

mobile Game-Based Learning to promote decision-making skills – a pan-European project

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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 pre-determined sectors e-health, e-commerce and career guidance but the game templates themselves will be 'generic'. This short paper outlines project rationale and development, identifying key issues and findings that emerged during the exploratory phase of the design process. These include indications that mobile strategy games of this kind might be worth developing in the context of m-government services.*

Keywords: m-games, strategy games, decision-making.

1. 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 also 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 & 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; Dempsey *et al*, 1996; 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 (Csikszentmihalyi, 1990).

mGBL is a 3-year pan-European project that began in October 2005 and is 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. Ten partner organizations form the consortium, from EU countries as diverse as Austria, Croatia, Italy, Slovenia and the UK. The project is led by evolaris research lab from Graz, Austria. Our mission: the design of gripping mobile game models that are fun to use and that can support development of decision-making skills and strategies for crisis situations. Our challenge lies in producing templates for great learning games that can effectively engage young adults.

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 has been developed that can support trainers in selecting particular types of mobile games to suit specific learning purposes. Ultimately we expect trainers will want the option of creating their own mobile learning games easily and efficiently, so a platform and templates will be developed for their use. A minimum of two prototype game templates will be created. They will be used to create a minimum of three example games in the pre-determined fields of e-health, e-commerce and career guidance. These are areas where the consortium has particular strengths. However the templates will be 'generic' in design and therefore useful in a wider range of sectors.

This short paper first provides an overview of the mGBL architecture, then outlines the social-constructivist pedagogical framework and the findings from the exploratory phase of the underpinning research. The authors go on to describe the mGBL approach to supporting learning and consider its potential for exploitation in m-government settings.

2. System overview

The project uses state of the art technologies and learning scenarios. Technology and standardization monitoring is therefore a key task of system architecture definition. Special attention will be given to what makes a positive user experience including intuitive navigation.

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. 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.

Figure 1 below 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.

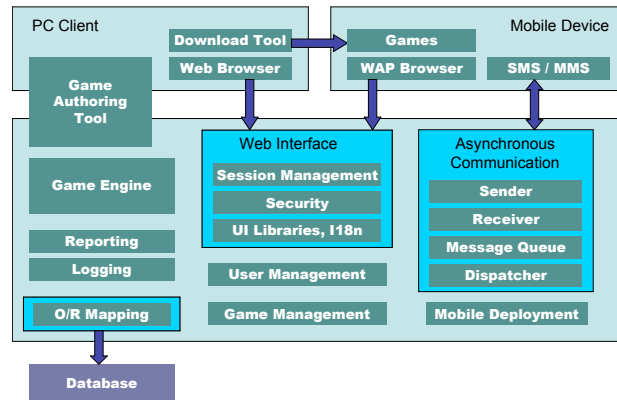


Figure 1: The mGBL system

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

3. The pedagogical framework

New generation mobile phones and hybrid PDAs have been turning into ‘world phones’ or ‘microbrowsers’ with multimedia and even wifi 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). There is also the issue of screen quality – some screens can be difficult to use in daylight.

From a pedagogical perspective however, the key issue arguably resides less in connectivity and phone quality (these will improve) 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 therefore that mGBL developers should design for social interaction and should seek to promote collaborative as well as individual learning. Our focus is on encouraging students’ awareness of learning *processes* in the context of lifelong learning. This is our broad stance in developing the pedagogical framework for the mGBL learning game models.

The mGBL models will be iteratively developed within a social-constructivist (Vygotsky, 1982) framework, using experiential learning and situated learning theories (e.g. Argyris, 1976; Schon, 1983; Kolb, 1984; Lave, 1990) that see learning as a social activity constructed in interactions with others. This approach suits learning models delivered via mobile phones. The models will support recognition-primed decision-making, facilitating use of recognised procedures. Importantly, they will also support creative decision-making, encouraging players to consider decisions from different perspectives (de Bono, 1967) with a focus on mission, defining significant results and doing rigorous assessment (Senge, 1998).

