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Editorial: Play and learn: potentials of game-based learning

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Games and learning: an introduction

Many of us have grown up playing games, and in primary education games have a high presence in nonformal and informal segments of our learning. Unfortunately, in formal education, games are still often seen just as an unserious activity, and the potentials of games for learning often stay undiscovered. Digital game-based learning is a novel approach in the area of universities and lifelong learning, and the search for new positioning of the universities in the changing setting of education; gaming is becoming a new form of interactive content, worthy of exploration.

As early as the 1980s and 1990s, many scientists stated that computers, and later, hypermedia could be used as a cognitive tool for learning. More recently, Brown (2002) suggested that learning comes as the result of the framework or environment that fosters learning rather than as a result of teaching. He maintains that today's students look upon technology as an integral part of life and a tool that they take for granted; for many of them computing has been part of their learning since early childhood. Hence there is a need to offer a variety of different knowledge presentations and to create opportunities to apply this knowledge within a virtual world, thus supporting and facilitating the learning process. To achieve that, it is necessary to provide a complex level of interactivity stimulating the users' engagement, and to apply different interactivity concepts such as object, linear, construct or hyperlinked interactivity, nonimmersive contextual interactivity as well as immersive virtual interactivity.

Despite many decades of research, the present e-learning solutions still focus on technology instead on instructional support and support of learners'; needs. Educators often compare video games to the act of teaching and do not always embrace the cognitive learning that modern commercial computer games can offer. Yet being an e-learner means often being confronted with boring and poorly structured learning materials in the form of pdf files and PowerPoint, learning within learning management systems where interactions prove to be complicated, and where the entire e-learning process is, in most cases, still focused on the replication of facts and data instead of challenging the learner and enabling active interaction with the knowledge. So, do modern e-learning technologies really support learning or does game-based learning provide a more appropriate platform?

Digital game-based learning can also be applied as an additional option to classroom lecturing. The intention of digital game-based learning is to address new ways of

ICT-based instructional design and at the same time to provide learners with the possibility to acquire skills and competencies later required in the business world. There are specific educational domains where game-based learning concepts and approaches have a high learning value. These domains are interdisciplinary topics where skills such as critical thinking, group communication, debate and decision making are of high importance. By means of digital games and especially of digital educational games, learners should be able to apply factual knowledge, learn on demand, gain experiences in the virtual world that can later shape their behavioural patterns and directly influence their reflection, etc. More details on aspects on game-based learning and educational games are provided in Dondi and Moretti (2005), Pivec and Dziabenko (2004) and Pivec (2006).

When introducing digital games in learning, some research questions emerge: how can we improve the game-based learning? Under which circumstances is a game or the game-based learning a good and efficient instructional strategy for supporting knowledge acquisition? How can we support cognitive processes within the virtual environments? These are only few of the questions worth exploring through research in the near future. The answers to these questions will be fundamental for the new generation of human-centred addictive (in terms of 'highly motivating') learning solutions.

Let us consider, based on the model of game-based learning by Garris, Ahlers and Driskell (2002) how and when learning occurs when learners interact, eg, play a game. The main characteristic of an educational game is the fact that instructional content is blurred with game characteristics. The game should be motivating, so that the learner repeats cycles within a game context; Garris *et al* termed this persistent reengagement, where the player returns to the task unprompted. While repeating, eg, playing a game, the learner is expected to elicit desirable behaviours based on emotional or cognitive reactions that result from interaction with and feedback from gameplay.

In Figure 1, one can see the debriefing process between the game cycle and the achievement of the learning outcomes. Debriefing provides a link between simulation and the real world, draws a relationship between the game events and real-world events and connects game experience and learning. This part of the model corresponds, as Kolb, Rubin and McInTyre (1971) have written, to the 'doing, reflecting, understanding, and applying' process of study in a game.

Figure 1: Model of game-based learning by Garris et al (2002)

Let us reflect upon this learning model based on an example of an adventure game. The purpose of an adventure game is entertainment or edutainment. In adventure games there are very complex environments, ie, microworlds, with no deterministic problem representation. An example of a typical edutainment game is *Chemicus* (by Heureka-Klett publisher; or TIVOLA for the US market), a puzzle-adventure game for self directed learning of chemistry. Similar to *Chemicus* one can find an entire series of titles, eg, *Physicus*, *Hystorion*, *Informaticus*, etc, by the same publishers built upon the same game concept.

