Designing mobile games to promote decision-making skills – a pan-european project

Alice Mitchell
Ultralab, Anglia Ruskin University
Bishop Hall Lane, Chelmsford, CM1 1SG, UK
e-mail: alice@ultralab.net, web page : http://www.ultralab.net

Paolo Inchingolo, Federica Vatta
DEEI, University of Trieste
Via Valerio 10, 34127 Trieste, Italy
e-mail: paolo.inchingolo@bioing.units.it, web page : http://www.units.it

Joze Gricar
University v Maribor
Faculty of organizational sciences
Kidriceva cesta 55a, 4000 Kranj, Slovenia
-mail: Gricar@FOV.Uni-Mb.si, web page : http://eCom.FOV.Uni-Mb.si

Dragan Cisic
University of Rijeka - Faculty of Maritime Studies
Studentska ulica 2, 51000 Rijeka, Croatia
e-mail: dragan@pfri.hr, web page : http://www.pfri.hr/

Otto Petrovic, Christian Kittl, Hans Joerg Peyha
evolaris Privatstiftung
Hugo-Wolf-Gasse 8-8a, Graz, 8010, Austria
e-mail: otto.petrovic@evolaris.net, web page : http://www.evolaris.net

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Abstract - Research shows the potential of mobile games to promote learning in young adults. The 3-year EC-funded project mGBL (mobile Game-based Learning) will prototype a platform and tools for the cost- and time-efficient development and deployment of mobile learning games. At least two types of game template will be designed. These will be for strategy games that can support the development of decision-making skills for crisis situations. Example games will be developed in the fields of e-health, e-commerce and career guidance. This short paper outlines project development stages and identifies issues emerging during the exploratory phase of the design process.

I. INTRODUCTION

The market for mobile games is an important growth area for the games industry. This market is predicted to grow rapidly with the convergence of mobile technologies and as mobile applications become less constrained by device limitations. Newer mobile devices with higher definition colour screens, enhanced memory and functionality are already making mobile gaming more appealing - and development costs are lower for mobile games than for games on 'traditional' platforms.

The mobile Game-based Learning (mGBL) project will contribute new learning models to this market, based on research findings (e.g. Mitchell, 2003, Mitchell and Savill-Smith, 2004) that games designed for mobile devices have considerable potential for encouraging learning, especially socio-affective learning, in young adults. This is in line with a wide body of research that documents the pedagogical role of fun in learning (e.g. Doolittle 1995, Bisson and Luckner 1996, Dempsey *et al* 1996, Goodman 1999, Fabricatore 2000, Prensky 2001, Wu *et al* 2004). Moreover strategic use of games can contribute a 'flow' experience that is a characteristic of successful learning processes (Csiksentmihalyi 1990).

The mGBL project is a 3-year pan-european project, supported by the European Commission's Information Society Technologies (IST) programme within the Sixth Framework. mGBL sets out to improve the effectiveness and efficiency of learning in young adults aged 18 - 24 through the development of innovative learning models based on mobile games.

mGBL began in October 2005. Ten partner organizations, from EU countries as diverse as Austria, Croatia, Italy, Slovenia and the UK, form the consortium. The project is led by evolaris research lab from Graz, Austria.

Our mission: the design of gripping mobile game models for use in the fields of e-health, e-business and career guidance. We want to create exciting learning games that are fun to use and that can support development of decision-making skills and strategies for crisis situations. Our challenge lies in producing formats for great learning games that can effectively engage young adults.

This short paper outlines key stages of mGBL development and identifies emerging issues in the exploratory phase of the research.

II. TOOLS FOR TEACHERS

The overall goal of the project is to improve the effectiveness of game-based learning in the target audiences through the design of innovative learning models based on mobile games. A minimum of two prototype games will be created for teacher use in the pre-determined fields of e-health, e-commerce and career guidance. The design process will be informed by the reading of literature and, importantly, by consultations with prospective users, as will be explained further below.

