Game-based learning framework for collaborative learning and student e-teamwork

Maja Pivec
Olga Dziabenko

The paper introduces issues on game-based learning applied within the university and lifelong learning. "UniGame: Social Skills and Knowledge Training" framework, that enables teachers to define their own games is described in more detail. The framework promotes soft skills acquisition and interdisciplinary approach to learning and is based on collaborative learning theory.

1.   Motivation

An experience provided in the virtual world can be considered, where people would have a chance to learn incidentally [Holzinger99], without special effort, similar to small children where the learning process through trial and error is part of life. How to design effective learning opportunities? Why is learning by experience often more efficient than learning by studying? How to provide the learning experiences needed to respond to current challenges? Research has been focused on finding ways that help people to learn how to solve problems and perhaps enable them to adopt new ways of reasoning [Al-Ubaidi et al., 00] [Maurer, 99] [Pivec, 00] [Pivec, 01] [Dondi et al., 03] [Dziabenko et al., 03] [Pivec et al., 03]The learning process should be interesting, easy and it should be fun to learn. It also should fit with everyday task and the working environment in order to achieve the optimum results.

Using computer games and games in general for educational purposes offers a variety of knowledge presentations and creates opportunities to apply the knowledge within a virtual world, thus supporting and facilitating the learning process. An innovative education paradigm like game-based learning suitable for this purpose is described in this article.

2.   Game-based Learning

Although games are part of children grow up and formal education, digital game-based learning is a novel approach in the area of Universities and Lifelong learning. In search for new positioning of the universities in the changing setting of lifelong learning, gaming is becoming a new form of interactive content, worthy of exploration. One of the European Projects, exploring this topic is Minerva project UniGame: Game-based Learning in Universities and Lifelong Learning. Goals of the UniGame project were as follows: to promote digital game-based learning in Europe, to test different educational games within different subjects in various European countries and to focus on social game forms that include virtual communities and collaborative learning.

Digital game-based learning can be applied as additional option to classroom lecturing. Intention of digital game-based learning is to address new and ICT based didactical approaches to learning and at the same time to provide learners the possibility to acquire skills and competencies later required in the business world. By means of educational games learners should be able to apply factual knowledge, learn on demand, gain experiences in the virtual world that can later shape their behavioral patterns and directly influence their reflection, etc. Learners are encouraged to combine knowledge from different areas to choose a solution or to make a decision at a certain point, learners can test how the outcome of the game changes based on their decisions and actions, learners are encouraged to contact other team members and discuss and negotiate subsequent steps, thus improving, among other things, their social skills.More details on aspects on game-based learning and educational games are provided in [Dondi et al. 03], [Pivec et al. 03], [Prensky 01].

