld use included difficulties with text input, screen size, keeping the batteries charged, and screen calibration. Younger students often reported problems with stylus use (due to developing fine motor skills).

Teachers were equally positive, stating that handhelds were easy to use for a variety of projects involving data collection and analysis, writing, and sharing/collaborating through beaming. In addition, handhelds helped teachers be more efficient and organized when it came to record keeping, transferring information between work and home, and distributing information to students and parents. Logistics were a major issue, as teachers grappled with maintaining a classroom set of handhelds, dealing with software installation, hotsyncing, keeping batteries charged, and monitoring student handheld use. Teachers also needed more time to explore all the possibilities.

Teacher suggestions related to hardware included a perceived need for more durability in order to withstand the daily (ab)use by students. Displays caused the majority of problems because the digitizers would fail after prolonged periods of excessive pressure. Teachers also expressed a desire for more educational and affordable hardware and software for their grade level or subject area.

In summary, widespread use of handhelds in K-12 education may have a substantial impact on teaching and learning with the continuing development of educational hardware and software. Preliminary research like that conducted by RCET indicates that handhelds are more effective than desktops or laptops because of the potential for 1:1 computing anytime, anywhere (Bannasch, 1999; Soloway, et al., 2001; Tinker, 1997), for computer-supported collaborative learning through beaming and short-range wireless networking, as well as for the representation of individual or shared knowledge in a wider variety of ways (Pea & Gomez, 1992; Roschelle & Pea, 2002). RCET researchers emphasize that this is a preliminary evaluation and recognize that further research is needed to fully explore these areas.

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Mark van 't Hooft
Tech Specialist/Researcher
Kent State University
Research Center for Educational Technology
036 Moulton Hall/201 Moulton Hall
Kent, OH 44242
USA
Tel +1 330 672-9722
Fax +1 330 672-5834

Sebastian Diaz
Kent State University
Research Center for Educational Technology
036 Moulton Hall/201 Moulton Hall
Kent, OH 44242
USA

Susan Andrews
Kent State University
Research Center for Educational Technology
036 Moulton Hall/201 Moulton Hall
Kent, OH 44242
USA

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Writing and Computers: Tasks, Tools, and Costs

Introduction

The question that guides this research is whether writing with technology, specifically portable and inexpensive text editors, has a place in today's teaching and learning environment. Text editors, such as the AlphaSmart 3000, have been met with mixed reactions; power users (those who regularly integrated the use of technology into their work) embraced the AlphaSmarts while the rest focused in its limitations (e.g., small screen, not fully Windows compliant, unable to support multimedia tasks). This research is a case study into the use of these portable units in one classroom and the impact they have had on the writing process for the grade seven students who used them.

Background to Writing Process

In the Teacher's Guide that accompanies the AlphaSmart 3000s, the following claim is made "The AlphaSmart is exceptionally well suited for helping students improve the quantity and quality of their 'prewriting' – the raw material that will be refined at later stages in the composing process" (Marcus, nd, p. 3). Research (Hunter et al., 1988) suggests that the process of writing consists of "… four interrelated activities – generating, organizing, composing, and revising" (p. 3).

It has been observed that professional writers probably spend 85 percent of their time prewriting, one percent writing, and 14 percent rewriting" (Marcus & Blau, 1983). Beginning writers, however, tend to spend the bulk of their time writing and rewriting, limiting or neglecting the prewriting steps all together, often interrupting the flow of their thinking with regular, small revisions.

In an attempt to limit the interruptions, Marcus (1990) proposes the notion of invisible writing, a form of free writing. Invisible writing is "… a technique that helps build fluency by giving students permission to put on temporary hold their concerns such as spelling, grammar, punctuation, and complete sentences" (p. 2). It frees students from the "… compulsion to tinker with their text – a common problem when trying to prewrite with a word processing package … [and] evokes writing that comes from the subconscious … [and] encourages the movement from facts to feelings … [helping students to] focus on the content of their writing instead of its surface features" (p. 1-2).

