

Designing a Browser Game to Engage Learners Difficult to Reach in IT Learning

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Abstract

This paper reports on the development of a Multiplayer Browser Game realized in the course of the SpITKom project. The game has been designed to support the acquisition of IT knowledge for learners difficult to reach. In order to provide an engaging and motivating learning environment for the target group, the player-centred game development process has been guided by a pre-study and several testings. First results already indicate, that the game is being accepted as an intuitive and low-threshold learning offer. After briefly outlining the SpITKom project and its underlying pedagogical assumptions, we will introduce the initial study and present some of the recommendations that were deduced to guide the game design. We will then illustrate the SpITKom game design and the corresponding prototype and eventually present first results from the ongoing game testing that further determine the design of the final prototype.

IT KNOWLEDGE, GAME-BASED LEARNING, PLAYER-CENTRED GAME DESIGN, LEARNERS DIFFICULT TO REACH

Introduction

It appears that traditional educational settings have lost the learner and that in many cases they lack to meet the needs of pupils sufficiently (cf. [8], [17]). Especially people with a lower educational background often have a very limited motivation to learn due to their negative learning experiences. They are increasingly difficult to reach by traditional teaching and learning. Therefore, innovative learning scenarios that for example take their habits of using media into consideration are in dire need. In this context, it is often referred to game-based learning scenarios. Results of game studies have proved that such learning environments are motivating and that they meet the younger generation's needs (cf. [5], [13], [16]), especially those of learners difficult to reach (cf. [4]).

According to Meier and Seufert [12], game-based learning approaches particularly make sense if the considered target group are rather difficult to motivate for learning, if the target group already have an affinity for computer games (e.g. younger target groups), and/or if the target group do not have the necessary competencies to deal with computer respective web based training scenarios (i.e. the competence to act or learn self-directed).

But despite the steady recognition of games as innovative and motivating educational settings, there is little agreement on the essential characteristics a so called Serious Game (cf. [22]) should provide, especially with regard to a specific target group. The research project SpITKom therefore carried out a pre-study to direct the game design. In its course, the computer game preferences of the target group and the target group's competencies in playing computer games were analyzed in order to create a game that ideally meets the target group's needs. Additionally, ongoing game testing guided the game design. With this player-centric approach [1] the project hopes to design a learning game that *entertains* and *empathizes* [1], thus providing a motivating way back into education for the target group. In the following we will briefly outline this project.

The SpITKom-Approach

SpITKom¹ is a German research project that intends to engage learners difficult to reach in IT learning. It intends to do so by providing them an educational setting that is assumed to be in line with their leisure time activities (cf. [11]). The project therewith addresses one of the major problem of current education, the motivation of learners difficult to reach.

Target Group

The project is targeted at participants of state funded professional qualification programs offered by the Education Centres for the Building Industry (Bildungszentren des Baugewerbes e.V.). The target group consist of predominantly male participants aged 17 to 25. According to the target group analysis we carried out in the beginning of the project, only few participants have a school leaving certificate. Their level of literacy is very low. Also, their capacity to memorise or to concentrate on something. They have little stamina, a poor frustration and conflict tolerance and only little or no ability to work in a team or to communicate. They are not used to learn at all and they are not willing to actively participate in learning activities [18]. Furthermore, they have strong personal and social deficits that hamper or even inhibit finding an apprenticeship.

Instead of a computer, this target group are rather in possession of television and gaming consoles [11]. Thus, they have developed little or no competence in using the computer as a tool for information and/or work. By now, most jobs however require at least basic skills and knowledge in the professional use of common computer applications. This also applies to the building industry which increasingly relies on the use of computers for day to day communication or logistic matters for example. By providing IT knowl-

¹ "SpITKom" is the abbreviation for "Spielerische Vermittlung von **IT-Kompetenz** für benachteiligte Jugendliche zwischen Schule und Ausbildung". The project is funded by the German Federal Ministry of Education and Research (BMBF) and the European Social Fund (ESF). Up-to-date information on the project can be retrieved from: <http://www.spitkom.de>

edge, SpITKom aims at preparing and enabling educationally disadvantaged learners to find an apprenticeship.