3.   UNIGAME: Social Skills and Knowledge Training

3.1. Game Idea

"UniGame: Social Skills and Knowledge Training" [UniGame] [Figure1] is a framework that provides a possibility for every interested teacher to apply game-based learning for his/her classes. "UniGame: Social Skills and Knowledge Training" is a game where teachers can define various topics, thus modifying the game for their own purposes.
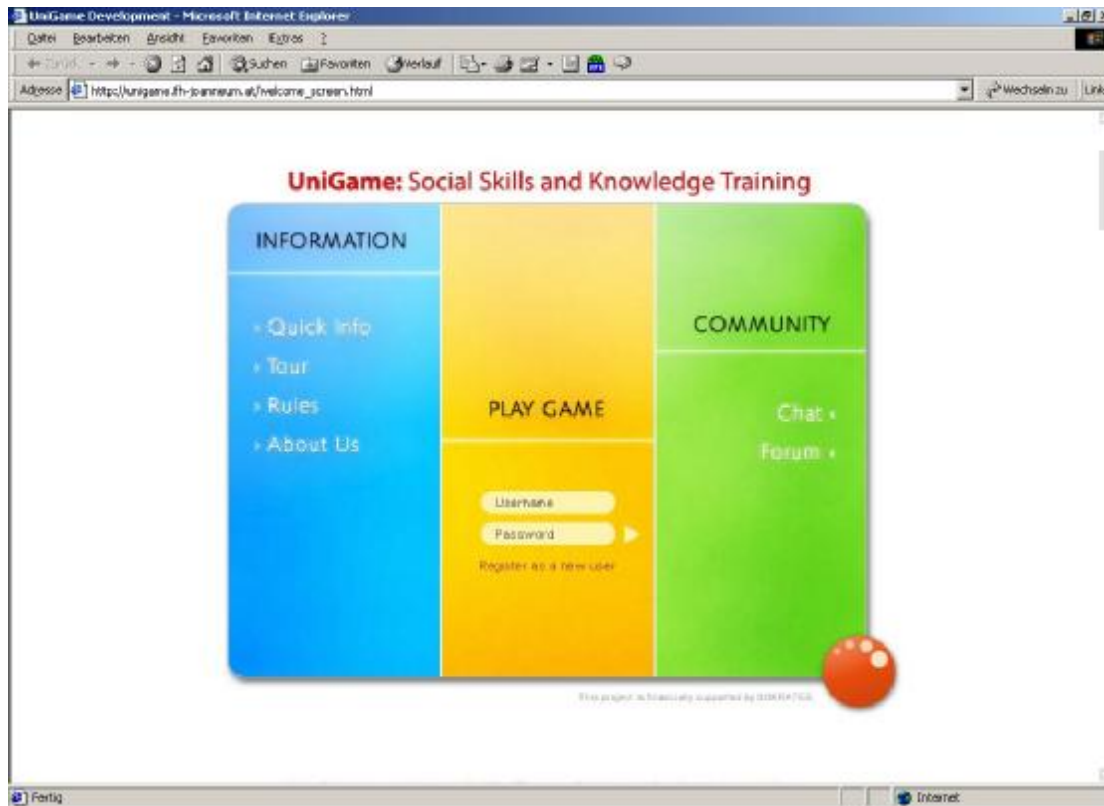

Figure1. Welcome screen "UniGame: Social Skills and Knowledge Training" public game domain.

It can be classified as a role-play game, that fosters participation in problem-solving, effective communication, teamwork, project management, as well as other soft skills such as responsibility, creativity, micro-entrepreneurship, corporate culture, etc. The game is based on constructivist learning approach and collaborative learning. It should be used additionally to regular face-to-face or online classes.

The game is accessible through a website, giving the opportunity to users to join from different places. It is a multi-player game. The players form four teams, which can have up to six players. It is moderated by the teacher (the game is designed to be used as supplement to normal in-class teaching, but it is not impossible to be used independently from a class course). The aim of the players is to comprehend their specific role inside their team and have argumentation with players of other teams over a specific subject, which is specified by the theme of the game. The players gain knowledge over this subject by searching for information and using it in the discussions that follow with other teams' members. The website offers several means for communication to its users: Users can communicate using private or public forums, text chat modules and voice chat modules. The game ends when all the specified sub-parts of the selected subjects have been discussed. In each discussion the goal of the players is to reach a consensus with the other teams. If they reach a consensus they gain some points (chips). The amount of points they can win from each discussion has been specified by them before the beginning of the discussions, when the 'chip allocation procedure' takes place. In 'chip allocation' each

team allocates 100 points in total to three of the six available sub-parts of the subject that will be discussed. The team, which has the more points when the game ends is the winner.

3.2. Scenario of the game

In this section important parts of the "UniGame: Social Skills and Knowledge Training" scenario are outlined briefly. See [Dziabenko et al., 03] for more detailed information.

The game starts by the teacher, who has to define the 'Game Theme', i.e. assignments and subjects to be discussed by the students. The students will use the game website to communicate or to search for information about the theme. The play time of the game can fluctuate from several days to few weeks depending on the difficulty of the theme and the basic skills of the students. The game flow and its various stages are presented in Figure2. The basic stages can be distinguished as follows:
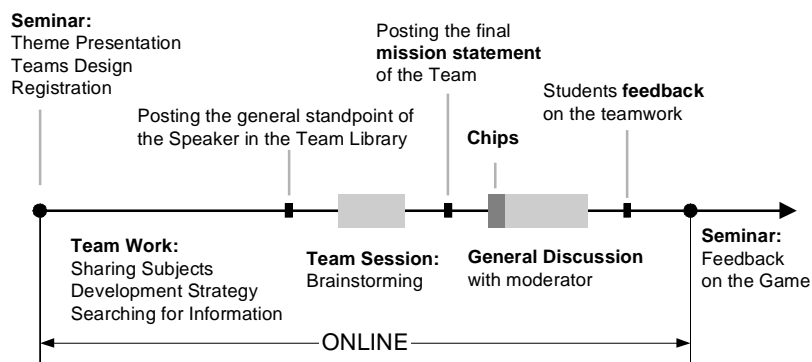

Figure 2: Time plan of the Game

Introductory seminar

In this seminar the teacher explains the theme to the students. The teacher provides information about the theme, the particular subjects (interest areas) of the subjects that are available for discussion, the teams that will be formed, and the roles within each team. The teacher discusses with the students about the theme and provides more information if requested. Finally, the teacher and the students reach an agreement about how the teams will be formed.