By discouraging the kinds of local editing which tend to be counter-productive at certain stages of the composing process, the writing strategy suggested by Marcus & Blau (1983) tends not to obstruct written fluency or dilute concentration on the content. Teachers who have worked with novice writers using word processors can commiserate about the amount of time spent changing font and size and reacting to the green and red squiggles suggested by the word processor when grammar errors or unconventional spelling is typed, supporting the idea that obstruction and diversion negatively affect concentration and content development.

Background to Technology and Writing

Today, features previously found only in high-end graphics packages are standard with basic word processor software, giving fuel to the "'Technology 80/20 Rule': eighty percent of the people who use a given piece of hardware or software make use of only twenty percent of its power" (Marcus, nd, p. 3). Consequently, it is not surprising that when novice writers sit down to write, their attention is easily diverted by the bells and whistles of the software and the lure of inserting graphics taken directly from the web.

So the question becomes how can we maximize the benefits of word processing and minimize the distractions?

Methodology

This research was conducted over the span of seven months. The teacher and the researcher met once at the beginning of the project. The rest of the collaboration was completed via email and the sharing of video footage that was then edited into an iMOVIE for coding and analysis.

The teacher collected writing samples from assignments consistent with Moffett's (1968) Scale of Intellectual Ascent for Discourse (recording, reporting, generalizing, theorizing). Moffett felt that this scale required students to increase their cognitive complexity in terms of written discourse. The written work was then analyzed in terms of quantity and quality.

The research set out to confirm the findings of Blau (1983) suggesting that the more complex the writing task, the greater the benefit of invisible writing as there is a greater degree of concentration required. The parallel in this research is that the use of AlphaSmarts, due to their limited screen size and editing options, is similar to the use of invisible writing strategies.

Discussion

Admittedly the sample for this study was small, but it did range over the course of the academic year, capturing changes in skills and attitudes as the novice writers completed their grade seven year. All students in the class wrote all the assignments, but the teacher was able to take comprehensive field notes on only the four included in this study.

This research focused on two distinct elements: (1) student attitudes toward writing, and (2) the quantity and quality of student writing in three distinct tasks – reporting/recording, generalizing, and theorizing. It determined that children's writing and attitudes toward writing improved by using portable technology, specifically the AlphaSmart 3000 text editors, and it helped children make the transition between school and home as the devices were portable and easy to use. Further it found that this portable technology was affordable in terms of savings on hardware, software, furniture, space, technical support, and wiring.

Conclusion

The AlphaSmarts appeared to encourage positive attitudes in the children toward writing and to discourage concerns about local editing. Children tended to focus on the content and tended to write more and at a higher quality.

Based on initial findings, it would seem appropriate to expand this research design to a larger population in a longer study as the format appeared to capture the writing process accurately and engage both the teacher and students in the research process.

Further, students used the AlphaSmarts to generate text, choosing to draft their work on these tools even when desktop computers were available. The portability of the AlphaSmarts allowed the students to work where they wanted to and to take their work home with them. Comments from both the teacher and the students should encourage others to consider mobile solutions to classroom technology needs, recognizing the cognitive advantages these tools offer.

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Dr. Susan Crichton
602 Ed Tower, Faculty of Education
University of Calgary
2500 University Dr. NW
Calgary, AB, Canada T2N 1N4
Tel +1 403 220-755
Fax +1 403 282-8479
crichtos@ucalgary.ca

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Improving Face-to-Face Learning with ConcertStudeo

Abstract

Achieving fruitful participation of students in a traditional lecture is a goal that requires additional preparation and coordination effort. This extra load jeopardizes the ultimate goal: learning. ConcertStudeo augments presentation and interaction in traditional lectures with mobile computing to increase the learning outcome and to arrest the learners' attention on the subject.

Deficits in Traditional Lecture

Many variants of ex-cathedra teaching suffer from a low involvement of learners. This allows students to develop a passive mindset that leads to non effective learning, as described in the proverb "What you hear, you forget. What you see, you remember. What you do, you understand.". Moreover, neither teachers nor learners know the class' current state of knowledge (see Gage96, p.29). Due to this, teachers may give lecture about "wrong" information and may overlook misunderstandings. On the other hand, this can make a learner feel as if he understood everything correctly, although he didn't. These consequences lead to frustration on both sides which influences learning in a negative way.