Educational objectives

SpITKom is targeted at supporting the acquisition of IT knowledge as one of the key competencies and requirements of today's labour market (cf. [2], [23], [7]). Therefore, the project has chosen to integrate the European Computer Driving Licence (ECDL)² as a commonly accepted standard that reflects and certifies up-to-date skills and knowledge in the use of a computer and common applications.

Besides IT-related skills and knowledge, SpITKom aims at supporting the acquisition of knowledge related to the building industry. As opposed to the ECDL, this content is not based on a fixed curriculum or a certain syllabus of instruction. Instead, it is geared to the different scenarios in the game, i.e. building a garage, a detached house or a park for example. Every scenario is described by means of phases and their respective workflow. Building a garage for example comprises the phases: setting-out the building-site and stripping the topsoil, trenching for the strip foundation, casting the strip foundation, etc. For every phase additional information is available.

Pedagogical Assumptions

SpITKom aims at utilizing the pedagogical potential computer games provide (cf. [5], [6], [14], [15]) by offering a learning scenario that is based on a Multiplayer Browser Game. Besides the current success of this genre, the following arguments supported the assumption that Multiplayer Browser Games (i.e. construction and management multiplayer browser games) are adaptable for the educational setting of SpITKom:

- The business model of Multiplayer Browser Games can be adapted as a central game mechanism for learning. Traditionally, Multiplayer Browser Games offer free access to the game on a first level. Higher levels or special items usually require "extra input" in form of e.g. credit card payments. This mechanism can be adapted to the learning by letting players "pay" with their IT knowledge instead of their credit card.
- The social aspects of gameplay permit reciprocal apprenticeship and learning in a community of practice (cf. [10], [20]).
- The "easy-in, easy-out"-characteristic of Multiplayer Browser Games [9] could attract a broad audience (including non-gamers and casual gamers).
- The fact that no installation is required enables a low-threshold usage.
- The comparatively low production costs make it easier to compete with commercial off-the-shelf games of the genre.
- The central practice in construction and management multiplayer browser games is to build something up. This perfectly fits to the building industry. Thus, the genre ideally reflects the story and the gameplay in SpITKom.

Comprehensive empirical evidence on the educational value of Multiplayer Browser Games is missing though. Therefore, this project has developed a prototype to further

² <http://www.ecdl.org>

scrutinize the motivational effects and the knowledge gains that Multiplayer Browser Games enable.

Parameters for the Game Design

To make sure the prototype meets the target group's gameplay needs, a study was carried out in the beginning of the project (i.e. autumn 2009). In the course of the study, information was collected regarding (a) the computer game preferences of the target group and (b) the target group's competencies in playing computer games. In the following, we will outline these results and depict the recommendations for the game design that were deduced from the study results.

The study comprised predominantly male participants of state funded professional qualification programs from the building industry aged 17 to 25. It collected data from questionnaires (n=43), qualitative interviews (n=18) and from observing the target group (n=9) while playing the Serious Games McVideogame and Techforce. The results of the videotaped game sessions were assessed as case studies and interpreted by combining segmentation and sequential analysis. The transcripts of the qualitative interviews were coded and analyzed by way of qualitative content analysis.

As a result it became obvious that most participants prefer to play action games (e.g. Sports and Racing Games and First-Person Shooter) in their spare time. Multiplayer Browser Games are not played on a regular basis. However, some of the study results suggested that Multiplayer Browser Games (which usually contain construction and management features) could appeal to the target group [18]:

- (1) Parts of the target group get into construction- and management-oriented actions within other genres. 68 % of the participants agreed that building up something and managing it is fun.
- (2) The members of the target group are interested in playing management simulations in the course of formal education and they are able to handle it.

The observation also revealed that many players have difficulties with a complex game system that only provides little guidance and instruction. Many players were overwhelmed by too many variables and options. Input that was not followed by immediate feedback confused them. Thus, a number of prerequisites were assumed to be necessary if the target group were to master construction and management games. They included a well-structured game environment (with a lucid interface and clear instructions), a high level of stimuli and immediate feedback to gameplay actions.

Thus, it was recommended to look at Social Games such as FarmVille³ or Social City⁴ as a reference for accessible, easy to use game environments that offer high level of stimuli as well as ongoing feedback. Further recommendations were deduced from the students' gaming habits, their preferences and competencies (cf. [18]):

- The text embedded should be as short and clear as possible.

