

# **Proceedings of the 3rd European Conference on Games Based Learning**

**FH JOANNEUM University of  
Applied Sciences, Graz, Austria  
12-13 October 2009**

Edited by  
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Graz, Austria

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Papers have been double-blind peer reviewed before final submission to the conference. Initially, paper abstracts were read and selected by the conference panel for submission as possible papers for the conference.

Many thanks to the reviewers who helped ensure the quality of the full papers.

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ISBN: 978-1-906638-48-1 CD

Published by Academic Publishing Limited  
Reading  
UK  
+44-(0) 118-972-4148  
[www.academic-publishing.org](http://www.academic-publishing.org)

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## Preface

These proceedings represent the work of researchers participating in the 3<sup>rd</sup> European Conference on Games-Based Learning, which is being hosted by The FH JOANNEUM University in Graz, Austria. The Conference Chair is Maja Pivec from FH JOANNEUM and the Programme Chair is Thomas Connolly from The University of the West of Scotland, UK.

The conference will be opened with a keynote from Liz Boyle, University of the West of Scotland. The second day will be opened with a presentation from Maja Pivec on the topic of *ENGAGE Learning, Changing learning one game at a time*. There will also be a Panel Discussion led by Rob Davies, MDR Partners in the UK looking at *Increased mainstreaming of games in learning policies*.

The main purpose of the Conference is for individuals to present their research findings, work in progress and conceptual advances in many different branches of games-based learning as well as to come together to share knowledge with peers interested in the same area of study. The research included in these proceedings is clear evidence that the subject of Game-Based Learning continues to develop and mature.

A key aim of the conference is about sharing ideas and meeting the people who hold them. The range of papers will ensure an interesting two days.

With an initial submission of 82 abstracts, after the double blind, peer review processes there are 54 papers published in these Conference Proceedings. These papers represent research from Australia, Austria, Belgium, Bulgaria, Canada, China, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Russia, South Africa, Spain, Sweden, UK and the USA.

We hope that you have an enjoyable conference.

Prof Thomas Connolly  
Programme Chair  
[thomas.connolly@uws.ac.uk](mailto:thomas.connolly@uws.ac.uk)

# Biographies of Conference Chairs, Programme Chair and Keynote Speaker

## Conference Chair

**Maja Pivec**, Ph.D, is professor of Game Based Learning and Learning with Multimedia at the University of Applied Sciences FH JOANNEUM in Graz, Austria. For her research achievements Maja Pivec received in the year 2001 Herta Firnberg Award (Austria) in the field of computer science. In the 2003 she was awarded by European Science Foundation in form of a grant for an interdisciplinary workshop organisation in the field of affective and emotional aspects of human-computer interaction, with emphasis on game-based learning and innovative learning approaches. She is co-ordinator, scientific leader or partner in several EU or national founded projects. She is editor and co-editor of two book publications in the area of innovative learning approaches. She is guest editor of British Journal of Educational Technology, Special issue on learning from games, May 2007. Her research work is published and presented at more than 70 international conferences and publications. She is international advisory board member of MJET – Malaysian Journal of Educational Technology. She is Program Committee member of GAMEON conferences and F.R.O.G. conference. She is reviewer for European Science Foundation and for British Journal of Educational Technology (BJET).



## Programme Chair



**Thomas Connolly** is a Professor in the School of Computing at the University of the West of Scotland, having managed the Department of Computing and Information Systems for several years. Thomas worked for over 15 years in industry as a Manager and Technical Director in international software houses before entering academia. His specialisms are games-based learning, online learning and database systems. He has developed three fully online MSc programmes and developed and leads the undergraduate BSc Computer Games Technology programme. He is co-author of the highly successful academic textbooks Database Systems (now in its 4<sup>th</sup> edition) and Database Solutions (in its 2<sup>nd</sup> edition). He is a reviewer for several international journals and has been on the committee for various international conferences. He is a member of CPHC (Council of Professors and Heads of Computing) and member of the Higher Education Academy.