When trying to integrate exercises and other interactive training in conventional pen and paper scenarios one will encounter the following difficulties:

- time loss, due to preparation, cleanup and counting
- media breaks, because of the limitation of the classic tools
- noise, due to people moving to the front or shifting paper around
- loosing the thread, because an exercise took too long

If a teacher wants to know if his lecture was understood well, he usually proposes a test question to the class. This can be answered by one or two students, but the teacher can only assume that the whole class would have answered correctly. If he asks all students to answer by raising their hand, unsure learners will join the majority and thus, alter the outcome. To eliminate this, the teacher has to do a written examination which is so time-consuming, that the teacher can not use this as an indicator for knowledge, in order to adapt the current lecture to the need of the class.

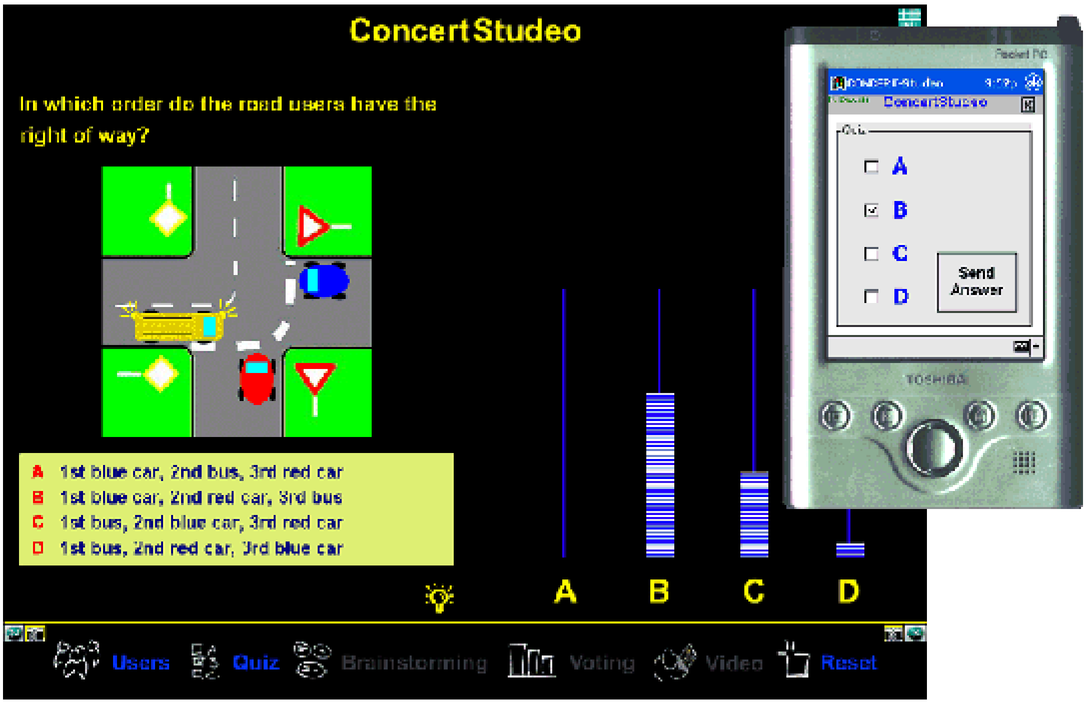
Augmenting Face-to-Face Learning with Interactive Learning Tools

Using computer support the teacher may use test questions to test and demand

- all class members at once
- with no time loss
- in an anonymous and private way
- with automatic counting and histogram generation.

Other examples for exercises are brainstorming sessions, to introduce a topic in an active way, or introduce controversial topics, ballots or votings, to achieve a majority decision or survey, and a video session that may be interrupted by every participant as soon as a question arises (see Wessner03).

How does a lesson with ConcertStudeo take place? In class, the teacher controls the system via an electronic blackboard and each learner is provided with a handheld computer. The teacher prepares some electronic slides that outline the lesson. He decides at which point he wants to introduce which exercise and provides the exercise-related material. During lecture he navigates through the course materials which results in a frequent switch-over between introducing new information and interactive exercises. This way, he is always aware of the class' current knowledge and motivates the learners to ask topic-related questions.