As a starting point a classification has been developed that maps attributes of different kinds of mobile games against a range of different learning targets, contents and audiences. Building upon this classification a software application will be developed that can support teachers in selecting types of mobile games to suit particular learning purposes.

Ultimately we expect teachers will want the option of creating their own mobile learning games easily and efficiently, so a platform will be developed for their use. It will enable teachers quickly to develop mobile games from their own existing material (scripts, lesson plans etc.) and to distribute these to their students via mobile technologies.

III. USER REQUIREMENTS

A User Requirement Analysis will identify the key requirements of all stakeholders (students as well as teachers) for successfully implementing mobile game-based learning in the pre-selected fields of e-commerce, e-health and career guidance. At the same time the project aims at expanding knowledge in the wider field of m-

learning. The mGBL user requirements research therefore concentrates on the 'generic' learning needs of young adults wishing to develop decision-making skills for use in critical situations. We will focus on the following areas:

1. Usage patterns for mobile technology:
   - Build up an understanding of which mobile services are currently available and how far these are used.
   - Collect qualitative data on the time spent in mobile communication by various means (telephone calls, sms/mms, taking pictures, using games, internet, email, etc.). Gain an understanding of motivational factors as well as of barriers for usage in each category.
   - Collect data on the context in which mobile devices are used.
   - Identify regional differences including differences among target audiences concerning the usage patterns for mobile technologies.

2. Future development of mobile technologies:
   - Assessment of emerging technologies' role in influencing mobile communication in the mid- to long-term (UMTS, RFID, WiFi…).
   - Identification of potential new mobile communication paradigms.
   - User expectations of a broad range of potential mobile applications in order to understand the position of mGBL amongst other applications.

3. Qualitative evaluation of user expectations towards new mobile applications:
   - Identification of the key triggers for a positive communication perception, user experience, trust, etc.

3. Detailed understanding of requirements for the mGBL system, e.g.:
   - Collect broad usage ideas for mGBL based on a basic description (e.g. types of learning content that could be embedded in a game).
   - Propose different usage scenarios for the mGBL applications and collect user feedback on potential use and expected user experience.

Methodology used will be open-ended interviews with at least n=10 new media experts per country (total: n=40 to define our target audiences and to gain first insights into their needs and wishes.

In addition a user-panel will be convened of young people, those in the pre-defined sector areas and some others who are at a decision stage regarding their further education or career. We plan to set up one-to-one in-depth interviews with a total of 90 prospective users drawn from the consortium countries and from each of the mGBL target fields. Each interview will take about 1 hour, making use of a semi-structured interview guideline with mainly open-ended questions. evolaris research lab will co-ordinate the study and provide all participants with a

questionnaire and report template for use in data analysis. The fieldwork itself will be organized by each participating country.

The quantitative and qualitative approach will be supported by a survey of the latest research in the area of requirements and backgrounds for mobile learning and ICT- supported game based learning.

III. PEDAGOGICAL FRAMEWORK

New generation mobile phones and hybrid PDAs have been turning into 'world phones' or 'microbrowsers' with multimedia functionality. Connectivity continues to improve and at the same time devices are becoming more affordable. There are nevertheless still real user interface issues for mGBL game designers to consider. These include for example slow text input facilities, small storage capacity, limited battery life, low bandwidth network capabilities etc. In particular screen size limitations directly affect user behaviour (Ionnis *et al* 2003).

From a pedagogical perspective however, the key issue arguably resides less in connectivity and phone quality and more in the extent to which we can exploit the nature of the Web, where a shift is perceived from supporting the individual to supporting relationships between individuals (Seely-Brown, 1999). We believe mGBL developers should design for interactivity and should seek to promote collaborative as well as individual learning, encouraging students' awareness of learning *processes* in the context of lifelong learning. This then is our stance in developing the pedagogical framework for the mGBL learning game models.