## Keynote Speaker

**Liz Boyle** is a Lecturer in Psychology in the School of Social Sciences at the University of the West of Scotland. She has published papers on approaches to learning, learning styles and personality, motivation and games-based learning.

## Biographies of contributing authors (in alphabetical order)

**Matthew Bates** is currently a PhD research student investigating design and modification tools to encourage knowledge distribution amongst children when interacting with new educational technologies. Member of The Interactive Systems Research Group at Nottingham Trent University and currently collaborating with Derbyshire Libraries and local secondary schools to create new serious-game content for children.

**David Brown** is Professor of Interactive Systems for Social inclusion and Director of the Interactive Systems Research Group (ISRG) at Nottingham Trent University. He is project coordinator for three EU projects developing serious games for people with disabilities on a range of static and mobile platforms, and combining these with location based services. Other current ISRG projects include the development of a rehabilitation glove using Wii technology and associated serious games for use in upper limb stroke rehabilitation.

**Patrick Blum** is a Managing Partner of the inside Business Group in Aachen, a leading company for e-Learning and Blended Learning in Germany working mainly for insurance and finance industries. He is a corporate learning expert and his work synthesizes concepts from the fields of computer science, instructional design, and cognitive psychology. Over the past twelve years, he has designed and developed e-Learning and Blended Learning scenarios, online assessments and certification programs, knowledge management systems and game-based as well as simulation-based learning applications. Dr. Blum believes in learner centred learning approaches and concepts of content-driven or goal-driven design. Dr. Blum is a regular speaker at international conferences and member of several committees of international conferences on e-Learning.

**Shamim Bodhanya** holds an engineering degree and an International MBA. He is currently completing his doctorate in Strategic Enactment. He worked in the corporate sector for nearly 14 years, where he served in a variety of capacities before joining academia. He is now actively involved in research, academic development, lecturing, and facilitation and consulting. His professional interests include large scale systemic change characterised by complexity.

**Natasha Boskic** works as an Educational Technology Manager at the University of British Columbia (UBC), Vancouver, Canada. She offers instructional and technical support to instructors and staff, and gives tutorials and workshops on online course development and delivery. She is working on her Ph.D. in Language and literacy education at UBC. The focus of her research is the intersection of games and narratives, with special interest in alternate reality games.

**Thomas Bröker** is a researcher at the chair of building physics, Bauhaus-Universität Weimar. He has helped to develop and implement eLearning Bauphysik, a further education programme and masters course in the field of building physics. He has a background in architecture and worked and lectured for several years on the conjunction of architecture and civil engineering. His research aims at the development of learning scenarios to mediate the complex scientific and planning coherences in civil engineering and ways to unitize their implementation.

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# Parameters for Video Games for the Treatment of Mental Illness in Children

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**Abstract:** Children from dysfunctional families often exhibit behavioural and emotional disorders which have long term consequences such as mental illness. As well as direct physical abuse children may experience neglect and such things as the use of television and computer games as child care substitutes. The games played by these children are often of an age rating far above their own. Adults from dysfunctional backgrounds and children from “normal” backgrounds have been shown to have been adversely affected by exposure to violent computer games. How much more damage can be done to these more vulnerable children? As repeated exposure to negative behaviour patterns through role playing computer games can have such a significantly bad effect on children with behaviour disorders, can role play games using good models of behaviour be designed to produce a positive effect on these children? Such games need to use existing principles of Cognitive Behavioural Therapy (CBT) or some other treatment method. Modelling is a common theme of CBT and social learning. Any intervention to treat conduct disorder must use social learning. In these approaches clients are presented with models of proper behaviour and appropriate communication between individuals and groups. Tools for this modelling commonly involve such things as work books, board games and discovery groups of many kinds. However, many of these methods do not easily motivate children. In particular they lack the motivation for homework based around these materials. A lot of work sheets need them to engage in activities they find boring or difficult (because of lack of literacy). Games offer the potential for engagement and motivation that many other methods now lack. This paper reports on progress in the design of a computer game based on CBT principles to treat mental illness in children. In addition to ethnographic study and experiments described previously analysis of the current content of standard CBT treatments has been used to derive the fundamental principles needed in the game. A wide range of current games and work books have been analysed. In addition to this other computer based tools (both for adults and children) have been studied to derive the principles needed for the game. The pilot of the game is being tested and evaluated by health professionals. The game is based around a set of narratives derived from everyday life. In the game images are used to convey the setting. In any narrative there is a central theme that defines the overall fundamental game play which revolves around the idea that thinking feeling, body signals and behaviour are linked and cannot be disconnected from each other. In addition secondary ideas derive from the main theme.