Multiple-choice quiz in ConcertStudeo

Reasons for Using Mobile Technology

We chose handheld devices to achieve a goal called "Calm Computing" (see Weiser96), where the devices move into the background. This is especially true since the focus of all students should be at the subject and not at the devices themselves. We use a quantity of very small computers connected via wireless LAN. That allows the students to move across the classroom without tripping over wires. Moreover, the whole class can easily move to a different room or outdoors without any extra hardware installations.

Students can bring their own handhelds to class and plug them easily into the system, which makes introducing ConcertStudeo quite cost efficient. In this case, homework will be automatically downloaded to the handheld, ready to be studied on the way back home.

Experiences

In the internal tests up to six researchers technically evaluated the system. One aspect was to choose the most appropriate network protocol, although our communication overhead is quite low.

Brainstorming session in class with ConcertStudeo

In a course on Computer-Supported Cooperative Work at the Darmstadt University of Technology eight students and the lecturer used ConcertStudeo to enrich the interactivity of the course. Lecturer and students liked the system, especially because it could be seamlessly integrated in the regular classroom activities as well as with existing learning material.

Conclusions and Prospect

We are convinced, that ConcertStudeo does not only reduce the stated deficits of traditional learning, but also helps teachers and learners to concentrate on the topic and thus, increase the learning outcome.

We are aware, that all participants need some minutes of getting familiar with the devices, in order to use ConcertStudeo in an effective way. But we believe that achieving this will pay off very well.

Although we used wireless technology in a static and foreseeable environment, we had some trouble choosing the right network protocol. We think there is still some research to do evaluating the great amount of wireless transportation protocols (see Thoppian01) and stating digested advice for people that are not experienced in wireless technology.

Since ConcertStudeo is a platform for many kinds of computer-supported learning tools, we are also going to develop new types of interaction and cooperation that do not have a counterpart in traditional pedagogy in the next project phase.

For more information about the ConcertStudeo project see http://www.ipsi.fraunhofer.de/concert/projects/studeo.

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Laura Dietz
Fraunhofer IPSI
Dolivostrasse 15
64293 Darmstadt, Germany
Tel +49 6151 869-961
Fax +49 6151 869-963
Laura.Dietz@ipsi.fraunhofer.de

Peter Dawabi
Fraunhofer IPSI
Darmstadt, Germany
Dawabi@ipsi.fraunhofer.de

Alejandro Fernandez
Fraunhofer IPSI
Darmstadt, Germany
Casco@ipsi.fraunhofer.de

Martin Wessner
Fraunhofer IPSI
Darmstadt, Germany
Wessner@ipsi.fraunhofer.de

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An Ubiquitous and Multimedia Environment for Education (EUME)

The teaching domain is one of the least accessible to new technologies in computing and communications. Most of Schools and universities worldwide typically shows a teacher writing in a traditional blackboard and the students filling in their notebooks. The research activity in the field of computer-based education is mainly intended for special situations in which technology either deals with communication problems between teacher and students, like in Distance Education, or partially replaces the teacher, like in Intelligent Tutoring Systems.

In order to develop a Intelligent Learning Management System (ILMS) compatible with different teaching methodologies and suitable for a traditional classroom, we started in year 2000 a research project called EUME (an acronym for *Ubiquitous and Multimedia Environment for Education*). Our system aims to support general services for teaching activity, like authoring resource management, collaborative learning, distance education or personalized tutoring.

One of the research lines within the project concerns with portable electronic devices that will permit to maintain a continuous communication with the world. Likewise, this device might act as a universal remote control for every appliance located in the environment. PDAs might be good candidates as they allow wireless communication (Irda, IEEE802.11b, GSM, Bluetooth, ...) and provide processing power to perform several useful tasks. Nevertheless they currently pose important shortcomings: large size and weight, poor user interaction mechanism and high cost.