As it evolves, the pedagogical framework will incorporate research findings concerning ethical and legal issues as well as educational theories and standards that can underpin the game design. It will continue to be refined by working with Focus Groups drawn from mGBL target audiences and the results will be fed into the demonstrator development. We have already begun this process. Early findings encourage us that we are on the right track:

First of all, in respect of the pre-determined sector areas there does indeed appear to be a huge need among people in general for financial literacy, for advice on health aspects and for guidance on career choices. At the same time we find confirmed the real potential of mobile game-based learning as an engaging way of learning in these sectors, especially where games are integrated into existing educational provision.

We continue to investigate the learning potential of mobile games such as management and strategy games, quiz games and other game types. However in designing the mGBL game models we will be mindful of a clear warning, made frequently by our fieldwork respondents and also found in the literature (e.g. Fabricatore 2000, Prensky 2001): an educational game will not work unless it is a *real* game first and foremost. Half measures will not

do. It need not be an "all-whizzy" computer game, but it *must* be great fun - and relevant to their learning, otherwise young people simply won't be interested.

IV. SYSTEM ARCHITECTURE AND SYSTEM REQUIREMENTS

The project will use state of the art technologies and learning scenarios. Technology and standardization monitoring will therefore be a key task of system architecture definition: Following an initial review of existing and emerging technologies the most suitable technology for mGBL purposes will be selected. New learning approaches and scenarios will also be monitored and evaluated. In order to guarantee compatibility and openness of the system, attention will also be focused on standards.

Technical specifications and system architecture will include a detailed description of the 'hardware' and 'software' requirements as well as definitions of the web-mobile interfaces. The results of the above-mentioned User Requirements Analysis will be the basis for designing the functional specifications. Special attention will be given to what makes a positive user experience including intuitive navigation.

The following modules will be designed:
- An authoring system that enables teachers easily and efficiently to select and build m-learning games from templates.
- A module for monitoring game usage and for evaluating learning success.
- A deployment module that enables the mGBL games to be deployed to the handsets of target audiences. This module will ensure the availability of the services on a variety of networks.

A major requirement is for the platform to be used in cross-border environments. This means it must be available in multiple languages (in all the languages of partners' countries) and also needs to be open to use with different mobile network operators. This will be achieved via a modular implementation.

V MODULAR IMPLEMENTATION

The project requires a multi-user client/server software architecture with both mobile and stationary clients supported by an application server.

Block diagram in Figure 1 provides an overview of the system, containing the modules required for the project and their positions within an object-oriented, three-tier software architecture. Depending on its architectural position and functionality, a module can be implemented with one or more server applications, stand-alone client or

mobile programs, or with any software based on existing frameworks.

The game modules will contain software required for the implementation of specific games using the mGBL game templates. Therefore the functionality required within each of the modules greatly depends on the design of the particular game templates, the mobile devices for which these are developed and the runtime support they need. However since the game templates are expected to require a similar type of support, it is desirable that the modules contain a lot of reusable code to simplify the creation of additional games.
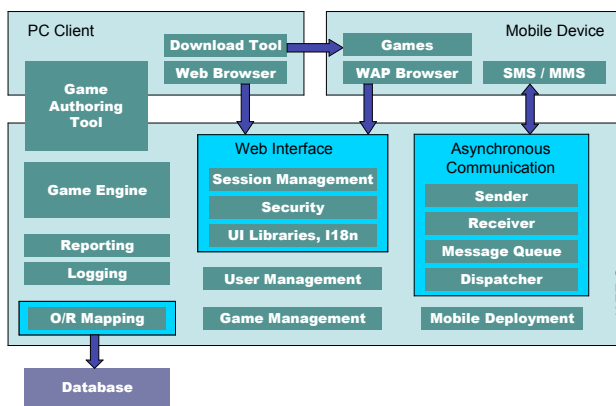

Figure 1. Block diagram of the mGBL system

Both the mGBL game templates and the associated example games have to be distributed to potentially many users and thus have to reside on the application server.