**Keywords:**

# **Gaming and the Firewall: Exploring Learning Through Play via Game Design With Children**

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**Abstract:** Respect from your peers is priceless in today's video-game culture. Gamers learn through play and share knowledge with others to form important social scaffolds. However, the potential of gaming as an emerging educational medium is often overlooked by schools and libraries which block access via firewall software and classify gaming as a threat! Could the ability for children to explore gaming in the classroom provide an important motivation for participation in group discussion and design? Knowledge transfer via collaborative activities can be readily observed in commercial Massively Multiplayer Online Games (MMOs) such as World of Warcraft. Some suggest it is a quest for greater social status within the gaming community that encourages players to gather and trade knowledge through exploration with others. Simple 'web-games' such as the MMO Poptropica are cultivating similar online communities through peripheral methods such as media rich blogs. Created by gamers as young as 12, these blogs often rival content created by official games developers. Current research within the Interactive Systems Research Group at Nottingham Trent University is investigating the pedagogies of these young gamers by collaborating with the Derbyshire Libraries group (consisting of over 40 individual libraries) and a design team of children aged 11-16. The group is observing how these young gamers convert their gaming knowledge into instructional theory when presented with key learning goals and a selection of physical and digital design tools. The design team has participated in a series of after school workshops at a local secondary school to design a new library based video-game. Workshop activities have included creating simple rule sets by modifying popular board games and building design prototypes using accessible games creation software. The team has used both Game Maker and Sims Carnival to create and modify a variety of simple game designs. A project blog for the investigation has been monitored to uncover if the social scaffolds created via large scale MMOs can also be experienced in educational activities of a much smaller scale. This paper discusses the conceptual design of this research including how video-games provide an important motivation for knowledge transfer via social activities. The initial results of the investigation are discussed including issues encountered with firewall software in secondary schools and libraries. The suitability of video footage, worksheets and electronic blogs as methods of data capture are assessed for use with children and important future work is highlighted.

**Keywords:** Games-design, modding, library, Poptropica, Game-Maker, MMOs

# Computer Game to Teach Programming Constructs

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**Abstract:** While new students on MSc IT conversion courses and new undergraduates are generally very experienced with computers they often have little or no experience of programming. In particular most of the students have been regularly playing computer games from an early age. Conventional techniques for teaching programming to these students take simple tasks that gradually build into more complex programs that exercise the full range of the fundamental constructs of the language. However, many students find it difficult to grasp the purpose of these concepts, even though the examples may be quite practical. It is common for programming teachers to divide students up as “programmers” and “non-programmers” and accept the non-programmers as never going to become programmers. In the past attempts were made to introduce programming via more visual tools. In particular the “Logo” language, which used a “turtle” that followed paths derived from instruction sets, to draw pictures on a screen, were found useful in teaching these basic concepts to a wide audience. This paper outlines the results of experiments with a computer game designed to teach basic programming constructs to MSc IT conversion course students. In the game students build mazes from a set of tiles and then produce commands from a set of basic programming constructs which are used to direct a “player” character through the maze. This can be used to undertake challenge tasks (for example, find the shortest route through the maze or exhaustively explore the maze). The program has the potential to maintain the motivation and understanding of the “non-programmers” as they learn the basic programming constructs. They thus learn the purpose of the commands first and can then relate these directly to the program that is produced. The system makes use of common game characteristics so that the players are familiar with the environment and need little in the way of instruction to know what to do. The tasks can usually be completed in a number of ways but learning the value of the programming constructs enables a higher score to be obtained. Thus players are motivated to learn rather than use trial and error to succeed in the game. For example in the exhaustive search of a maze correct use of while loops reduces the number of steps required to complete the task and thus gains a higher score.