Another research line is the construction of task models for both professor and students [1] as well as an ontology for the domain of collaborative learning. For the first goal we have used the commonKADS methodology, whereas for the second one we have selected the IMS specification as our high level ontology.

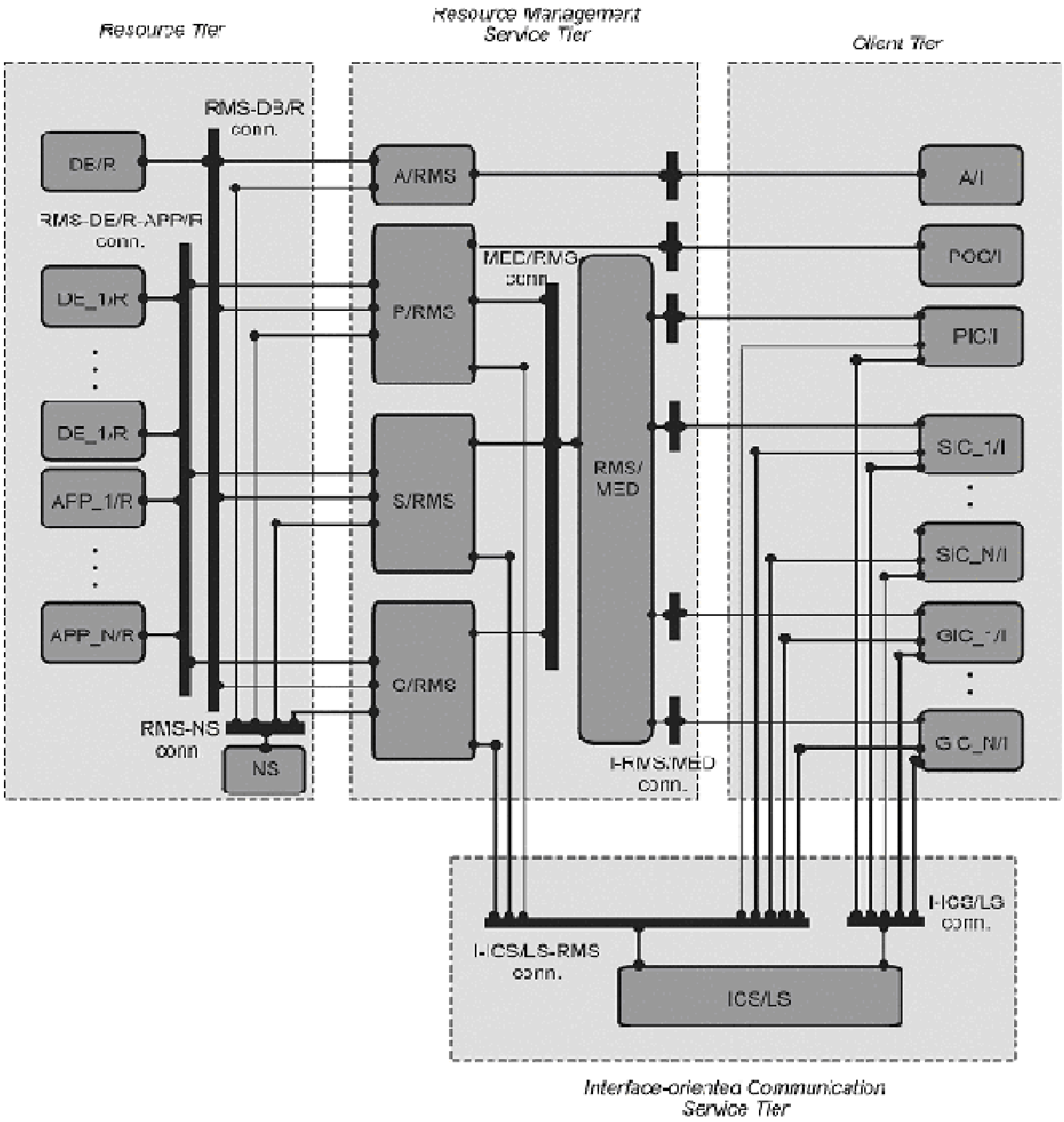

Figure 1. System architecture

And finally we have also worked on the design of software architecture, which must be flexible enough to satisfy the aforementioned requirements. We have resorted to a multi-layer agent based approach [2] that allows both professor and students to manage all types of educational resources (projectors, whiteboards, software applications, educational materials and course information) using PDAs as well as other client devices. Figure 1 shows a multi-layer architecture structured in four layers. Resource tier layer packages all resource drivers available en the environment. Resource Management Service Tier offers high and low level services to handle the resources. Interface Tier includes all graphical interfaces. Finally, Interface-oriented Communication Service Tier allows interface-interface as well as service-interface interaction [3]. The system is being implemented using Java technology.

A first prototype of our system was installed in 2001 in a classroom of the University of Santiago de Compostela (figure 2). It consisted on a multimedia projector, a Mimio device (a blackboard manager), a classroom computer server and a wireless access point. This system allows multimedia presentation, Internet connection and