It is envisaged that the learning opportunities embedded in mGBL games will not remain static but will be regularly edited using the game templates provided. The game authoring tool is an application that allows authorized users to edit content for game templates and thereby create new games, which are made available on the application server. Depending on the complexity of the game, the game authoring tool may be anything from a simple XML editor to a complex graphical modeling tool. For simple authoring tasks, a game template may use a web application, which allows the user quickly to create content within their web browser without having to install software locally. For more complicated tasks it may be reasonable to create a client application, probably based upon an existing development framework like Eclipse, where the user creates content offline.

In order to test the system, example games will be developed for use in the fields of e-health, e-commerce and career guidance services. These will be tested in a series of user trials in the transnational environment (end-user evaluation, expert evaluations, laboratory usability tests).

VI. USER TRIALS AND VALIDATION

It has been described above how, as the prototype games and platform are iteratively developed, a process of formative evaluation will continually review user experiences. User trials will be part of this process. They will be held at different universities and at institutions performing educational advice services and will yield qualitative and quantitative data. Findings will be fed to the development teams at key stages of the project. The eventual prototypes will be empirically validated with a large sample.

In order to widen the usefulness of the mGBL products and services, user trials will involve some people from outside of the specific mGBL target audiences, The sample will largely consist of students and their teachers in the pre-selected sectors but will also include some young adults who have reached a decision stage regarding their education or career. The result will be a mix of young people from different societal fields, from different regions and countries.

If the mGBL learning games are to engage and inspire the target audiences, their design should go far beyond facilitating information collection and distribution. They must cater for affective as well as cognitive issues behind decisio-making. This then will be the main focus of the evaluation as it gathers feedback on project outputs from potential and actual users. Special consideration will also be given to:

- usability;
- user behaviour and interaction;
- organizational aspects.

The trials will be conducted at several stages for formative and summary evaluation. An initial review will focus on the kinds of bias that users may have towards mobile technologies in all participating countries. To this end we will gather data concerning usage of information and communication technologies by target audiences, including data on related skills, experiences in e-learning, etc. Of particular interest will be data concerning mobile phone usage, which we will compare with published data. Subsequent reviews will consider the overall functioning of the transnational partnership and what benefits, if any, partners are deriving from participation. These reviews will take place periodically throughout the lifetime of the project and will be conducted during project meetings in open discussion and in special problem solving sessions.

There will be two main data-gathering approaches:
1. Use of questionnaires, interviews and focus groups to collect feedback on the game prototypes and to generate ideas for possible future actions.
2. The involvement of educationalists and other experts in the field (for example via the dissemination events). This will be not only to collect feedback concerning the mGBL platform and tools, but also to invite comments and ideas concerning the usage of games to support learning, in particular life-long learning.

Summary evaluation will be carried out at end project in order to assess whether and to what extent the project

objectives have been achieved and to suggest future actions.

The evaluation process will provide the mGBL project with understandings and insights concerning potential user behaviors and expectations. The results will be aggregated in a comprehensive report and presented to all mGBL members.

VII. IN CONCLUSION

In seeking to cater for the learning needs of young people who in general have high relation to mobile technologies (Fabricatore 2000, Prensky 2001), merely trying to incorporate material from existing educational books or lecture notes into formats that fit the screen of mobile phones will by far not be enough. They need m-learning opportunities that are not only cognitively accessible but also engage them in affective learning. mGBL will seek to demonstrate how a mobile game-based approach can effectively be used to this end.

The project consortium has high interest in disseminating the results among the wider academic community, in exploiting the expected results commercially and in expanding the usage of the developed models and systems beyond the scope of e-health, e-commerce and career guidance services. Our final objective therefore, and one of the most important, is the diffusion of the project results, both within the m-learning community as well as to the wider public. mGBL will develop and apply various means of communication, from interactive websites, classic conference poster presentations and papers in academic and specialist journals, to very innovative formats, enabling viral marketing.

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