**Keywords:** Teaching programming, higher education, learning motivation

# Using Educational Game Design to Teach Software Engineering

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**Abstract:** The area of computer games for education is now popular with technologists and educators. The main aim is utilise the inherent motivational nature of games and their ability to encourage engagement as a way to improve learners' time on task and their ability to repeat trial and practice tasks without the danger of student boredom. Many games have failed to either work as games or as education. The first problem occurs because they are not games but ideas taken from other educational tools and repeated as games by adding game elements as a wrapper but failing to integrate the educational aim into the game play. These games are usually led and developed by educators rather than technologists. At the other end are good games but this time are failed educational tools because they can be "won" without the player understanding the "lesson" behind the game mechanic. These games come from enthusiastic game designer or technologists who have failed to understand the educational process. Educational game design then is an intrinsically interesting area in which to attempt to learn the most difficult parts of the software engineering process. When teaching software engineering in a higher education setting one of the most challenging aspects is to identify a task that is a challenging practical problem that will demonstrate the value of good software engineering practice and at the same time is understandable as a task by the students themselves. Game design is valuable from both these perspectives. Students understand computer games. Most have been playing from an early age and have ideas of the needs of gaming. Games for educational purposes are also an obvious idea to them and most can outline how they have learned through some game in the past. This paper describes the use of the development of an educational game in the teaching of software engineering in an MSc course at the University of Nottingham. Valuable lessons have been learned in how to design a software engineering module. In addition practical experience of students in designing the games and going through the full set of software engineering stages are described. The exercise has now been run for three years and a number of useful and effective educational games have been produced.

**Keywords** Software engineering, higher education, module design, XNA, requirements and testing

# **A Concept for the Integration of Online Business Games Into Blended Learning Scenarios Based on Kolbs Experiential Learning Theory**

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**Abstract:** Business games have a long tradition in corporate learning and are experiencing a comeback these days because of their unique capability to provide learning through experience. Based on the extended model of learning through experience by David Kolb, it is possible to integrate online business games into blended learning scenarios in corporate learning using its main advantages such as mastering complexity, the achievement of higher cognitive objectives, learning from mistakes without risk through trial and error, learning from operating experience through time-lapse and particularly strong learner motivation. The German insurance industries are using business simulations to teach learners how to act in environments with complex business and economic inter-relationship networks. Using the example of the closed, stochastic and single player online business game “SiVa – a simulation of an insurance agency” – a concept of a blended learning scenario and its theoretical background are presented.

**Keywords:** Online business games, e-learning, blended learning, simulation, experiential learning

# Exploring the use of Simulation as a Tool of Change Management

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**Abstract:** The ability of an organisation to change and adapt is critical in a world of constant upheaval and turbulence. The process of change however tends to be more challenging than originally conceived, and organisations frequently rush into change initiatives without considering the wider systemic effects of the change on employees and their skill base, leading to unintended and often undesirable consequences that undermine the change effort itself. Relevant stakeholders are often not included and there remains much contention around critical issues of communication and participation. As a result many change efforts fail. Current theories and models of change are criticised for being over-simplistic, and the change process generally tends to be a negative experience. A proactive and holistic approach to change encourages participants to understand the need for change in the context of the whole system in which the change is embedded, to explore their own problems, and to work collaboratively in finding solutions towards implementation of the change. Simulations have proven beneficial in enabling participants from various backgrounds to meaningfully engage in “learning from experience”. The safety of the environment enables participants to explore ideas and strategies, with the aim of developing abstract thinking by observing and reflecting on their experiences. This is an effective form of double-loop learning which is imperative for change to be enduring. This paper draws on multiple strands of literature, namely, simulation and gaming, systems thinking, complexity theory and change management to explore how game-based learning may contribute to effective organisational change processes, in the context of social complexity. One of the contributions of the paper is a set of design principles for simulations and other forms of game based learning, to contribute to effective change management. It is envisaged that the findings generated from this study will add value to the theoretical base on change and simulations, as well as prove to be a key resource for organisations contemplating or already grappling with change efforts.