blackboard data storing. We developed a "virtual pad" (figure 2) that provides the teacher full control of this system from a PDA. This application was based on a remote generation of keyboard and mouse events [3]. The prototype was tested by a group of teachers during first semester of 2001. In parallel with the evaluation process, we scheduled some meetings with experts in education in order to acquire domain knowledge about the different tasks developed by teachers and student in the classroom [4].

Figure 2. EUME environmet (left) and teacher PDA (right)

Based in the information collected from the evaluation process and from meetings with experts we redesigned the architecture and develop a new task-oriented user interface (figures 3). This interface maintains the virtual PAD functionality but includes a menu based interface oriented to the management of the most common software applications into the classroom: web browser, word processor, slide editor and Mimio tool. This second version of EUME system is nowadays under evaluation.

In the project website (http://www.eume.net) a collection of papers related with this project, a short curriculum of team members, and some multimedia material can be found.

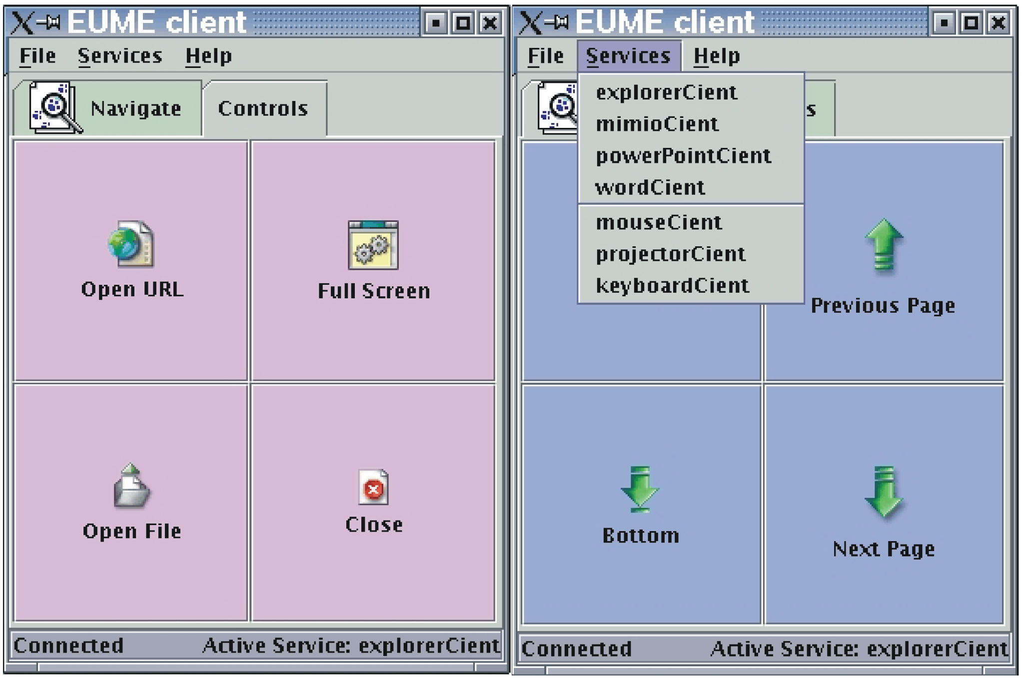

Figure 3. Some screens of the new teacher PDA interface

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[2] E. Sanchez, M. Lama, R. Amorín, A. Riera, J. Vila, S.Barro. "A multi-tiered agent-based architecture for a cooperative learning environment".*11-th Euromicro Conf. on Parallel Distributed and Network based Processing*. Genova, Italy. 2003.

