Martin, S., Boticki, I., Jacobs, G., Castro, M., & Peire, J. (2010, October). *Work in progress: Support for mobile collaborative learning applications*. Paper presented at the 40th Annual Frontiers in Education (FIE) Conference, Arlington, VA, USA.

Martin, S., Boticki, I., Jacobs, G., Castro, M., & Peire, J. (in press). Work in progress: Support for mobile collaborative learning applications. *Frontiers in Education (FIE) Conference, 2010*. Washington, DC: American Society for Engineering Education.

# Work in Progress: Support for Mobile Collaborative Learning Applications

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***Abstract* –This work is intended to describe a framework aimed to address the challenges in the development of mobile Collaborative Learning applications. Firstly, the paper offers an overview of some of the main principles of Collaborative Learning that will be the basis of the framework, which is based on three main pillars: collaboration and communication among students; context-awareness (gathering users' data, such as geo-location, movements, academic information, and history) to provide personalize information and services; and interoperability with e-learning as many organizations use them. Evaluation will be conducted with a group of students of a "Professional Expert Course on Mobile Programming" that will use the framework to build their applications.**

*Index Terms* – mobile learning, collaborative learning, context-awareness, location-based, e-learning platform;

## INTRODUCTION

Collaborative Learning (CL) is becoming more important everyday within all educational environments. It is being implanted from primary school to university; and in subjects from mathematics to biology, electronics, or history.

On the other hand, mobile devices are also reaching all levels of our society, being the only device that we carry on all the day. This feature together with the incorporation of new engaging sensors (e.g. GPS, camera, motion sensors) and the proliferation of mobile broadband connections make mobile devices the perfect vehicle to complement traditional education. They can offer an added-value education by supporting context-aware learning applications that act and react according with the user's needs and circumstances in each moment, and place.

The present paper is aimed to describe a programming framework, M2Learn, devoted to support and simplify the development of mobile CL applications.

## MAIN PRINCIPLES OF CL

The student-centred paradigm is enhancing students' learning experience by emphasizing the need for communication and collaboration skills in the acquisition of knowledge. CL is a key element of this paradigm.

CL aims to promote learning by fostering cooperation among students. While there is no one accepted version of CL, some authors have offered the following principles [1] [2]:

1. Heterogeneous Grouping – students work with peers who are different from themselves on a variety of possible variables.
2. Collaborative Skills – students practice working together as they are learning together
3. Group autonomy – student groups seek to be less reliant on teachers/professors.
4. Maximum peer interaction – students spend significant time discussing with peers in exchanges involving higher order thinking.
5. Equal opportunity to participate – students are encouraged to involve all group members
6. Individual accountability – each group member is encouraged to share what they know and don't know with group mates.
7. Positive interdependence – promoted among group members is the feeling that everyone is important and that they need each other to succeed.
8. Cooperation as a value – students are encouraged to see cooperation, rather than competition or isolation as the first option in their encounters with others.

CL is usually carried out through activities such as challenge-based or question-answer activities, role games, brainstorming in groups, information exchange, and graphic organizers.

### M2LEARN: A FRAMEWORK TO SUPPORT FOR MOBILE CL

Based on these principles and activities, the authors are proposing the M2Learn framework [3], which facilitates development of mobile learning (m-learning) applications focusing on ubiquitous technologies. Ubiquity is an added-value that m-learning provides and e-learning cannot, as e-learning does not support location-awareness and learning anywhere. The main features of this framework are:

- Interoperability with e-learning platforms (e.g. dotLRN or Moodle). Existing services (e.g. assignments, forums, wikis, or blogs) and knowledge in e-learning platforms can be reused in the new m-learning applications with the objective of not having to build them again and gathering student's activity information (e-portfolio), no matter if it comes from e-learning or m-learning applications.
- Support for plug-and-play communication and collaboration methods (e.g. forum, chats, and blogs). Existing services can be easily integrated in new m-learning applications through the use of Web Service-based interfaces.
- Context-awareness. Developed mobile applications will easily incorporate information about:
    - user's geo-location: useful for personalizing the services and activities or having a log of their movements in certain activities;
    - motion recognition: offers a more natural way of interacting with the technology;
    - user's academic profile (e.g. degree, subject, or preferences);
    - and user's history of activities (log).
- Open Source: There is an on-line community platform built around the framework to collaboratively improve it.

This framework provides an API to develop mobile CL applications, e.g., a virtual puzzle or a tool to study fractions as a challenge-based application.

Thanks to its collaboration interface, it is also possible to develop mobile wikis and blogs, where students can collaboratively create content anywhere and anytime. As an extension, this mobile wiki or blog could mind the student's location for learning outside the classroom (e.g. in a zoo, botanic garden, museum, or archaeological site). The framework also supports the creation of semantic maps, since it supports the integration of e-learning tools, especially those that are web-based.

In addition, the framework provides a communication interface that enables the development of discussion and brainstorming exercises, with the advantage of allowing its use anywhere and anytime, (e.g., students can discuss with their colleagues in the train).

In the same vein, games can be one of the most powerful tools for learning. Students are easily engaged with them, especially with those that use natural interaction, such as motion recognition (e.g., puzzles or question-based contests using the mobile device as a pointer). The M2Learn framework provides an easy access to motion data, and also allow integrating the game output (i.e. how the student have behaved in the game) in the e-learning platform, so the teacher can use mobile games as other module for students assessment.

### EVALUATION

Project evaluation will be conducted with the students of "Professional Expert Course on Mobile Programming". Within the course, students will have to develop three mobile applications using the framework, seeking to promote CL principles.

Students will complete a questionnaire on user satisfaction and the simplification degree obtained through the framework's use. Evaluation data will also include interviews, software logs and development time.

### CONCLUSION

One of the contributions of this middleware is the homogenization of contextual information and services that simplify the development of advance tools with a considerably reduced effort. For example, users will be able to create a mobile CL application using the location information instead of learning how the NMEA protocol of the GPS works on a mobile device; or communicating through a serial port with an RFID controller to read the information from an RFID tag, without understanding the RFID commands or the data organization inside the tag. Or, they can create a mobile blog using the services provided by an e-learning platform, but they will not need to create any web services in the platform language or understand how its database is structured. They just use the simple interface with information and services provided by the M2Learn Middleware.

The development of these kinds of architectures makes a step forward in the final arrival of ubiquitous and mobile learning technologies in society.

### ACKNOWLEDGMENT

Authors would like to acknowledge European Union Leonardo Project 142788-2008-BG-LEONARDO-LMP mPSS – mobile Performance Support for Vocational Education and Training Project and to Spanish Ministry of Science and Innovation the project TIN2008-06083-C03/TSI "s-Labs – Integración de Servicios Abiertos para Laboratorios Remotos y Virtuales Distribuidos". Also we thank Comunidad de Madrid for the support of e-Madrid Project, S2009/TIC-1650, "Investigación y desarrollo de tecnologías para el e-learning en la Comunidad de Madrid" and to the CYTED-508AC0341 "SOLITE-SOFTWARE LIBRE EN TELEFORMACIÓN" support.

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