Team work and team preparation

In order to play the game, the students form four teams, which have different roles in the discussion that will follow. For example, in a theme about environment protection, the teams could be 'Government', 'Heavy Industries', 'Environmental Groups' and 'Labor Unions'. Each student has to select a particular role within a team. After that, the team members have to connect to the 'map of the Subjects' which are relevant for future discussions. In this screen each member of the team has to select a subject for which he/she will be responsible for. Each team has to create a strategy for the general discussion that will take place with the members of the other teams as well as with the teacher (moderator) of the game.

During the team work, the players develop a game strategy, collect and select valuable information and prepare for argumentation. Teams communicate and exchange information in the 'Team Space', which consists of several screens that allow synchronous or asynchronous communication of the members of a team (Forum, Virtual Conference, Library [Figure3], Member List and Profile[Figure4]). Each team member uploads all relevant collected information about the subject he/she is responsible for, in the Library of the Team Space.
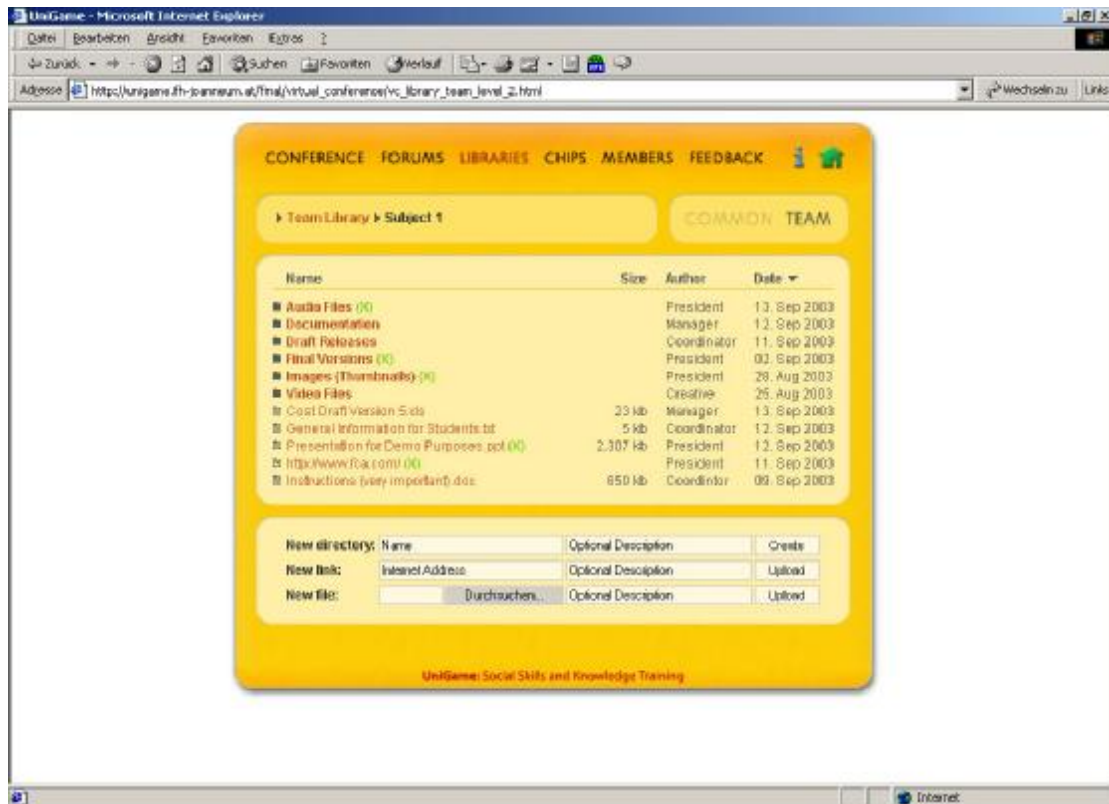
Figure 3. Team Library – to upload and share important information with other team members
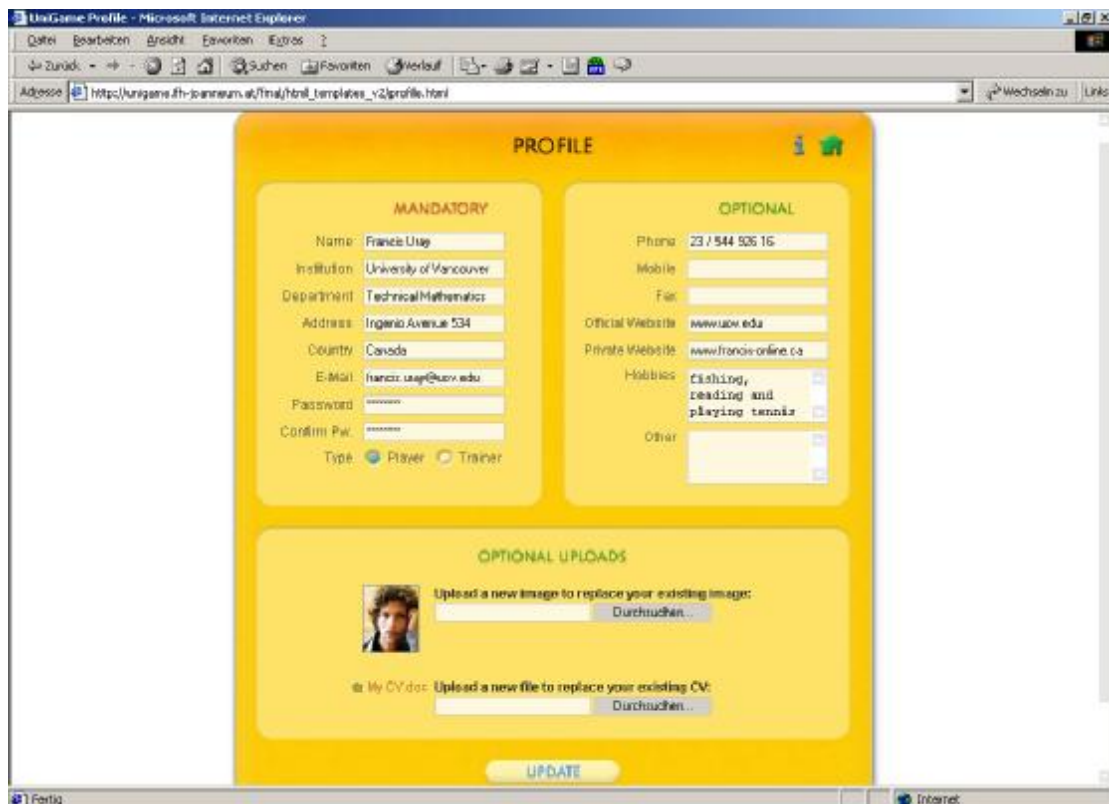