[3] A. Riera, J. Vila, S. Barro. " A PDA classroom computer system". *World Congress on Educational Multimedia, Hypermedia & Telecommunications*.Tampere, Finland. 2001.

[4] X. Vila, A. Riera, E. Sánchez, M. Lama, D.L. Moreno. "Usability Evaluation of a PDA-based Interface for a Computer Supported Educational System". *IEEE International Conference on Advanced Learning Technologies*. Athens, Greece. 2003 (accepted).

Xosé A. Vila
Intelligent System Group
Univ. Santiago de Compostela
Spain
vila@dec.usc.es

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Efficiency and Safety: The Role of Mobile Technology in Education

Mobile technology has many potential roles in education. These roles can be classified as either instructional or instructional support. Mobile technology in the author's mid-western district of 13,000+ students has primarily been used in the instructional support role. Two projects that use mobile technology include a textbook inventory system and a student identification / contact system.

Efficiency and Accountability

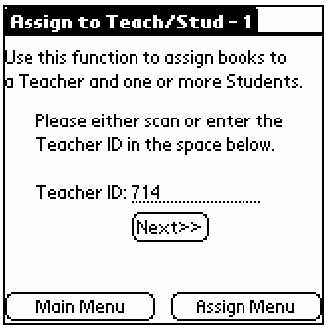
During the 1999-2000 school year the district planned to start a major investment in textbooks. The problem to be faced was that of efficiency and accountability. The previous textbook tracking system relied entirely upon individual teachers recording their own numbering scheme within the books they were issued. Transfers between teachers and buildings were done on a verbal basis with no written records. Teachers and buildings would stockpile extras "just in case." It was nearly impossible to recover the cost of lost/damaged books due to the lack of records on who was responsible for what books. The ultimate example of the problem occurred when one building purchased textbooks that another building had just thrown away.

As a solution the author developed a textbook inventory system called EMILY – Educational Materials Information, Location, and historY. This system uses a central database that tracks the current building, teacher, and student assigned to each textbook. EMILY also records when any of those items change. The system uses a Web interface and mobile Symbol/Palm scanners to record these changes.

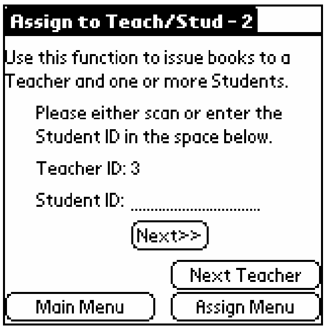
The district sends the publisher barcodes that are placed onto the inside back cover of the book prior to being sent to the district textbook processing center. The books are then recorded into EMILY using the Web interface. The books are then sent to their respective building and teachers. The teachers then assign the books to the students.

There are two methods for recording the assigning of books to the students. Both typically take less than ten minutes to process a class of thirty with each student having three books. The first is to have the students take their IDs and textbooks to the media center where the Web interface is used. The problems with this method include scheduling the media center and the time lost traveling.

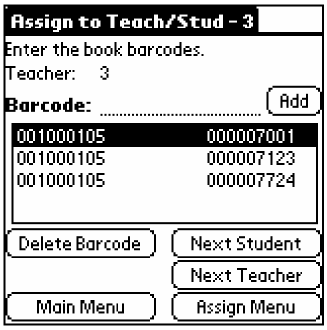
The second method is to take the Symbol/Palm scanner to the classroom. The Symbol/Palm scanner can hold the records for approximately twenty classrooms of thirty students with each student having three books. Once the user has collected all of the data, a transfer program is used to extract the data from the Symbol/Palm scanner and update the central database.