Adventure games use intrinsic motivation of the player to explore the game world. Intrinsically motivating games incorporate learning activities in their game world. To increase the immersion of the player, the game offers an extensive story at the beginning, often related to some murder or mystery. Game characters have to solve the mystery by solving a number of interrelated problems. In each case the problems are part of the game and players are motivated to seek knowledge to provide a solution in order to continue with the game. In the described game, enjoyment is strongly related to the learning activity, which can be viewed as a desirable outcome.

Why do we choose games for learning?

Why do we play games in the first place? Usually it is to have fun, to immerse into an imaginary world, to take the challenge and outsmart the opponents and/or win, etc. There are probably as many slightly different reasons to play games as there are players.

When we have a look at the games within the learning context as opposed to the activity only for the leisure time, we have the learners' and the teachers'; perspectives of using games for learning. From the learners' point of view using a game for learning can have various meanings, eg, learning and having fun, taking the challenge and achieving better scores, trying out different roles, being able to experiment and seeing what happens, being able to express the feelings and to reflect about certain conflict situation, etc. 'My knowledge of English comes from playing Monkey Island and not from English classes', claimed one of the students of Information Design when discussing game-based learning and possible benefits. 'I could not imagine learn that much of English, playing just an educational game, it would be more like "learning" and less "fun." Playing adventure games fostered development of my observation skills and problem solving skills', was the experience of his colleague.

From the teachers' perspective, we choose to use games for learning to reach a new generation of learners with a medium they are used to interact with from their childhood. We can offer a game for introducing a new learning topic thus raising the learners' interest for this topic, or as a complementary activity for many other reasons, eg, to create a complex learning opportunity, to increase the motivation of learners and to offer another way of interaction and communication.

In some cases, games can help to establish dialogue and break social and cultural boundaries. Games can also be used for personal development and to improve self esteem of the player, ie, learner (Pivec, Dziabenko & Kearney, 2005). For disabled people, digital games can offer the opportunity to experience the world in a way the majority of us take for granted. In a study of cerebral palsy students completed by Kearney (2005), it was found that the participants interviewed were not interested in learning games, or games specifically designed to help them to learn or to adjust to their environment. Rather, they wanted to play computer games that simulated the environment that others take for granted.

Most researchers conceptualise learning as a multidimensional construct of learning skills and cognitive learning outcomes such as procedural, declarative and strategic knowledge and attitudes. The game-based learning model is used in some areas of formal education very successfully, in particular, in military, medical, business, physical, etc, training. In many cases, application of games and simulations for learning means an opportunity for learners to apply acquired knowledge and to experiment, get feedback in form of consequences and thus gain experience in a 'safe virtual world'.

Teachers can define their own learning tasks and quests using games and game-like learning environments such as *Thinking Worlds* from Caspian Learning, thus enabling the adaptation of a game to different educational contexts. These solutions are based on the constructivist learning approach and collaborative learning. The major characteristics of the constructivist approach are, among others, interaction, coping with problems, understanding of the whole, etc. From the constructivist point of view, learners are active participants in knowledge acquisition, and are engaged in restructuring, manipulating, reinventing and experimenting with knowledge to make it meaningful, organised and permanent. In a game-like learning environment, learning by doing, active learning and experiential learning step into the foreground.

There are many different off-the-shelf games that can be used in a learning context. Several off-the-shelf products have parts of curricular information, thus making it easier to integrate in the classes. According to Gee (2003), players often get motivated by the current game they play to explore background knowledge and context of the game. There are also possibilities of using low-tech solutions for playing games like e-learning platforms, forums or chats. But which game to choose and how to use the game in the correct context? The first question that has to be answered is 'What do we want that learners learn?'

A symposium titled Game-Based and Innovative Learning Approaches: A Symposium in conjunction with SIG-GLUE (Special Interest Group for Game-based Learning in Universities and lifElong Learning), held at ED-MEDIA 2006 in Orlando, FL, USA, was a forum to highlight current research, developed solutions and the context of the application of games for learning. Suzanne de Castell and Jennifer Jenson from Canada presented *Contagion*, a role-playing adventure game targeted at children 10–15 (de Castell & Jenson, 2006). Health related topics of *Contagion* educate players by means of