Figure 4. Profile makes it possible to display also personal information

When search for information is finished, the team has to organize a 'Team Session'. This session enables students to discuss all problems of the subjects and all information that can be used in the argumentation with the other teams.

At the end of the team preparation time, the teams have to present a final mission statement within the game platform where they will outline their general standpoint.

Chip allocation

Following the team work and preparation, the teams have to allocate chips (points) to the available subjects. Each team has to decide which subjects are more important for them. The team members can select up to three subjects for discussion. They have a maximum number of 100 chips that they must allocate to the three subjects they selected. This has to be done within 30 minutes.

During the game the chips allocated to the subjects can be seen by the team in the screen. However, teams don not see chip allocation of other teams. The teacher has the all information about allocated chips of all teams.

General discussion

During the general discussion, all teams meet in the 'Virtual Conference' [Figure 5] screen to discuss the subjects of the theme. The discussions are moderated by the teacher. The aim of each discussion is to reach a consensus. The role of the moderator is to formalize the reached consensus. If the moderator decides that the teams reached a consensus during the discussion about a subject, all the teams that had allocated chips in this subject win these points, which are added to their total score. The team that has the most points when all subjects have been discussed is the game winner.

Figure 5. General Discussion - Virtual conference

As depicted in Figure 5, players see all participants in the general discussion virtual conference. The upper right corner of the screen provides some additional information of the game e.g. the timer that indicates how much time is left for the discussion and how much points the team has achieved.