³ <http://www.farmville.com>

⁴ <http://www.facebook.com/SocialCity>

- The player should be able to choose and/or design an avatar (though the avatar can not be controlled within the genre). In the course of the game the avatar should change its appearance according to the score.
- The story should enable career advancement; e.g. from apprentice to master.
- The in-game ranking should not reproduce the usual classroom ranking, i.e. besides performance (IT knowledge), the in-game success should also be influenced by other parameters such as the learner's stamina and collaboration with others.
- The interface should be clearly arranged and simple, e.g. functionalities which the player has to use while playing the game should be kept to a manageable number.
- Elements other than gameplay elements (e.g. IT questions, IT knowledge) must be tied in with the game logic, i.e. they should have an in-game advantage. It is assumed that additional information which does not offer any in-game value will be neglected by the target group.
- Latency should be avoided, e.g. it is important to give immediate feedback to anything the player does in order to keep him interested.

In the following, we will describe how the study results are reflected by the SpITKom game design.

The SpITKom Game Design

SpITKom graphically and conceptually reflects the style of the currently very popular Social Games. Its interface is clearly arranged and simple with short and clear text passages.

The actual game "BauBoss" (see Figure 1) guides the player through building- and construction-projects. In the course of the game, he is challenged to rise in level from apprentice to construction site manager. The player can do so by building, owning and finally letting objects, e.g. garages, detached houses, shopping centres, etc.



Figure 1. The SpITKom Game (Draft Version)

Because SpITKom's main intention is to bring the target group (learners difficult to reach) "in touch" with IT-content, applying IT knowledge is a vital way to score. Therefore, the game frequently offers ECDL test items. The questions are introduced by way of a ringing telephone which the player can choose to answer or reject. If he chooses to answer the phone, one of the ECDL-questions shows up. To integrate the question more seamlessly, the player is asked to help an older colleague (site foreman) who needs to send a construction plan for instance and requires help with regard to the most appropriate data format.

Correctly answered questions have an in-game advantage, i.e. they increase the *IT-Checker value*. A high IT-Checker value in turn shortens the time to finish buildings (*duration of building time*). The quicker a building is finished, the quicker the player can generate money from letting it. This again influences the *money* index and respectively the *score* increases.

Besides the player's IT knowledge, collaboration influences the gameplay and thus the player's career advancement, i.e. helping co-learners for example positively influences the *Team Spirit value* and the score respectively.

The *score* is reflected by an avatar which every player can define individually. After the first log-in, features such as hair colour, hairstyle or clothing can be defined. Also, particular items taken from the building industry or the living environment of the target group can be selected according to individual preferences. In the course of the game and according to the score, further changes to the appearance of the avatar are possible. In doing so, the game intends to strengthen the learners' identification with the building industry which is another objective of the project.

A more elaborate engagement with IT knowledge, i.e. the actual learning, takes place within the IT-Café (see Figure 2). The player can enter the IT-Café to perform explicit learning tasks, i.e. access explicit IT-related learning content, perform comprehensive ECDL knowledge tests and/or answer single ECDL questions. Again, every question answered correctly positively influences the gameplay. The same applies to the knowledge tests related to the seven ECDL modules. This way, the players' IT knowledge is directly linked with their success in the game (via parameters such as *duration of building time*, *money* and *score*). The project assumes that by tying in the learning with the game logic, the learners' motivation to deal with the integrated IT content is influenced positively.



Figure 2. IT-Café (Draft Version)

The IT-Café also provides the basis for generating the learner's competence analysis (target performance comparison). By matching the ECDL learning outcomes against the learner's concrete abilities, it analyses the learner's needs and accordingly offers questions and *units of learning* (UoL) in the sense of a concrete, contextualized unit of education or training (cf. [3]). Each UoL can be traced back to a single learning outcome.

The questions (within the game and within the IT-Café) are provided according to an adaptive testing system. To enable adaptivity, the questions were rated 1 (easy) to 3 (difficult). The rating itself results from test runs carried out to determine the level of difficulty. According to the learner's answer (right/wrong), the system then decides on the follow-up question. Thus, the learner's knowledge can be rated. The results (performance) are collected and stored in the learner's *Profile*.