'serious play' about diseases such as Severe Acute Respiratory Syndrome (SARS), West Nile Virus (WNV), Avian Flu, and Acquired Immune Deficiency Syndrome (AIDS) and possible preventive behaviour. Nora Paul and Kathleen Hansen from the University of Minnesota presented the results of modifying the game *Neverwinter Nights* to teach journalism (Paul & Hansen, 2006). The contents of the textbook *Behind the message: information strategies for communicators*, which is used in one of the core courses, are transferred into a game. Here, the reporter must decide on the type of story angle they will cover in response to a railroad accident and chemical spill. The aim of this game is that students learn to organise, interact, question and evaluate information from different resources. Aysegul Bakar and Kursat Cagiltay from Turkey reported on their study conducted to identify the opinions of prospective teachers on the use of games in classroom, based on playing three commercial games *Quake, The Incredible Machine* and *Age of Empires* (Bakar, Inal & Cagiltay, 2006). Paul Kearney and Maja Pivec (Kearney & Pivec, 2006) presented research using eye-tracking technology, on how games create the immersive environment that is often seen as necessary for learning.

Games for learning vary from single player to multiplayer games. Different types of games have different sets of features that have to be considered in respect to their application for educational purposes. For factual knowledge, improvement features such as content engine, assessment engine and increasing level of difficulty along with time constraints are important. To acquire precision skills, games have to be session based, where great attention is paid to the graphical details, thus enabling immersive simulation. In the area of decision making and problem solving skills acquisition, there is a necessity for the following features: narrative-based games where chance is a factor, real-time games, game situations divided into scenarios and/or specific goals relatively simple to reach, accurate problem descriptions, real-time monitoring of the other player/opponents' position and activities, open-endedness, background knowledge of content vital to successful completion or victory, etc.

Part of the process of choosing games for learning also includes the consideration of various constraints and opportunities in the learning setting, eg, size of the student group, technical possibilities for students, the ICT skills of students (as well as the ICT skills of the teacher), licensing policy, sustainability, etc. A systematic approach of introducing game-based learning and/or implementing their own game ideas is described in detail in the book *Guidelines for game-based learning* (Pivec, Koubek & Dondi, 2004).

Can game-base learning change acceptance of learning?—Reports from the field

The aim of SIG-GLUE is the establishment of structured collaboration and research in the game-based learning area, exchange of knowledge and experience in game-based learning, monitoring of the quality and establishing a quality seal for game-based learning resources, thus contributing to the innovation of European and worldwide institutions and universities.

SIG-GLUE is an open community where everyone is invited and welcome to participate, contribute and organise an activity. Apart from discussions within the working groups, SIG-GLUE offers also other resources, such as, eg, announcements, a bimonthly newsletter, a library where members can find and/or contribute book reviews, good practice examples, etc, and a glossary of game-based learning. Fostering the knowledge exchange and creating possibilities for networking is the aim of SIG-GLUE national and international events in form of symposia and workshops.

The last SIG-GLUE workshop was about game-based learning, it took place during the end of June at the EDEN '06 conference in Vienna, moderated by Maja Pivec and Paul Kearney. The workshop was aimed at practitioners, researchers and policy makers. The discussed topics were focused on Pros and Cons of the application of games for learning. The participants, trying to find answers to *Why don't we use games more often in classrooms?*, pointed at the difficulty to find games that cover the curricular topics, the low tolerance of the environment towards the games where the games are often perceived as unserious activity, some lecturers fear that the learning objectives would not be reached, and others might encounter difficulties with technical resources that schools do not have. Another important factor is the quality aspect of the games for learning where games should have an explicit learning purpose and can be used, adapted and adopted for supporting, improving and fostering learning processes within formal, non-formal and informal learning scenarios.

Further interesting discussions, software solutions and cases from the practice, were presented at the Online Educa conference in Berlin (2006), where this year a special games stream was introduced. The closing session of this special stream, organised by the SIG-GLUE members, was a vivid and open discussion between academics, teachers and industry practitioners, focusing on games and learning. One of the conclusions of this discussion was that it is essential to educate teachers, by giving them tools, methods and confidence to apply games in the classroom. National ministries for education could directly support the work of practitioners in the form of creating better acceptance and understanding of games by including game-based learning into curricula.

In this special issue on game-based learning, we reflect on why and how to choose appropriate games for learning, we highlight some ongoing research agendas and activities, and present reports from the practice that might spark practitioners towards introducing them into their classrooms. The topics include problem-based learning, applications in the classroom and some developments of games for teaching and learning, along with the issue of quality in games.

All observed movements and changes in recent years and the emerging field of games as one of the methods of applying technology for learning indicate that there is need and will to change the learning process and the learning environment. But we have still a long way to go. However, each event, each report from the practice and research result, brings us one step forward.

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