Provided set of emoticons and standard symbols like question mark, exclamation mark, etc., can facilitate the written conversation and give more detailed and emotional feed back of other players. The

white board enables players to work and elaborate together facts and data related and relevant to the topic discussed.

Student feedback and discussion of the game in a seminar.

The general discussion is followed by detailed feedback of all the players who participated in the game and debriefing carried out in a seminar.

3.3. Possible use cases

To illustrate possible application of the proposed UniGame framework, we present two examples of the game usage. A teacher that wants his/her students to reflect actively upon interdisciplinary consequences and ethical behavior of engineers, defines a game-theme called *Tunnel building*. The aim of the game is that 4 teams are competing to make the best offer and technical solution to build a tunnel on the defined location. The solution should consider different parameters like financial frame, time deadlines, technology applied, ecological acceptance, etc. During the game teams can "buy" knowledge from other experts. Teams are also expected to be able to react on unexpected new conditions e.g. new emission law, or the law regarding an area near the tunnel location, that was declared for natural park, etc. Teams use the preparation time of the game to elaborate their solution. During general discussion different important subjects should be discussed and a consensus on which solution is the most appropriate should be achieved.

To experience *Multicultural differences* another game-theme could be defined. In this game students worldwide can form teams. There are various possibilities: multinational teams or each nationality builds own team. Teams should work on the same task e.g. to design a multicultural website. Within the team session teams should work on their proposition, research similar web-pages in different cultural environments. Teams should publish their ideas and propositions about functionality and design of a page. Within the general discussion teams have to discuss the subjects and to reach a consensus (e.g. about features of a web page, which design would be the best, which parameters should be considered for cultural adaptation, etc.).

4. Conclusions

The "UniGame: Social Skills and Knowledge Training" game platform is based on the elements of collaborative learning and communication tools. Searching for information, selecting the appropriate and necessary information, development of discussion strategies, "conflict" of the arguments, decision-making process and negotiation are the important central aspects of the game. But the target and the culmination of the game is reaching a consensus in a problem solution. Players learn to understand and to combine different points of view, such as: individual/corporate interests versus team/societies interests; their own standpoint versus understanding the standpoints and opinions of others; from single aspects versus integrating of multiple aspects, from confrontation to cooperation. By playing different roles students learn and obtain both basic knowledge and practical experience and soft skills that are needed for the organizations of the modern industrial manufactures. The developed game concept can be seen as a game platform where different instructors can introduce different knowledge and contexts to apply game-based learning for their particular topics and specific learning goals.

More details on educational game research and related theoretical framework, use cases and proposed UniGame game model can be seen at the UniGame web page http://www.unigame.net.

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Biography

Maja Pivec

Maja Pivec has got her PhD at the Graz University of Technology. At the present she is lecturing Learning with Multimedia at the University of Applied Sciences FH JOANNEUM in Graz, Austria.

Her research is focused on game based learning, eye tracking supported adaptable e-learning systems, knowledge management, and multimedia knowledge modules.

In the 2003 Maja Pivec was honoured with the European Science Foundation Award 2003 to organise an Exploratory Workshop on Affective and Emotional Aspects of Human-Computer Interaction: Emphasis on Game-Based and Innovative Learning Approaches. For her research achievements she received in the year 2001 Herta Firnberg Award (Austria) in the field of computer science. Her research work was published and presented at more than 60 international conferences and publications.

She was involved in the international learning standard development carried out within the IEEE LTSC committee. She also contributes to the work of the OCG e-Learning group (Austria).

Olga Dziabenko

Olga Dziabenko is a visiting researcher at the Centre for Multimedia and Learning (CML) at the University of Applied Sciences FH JOANNEUM in Graz, Austria.

Her current research field is the e-didactic focused on game-based learning, community-based and collaborative learning in distance and online education for students (K12 and higher) and adults. Her research interests and competence include also the concept and content development, design, and usability evaluation for supporting collaborative and communicative e-learning systems.

Research results of O. Dziabenko were published in internationally recognised journals and presented at various international scientific conferences.

She is involved as a project scientist and manager in several European research projects such as "UniGame: Game-based learning in Universities and Lifelong Learning", "VirRAD: The Virtual Radiopharmacy - a Mindful Learning Environment ", and others.