Technical Infrastructure

Technically, the SpITKom architecture comprises two main components: the front-end community platform and the learning service components of the Open ICOPER Content Space (OICS) which was developed in the course of the European project ICOPER⁵. SpITKom uses the repositories and services offered by the OICS as a backend repository that encapsulates all contents and results relevant for the learning (cf. [19]). The community platform is based on the LifeRay open source community server and contains the flash-based game front-end (fig. 1) and the system's core backend component the CCT (Competence Checker and Trainer) which is realized through the IT-Café (see Figure 2).

Game Testing

Since the members of the target group are not necessarily familiar with Multiplayer Browser Games, the game design was based on continuous testings to support the game's playability and acceptance. The test runs aimed at getting evidence on the:

- a) interface and gameplay usability (i.e. the integrated features of the prototype).

⁵ <http://www.icoper.org>

- b) motivational aspects of the game design (i.e. Does the game attract the target group as a “game for fun” or is it seized to be more like instruction?)

A major testing of the first prototype was carried out with 10 members of the target group aged 17 to 20, assisted by two researchers. The participants were paired in five groups and asked to play for half an hour minimum. During this time, intervention was kept to a minimum and only ensured that the players got through to all the relevant parts of the game. Observers documented visible gameplay actions and relevant communication between the players. Afterwards, players were asked to answer a questionnaire. Also, qualitative data were collected from interviews. They were used to understand participants’ opinions and the experimental results.

Results

The game was accepted as an intuitive and low-threshold learning offer that meets the target group’s expectations regarding the graphical user interface (GUI). The gameplay was evaluated as easy to understand that requires no genre specific prior knowledge. Nine out of ten players stated that the rules and functions of the game were easy to understand.

The game testing demonstrated that SpITKom may motivate players to engage in information technology which cannot be taken for granted when it comes to the SpITKom target group. Four out of five groups took all the incoming calls (inquiries by the site foreman) despite the questions used for the prototype were far too difficult. We assume that the direct linkage between correct answers and the overall success in the game was one of the main reasons for players to do this. Additional information on the building phases which was provided clearly visible every time a player built a building was only chosen once during the reported game testing day. This verifies a central hypothesis derived from the initial study: Information without in-game value is neglected by the target group.

The testing also revealed a range of shortcomings with regard to the interface usability. Amongst other things, it showed that certain features were not clearly visible: The possibility to choose between different building objects for example was not instantly obvious due to the use of poorly distinguishable tabs.

Evaluation results also showed that the implementation of IT-questions into the game was not user-friendly. Answering a question required too many clicks. Also, the need to scroll in order to read the feedback turned out to be an obstacle. Additionally, some of the IT-questions had a screenshot embedded that displayed a scroll bar. Participants mixed it up with the scroll bar of the game and were irritated when there was no reaction.

The current prototype was adapted to the results. A more comprehensive and accurate study with this prototype that evaluates the overall user experience and the possible knowledge gain will follow. It is scheduled for spring 2012.

Conclusion and Outlook

In this paper, we have described SpITKom, a Multiplayer Browser Game designed to support the acquisition of IT knowledge. We have outlined a player-centred game de-

velopment process that has taken into consideration a prior analysis of the target group and ongoing game testing.

Because SpITKom offers an educational setting that is geared to the target group's preferred activities (cf. [11]) and designed according to the recommendations deduced from the target group analysis, it is assumed to positively influence the learning activities of learners difficult to reach. Testings on technical and usability issues have already indicated its potential as an intuitive and low-threshold learning offer and.

A systematic, overall study with particular focus on the educational value of SpITKom has yet to follow. It will be carried out in the first half of the year 2012 and will particularly focus on (a) the implementation of the game into the instruction of a state funded professional qualification program, (b) the effects of the game-based-learning-approach on the target group's engagement with information technology, (c) the (possible) appearance and structure of collaborative learning processes within a Multiplayer Browser Game, (d) the knowledge gain with special focus on IT knowledge and knowledge related to the building industry and (e) the influence on the participants's professional identity. The results from this study will be published in due course.

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