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. The design process will be further informed by the reading of literature and, importantly, by consultations with experts in the field and with prospective users. We have already begun this process, holding 40 hour-long interviews with new media experts in five partner countries.

4. Consulting new media experts

The first stage of user requirements research used open-ended interviews with 10 or 5 new media experts in each of five partner countries to define mGBL target audiences and to gain first insights into their likely needs and preferences. The 40 experts that we interviewed were equally distributed among the following areas:

- mobile technologies – market oriented;
- m-learning – publishing;
- e-learning professionals;
- teaching professionals;
- social services.

There was consensus among the respondents among the experts in all the participating countries on an impressive range of points, notably the following (verbatim quotes are not attributed):

- The need for flexible access to advice and support on financial/health/career/social matters:
“Increasingly typical in today’s society, many lack an extended family they can turn to.”
- Potential mGBL game options include:
 - games geared around real life communication – to fulfil social needs;
 - multiple choice quiz – to test knowledge;
 - simulations – to put the subject area into a risk-free, holistic setting;
- Use pedagogy we know works - social-constructivist framework - achieve user-centric solutions.

m-learning games were generally thought to be good for community-based learning - delivered not just on phones but using any mobile device. However phones are the favourite delivery platforms, not least because they are small, portable, with instantaneous connection. They are also widely used by target audiences as they are:

“Complex, pocketable, fistable”

“Multi-media - they do good everything!”

“You don’t have to worry overmuch about battery life”

Moreover phones are ubiquitous, indispensable:

“We’re going to get to a stage where no-one will be without them ... There’s been nothing like it. I never carry a pen around with me anymore. Everyone will carry around with them a connection to the outside world.”

A phone-based approach will build around communication, tacit learning, ambient learning. Moreover it will be important to use the full functionality of the mobile phone:

“No-one actually takes advantage of it all – I’m sure a game could – photos, video – heady mix of all those things coming together....”

As role- play games give way to games with real-life interaction, mGBL games should bring people together to solve real-world issues: players in different locations exchange/trade information, ideas.

5. Consulting potential users

We have also held sessions with 3 Focus Groups drawn from mGBL target audiences in Croatia, Italy and the UK, age range 18-24, a mix of males and females. Respondents committed to a 2-hour face-to-face

session and to subsequent Focus Group activity including minimum 2 hours active participation on a dedicated password-protected website developed by the lead research team.

Each Focus Group session was facilitated by 3 researchers: a Focus Group leader, a facilitator and an observer/scribe. With each group the same main activity areas were covered:

- Participants were introduced to various types of mobile games, following which they were asked to participate in a related discussion. This discussion was facilitated by the Focus Group Leader, making use of a prepared aide-memoire that contained warm-up questions, key questions, and closing questions.
- Participants were introduced to a Task Brief. This asked respondents to consider different kinds of mobile technologies and mobile games and to identify their suitability for use with mGBL target audiences.
- Follow-on discussion.

It is acknowledged that these Focus Group results cannot be treated as the definitive views of target audiences. Nevertheless they do permit some tentative findings. In summary these are that a key benefit of learning games delivered via mobile technologies would lie in providing flexible access to information and experiences that could help people make choices. Quiz games, simulation games and strategy games could be developed into mobile games for this purpose. Quiz games could offer a fun way of testing factual knowledge, while simulation and strategy games would enable people to experience a critical situation such as a job interview or a challenging working situation in a relatively risk-free way. People might also arrive at better self-knowledge, through trying out new situations and strategies.

To triangulate these early findings, 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. In September 2006 we will 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 an hour, making use of a semi-structured interview guideline with closed and open-ended questions. evolaris research lab will co-ordinate the user requirements 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.