Step 1: Scan teacher barcode



Step 2: Scan student barcode



Step 3: Scan multiple books

Recording the return of textbooks or the transfer of textbooks between schools is handled using similar methods. For many reasons (size / weight of the books, time lost traveling) users have found it beneficial to take the portable scanner to the books instead of the books to the scanner.

The first challenge to this solution was the technology itself. Many of the users have limited technical skills. Requiring them to use both a Web site and a hand-held device was challenging. Since the assigning / returning of textbooks occurs primarily at the beginning and end of each semester, the Symbol/Palm scanners tend to loose power during the intervening weeks. Most of the users are comfortable with reconfiguring the Symbol/Palm scanner and reinstalling the software whenever this occurs but some still have a problem proceeding past the "Tap Here" screen.

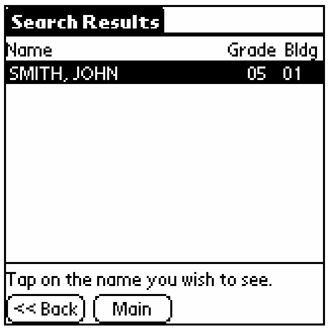
The second challenge was that of human error. This is a classic case of "garbage in, garbage out." One user complained that she bet that almost 10% of the information in EMILY was inaccurate. The author thanked her for the compliment because that meant that 90% of the information was accurate and that was a much better than the 0% accuracy that existed prior to EMILY.

Safety

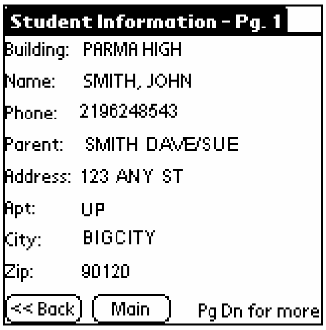
The safety department often needs to positively identify students in and around school and school events. During school hours the safety personnel could contact either the building office or district office to help confirm a student's identity and provide home contact information. After school hours there was no way for the information to be obtained. The safety department asked the information systems department during the 2000-2001 school year if there was a way for the student contact information to be stored on the their Palm units.

The author created a system based on a central database, a transfer/update program, and a Palm based program. The central database contained all of the student information. The transfer program takes the data from the central database and updates the Palm program. The Palm program, called pSID for portable Student ID, enables the users to quickly locate a student's basic biographical information as well as their home contact information regardless of where or when the information is needed.

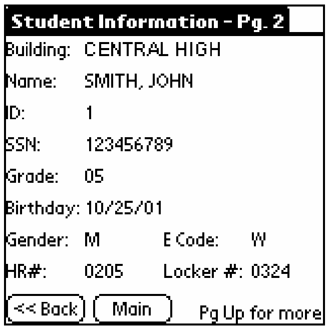
Step1: Enter part of last name



Step 2: Select name from list



Step 3: First screen of contact information



Step 4: Second screen of contact information

The primary challenge to this solution is the volume of information involved. Updating the 13,000+ student records can take thirty minutes. Searches for individual students on the Palm unit may take up to a minute. Neither of these problems defeats the ultimate benefit of being able to carry all of the information in a pocket.

Conclusion

Efficiency, accountability, and safety are all critical issues for educational institutions. There is a limited amount of resources available to any district. Using the projects described here, districts can either spend their time looking for information (where textbooks are or how to contact a student's parents) or using that information. Mobile technology combined with accurate data can help in all of these areas.

Technical Information

- Central databases – Microsoft SQL7 - http://www.microsoft.com
- Standalone computer programs – Microsoft Visual Basic 6 - http://www.microsoft.com
- Web tools development – Macromedia Ultradev 4 - http://www.macromedia.com
- Palm based programs – Puma Technologies Satellite Forms 4.1 - http://www.pumatech.com
- Symbol/Palm Scanner – Symbol Technologies Palm based scanners (Models SPT1500 and SPT1800) http://www.symbol.com

Dr. Robert T. Gulick
DBA/Technology Trainer
Parma City School District
Parma, OH, USA
Tel +1 440-885-7099
Fax +1 440-885-8307
Robert@TheGulicks.com

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