6. User Trials and Validation

As the prototype games and platform are iteratively developed, a process of formative evaluation will continually review user experiences. User trials will be key to 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 decision-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 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, m-learning, etc. Of particular interest will be data concerning mobile phone usage, which we will compare with published data. There will be two main data-gathering approaches:

- Use of questionnaires, interviews and focus groups to collect feedback on the game prototypes and to generate ideas for possible future actions.
- 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.

Project evaluation will consider the overall functioning of the transnational partnership and what benefits, if any, partners are deriving from participation. 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. 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 complement other MGBL field research and provide the mGBL project with further understandings and insights concerning potential user behaviors and expectations.

7. Exploring ideas for the mGBL learning game models

7.1. Current game ideas

Currently we have a number of ideas on the table that we will be exploring. These are ideas for games that can either be single player or multiplayer, depending on the needs of the learning situation.

Essentially the player enters the Scenario as an individual or as leader of a small team (virtual or real characters – the player cannot always distinguish which these are). The player reviews the crisis situation and identifies issues and resources. Then the player makes decisions, from *affective* and/or *cognitive* impetus:

- prioritising tasks;
- allocating resources to tasks;
- allocating tasks to different team members and/or self.

The player then implements the plans. At any time during game play the player can check their knowledge status via a Knowledge Quiz component, e.g. do they know what the official procedures are for a situation of this kind?

The player's decisions and actions have consequences – *intended* and also *unintended*, for themselves and for others (Anderson, 1997) - and they are encouraged to reflect on these via a 'double loop' learning approach (Argyris, *ibid*) as is explained further below (after Smith, 2001).

Central to each of the current designs is the concept that there are four main phases of learner experience (Race, 1994) relating to the four phases of the Kolbian (1984) cycle:

- 'Wanting'
- 'Doing'
- 'Feedback'
- 'Digesting'.

We envisage mGBL models where the Feedback and Digesting phases are key stages in a ‘double loop’ (Argyris, *ibid*) learning process, where players engage and re-engage with a learning Scenario (simulation of a real-life situation), ‘reflecting in action’ (Schon, *ibid*). This ‘double loop’ learning experience mirrors the simultaneous simplicity and complexity in the ways in which people actually learn (Race, *ibid*). Very briefly, in our conception of the models, the double loop theory (Argyris, *ibid*), reflection in action (Schon, *ibid*), is implemented as follows:

7.2. Single loop reflection – detection and correction of error

The player enters the Scenario with an ‘espoused theory’, *i.e.* they have, outwardly at least, committed to act in accordance with *governing variables* such as *official procedures*. However in practice, and especially in a crisis situation, what the player *thinks* will govern their actions (their ‘espoused theory’) may be different from what they are *actually* led by (their ‘theory in use’).

In single loop mode, the player follows procedures and a pre-set plan, e.g. an official plan for dealing with emergencies. The goals and values of their “*espoused theory*” are largely *taken for granted*. The focus in the Feedback is on strategies procedures and techniques and making these more efficient (*c.f.* Usher and Bryant, 1989: 87, cited by Smith, *ibid*).

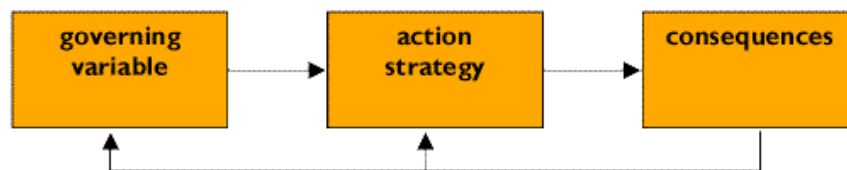


Figure 2: Single loop learning, Smith 2001
 Reproduced from the encyclopedia of informal education
<http://www.infed.org/thinkers/argyris.htm>

7.3 Double loop reflection – confronting assumptions

In double loop mode, the assumptions and systems behind the plans and procedures are confronted. The Debrief component encourages the player to question the governing variables themselves, subjecting them to critical scrutiny:

- Using feedback provided by Scenario ‘actors’, virtual characters chosen at random by the system.
- Using different ‘hats’ or perspectives (de Bono, *ibid*).

The player is encouraged to consider how far their ‘theory in use’ (the theory that they are actually using) corresponds to their ‘espoused theory’.

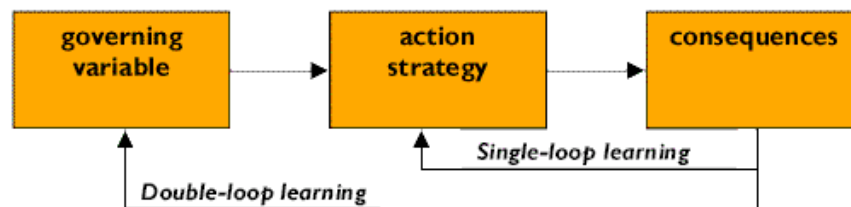


Figure 3: Double loop learning, Smith 2001
 Reproduced from the encyclopedia of informal education
<http://www.infed.org/thinkers/argyris.htm>

This approach that may ultimately contribute to the creation of new procedures.

7.4. Potential exploitation of the mGBL approach for m-government

We consider that this ‘double loop’ learning approach can be successfully exploited in each of the mGBL pre-determined sectors:

- e-health, e.g. in crises such as a multiple car crash, an epidemic or remote diagnosis of illness;
- e-commerce, e.g. in dealing with critical business situations;
- career guidance, e.g. in supporting decision-making at key points in the career path.

Based on our research findings to date, we also believe there is considerable potential for use of this model in m-government, to offer flexible support in developing skills and strategies for individual and collaborative decision making. We also believe, extrapolating from e-government scenarios (*c.f.* Heeks, 2001), that a mobile learning game that encourages reflective processes within a simulated environment can be an important and flexible tool in reducing risk of m-government project failure. Heeks (*ibid*) writes:

“A gap exists for all e-government projects between the design assumptions/requirements and the reality of the client public agency. The larger this gap between design and reality, the greater the risk that the project will fail. If you can reduce the gaps between design and reality, you can reduce the risk of e-government failure.”

He continues:

“To succeed in e-government – and to properly identify design-reality gaps – you have to understand current reality. Yet this may be difficult to achieve. eGovernment leaders can help by ‘legitimising reality’: by encouraging stakeholders to express the difference between prescriptive models of what they should be doing, and real depictions of what they are actually doing. Techniques for exposing and mapping organisational realities play a role here. Self- and third party observation helps expose realities. Use of soft systems tools such as ‘rich pictures’ helps map realities.”

For ‘rich pictures’ read: ‘mobile game simulations’ and the potential for adapting the mGBL model to suit m-government contexts becomes even clearer.

8. Summary and conclusions

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 that also engage them in affective learning. We will seek to demonstrate how the mGBL mobile game-based approach can effectively be used to this end, with its particular focus on supporting the development of decision-making skills and encouraging reflective processes. Players will be encouraged to interact with critical situations from different perspectives and to engage in ‘double loop’ (Argyris, *ibid*) reflection.

Early field research findings indicate that we are on the right track: in respect of mGBL’s 3 pre-determined sector areas there would indeed appear to be a real need among people in general, not only for easily accessible advice, but importantly, also for support in developing decision-making skills and strategies that can stand them in good stead in critical situations. We find strong signs of the potential of the mGBL approach as an engaging and effective way of learning, especially where games are integrated into existing educational or training 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 are mindful of a clear warning, made repeatedly by our expert respondents and also found frequently 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 people’s learning, otherwise they simply won’t be interested.

The project consortium has high interest in disseminating the results among the wider community. The results of the research and development activities will be aggregated in comprehensive reports and made available on the mGBL website. We are also concerned to exploit the results of the project in areas outside of the pre-determined sectors of e-health, e-commerce and career guidance. Research findings encourage us to believe that it would be worth exploring how the mGBL approach could be developed in m-government environments.

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