**Keywords:** Change management, simulations, organisational learning, systems thinking and complexity theory

# **Complexity and Dynamics of Gameworlds: Autopoiesis of Possibilities**

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**Abstract:** Studying the precise nature of the complexity of games enables a deeper understanding of the play phenomenon. Complexity theory offers a distinct approach to examining the world of games. The key segments in Salen and Zimmerman's (2004) definitions of play and games are theorized through complexity thinking. They are taken as a starting point and provide a framework for theoretical discussion about play elements and their functions. The paper explores how imposed constraints, that is, game rules, influence the freedom of movement of players. It looks at the importance of predictability and its impact on players' motivation and engagement. Open possibilities and the unexpected, especially in Massively Multiplayer Online Role Playing Games (MMORPGs), enable connectedness of components, which, as a result create new quality. Emergence of new properties leads to creation of new conditions, which again open new opportunities, developing an autopoietic loop. The paper also examines the notion of simultaneity of complexity theory and conceptualization of the disappearance of opposed dualities such as real and unreal. Games were for long considered as mere entertainment with no connection to serious activity or work. The explosion of video and computer games in quantity and in the level of skills and competences required from their players, have induced educators to reassess their pedagogic potential. While the future direction of development of games is uncertain, it is clear that play has significant implications for the way we think and work, as individuals and in the collective.

**Keywords:** Complexity, games, emergence, autopoiesis, predictability, constraints

# **Digital Mind Games: Experience-Based Reflections on Design and Interface Features Supporting the Development of Reasoning Skills**

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**Abstract:** This paper addresses the area of games based learning; it refers to digital mind games and explores what design and interface features best serve the educational purpose of enhancing reasoning skills, which are actually “key abilities”, transversal to any kind of learning. The considerations at the core of the paper draw on a small-scale, long-term pilot research project aimed at fostering primary school students’ strategic and reasoning skills by introducing the systematic use of a number of computer-based mainstream mind games in classroom activities. Taking for granted that the effectiveness of any educational intervention is primarily related to the soundness of the underpinning pedagogical design, in the framework of the above mentioned field study it was also demonstrated that the effectiveness of digital mind games to develop reasoning and problem solving skills is closely related to the game format and to some specific design and interface features (indeed, it was shown that different computer implementations of the same game have different degrees of educational effectiveness and impact). This paper presents concrete examples as a means to discuss which characteristics of mind games favor the development and the enhancement of reasoning skills. In particular those features that can support or, conversely, hinder students’ cognitive effort are considered, since, during the field experience, the cognitive load required to perform the task appeared to be a crucial point: those mind games that provided a variety of functionalities and stimuli able to sustain and orient cognitive activities, appeared to be better suited to the intended educational purpose, while it also emerged that cognitive overload represents a significant obstacle to learning. While exploring the use of mind games to support the development of reasoning skills, in this paper emphasis is given to those considerations that can have a general validity for their selection and pedagogical use as well as for their design and implementation, in case they are to be used for educational purposes.

**Keywords:** Games based learning, mind games, reasoning skills, software interface, software design, primary education

# **Purposeful Problem Generation in Simulation Games - an Approach to Extend the Target Group of Complex Simulation Games in Engineering Education**

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**Abstract:** Understanding and overseeing complex, interdisciplinary planning correlations in engineering is a difficult task; mastering them is an essential key to successful engineering. Nevertheless discussion of didactic approaches to mediate the necessary skills is quite new to engineering education. While there are implementations of alternative learning methods here and there, a media-compatible integration within the scope of e-learning has been developed only partially. Existing educational software and application of conventional software cover always only parts of the demands on alternative learning scenarios. Contemporary computer games seem to overcome these limitations offering situated learning in authentic contexts. In the course of a literature research today's demands on engineering skills, as well as didactic approaches to achieve them, have been determined. An important aspect here is the differentiation into targeted learning of scientific engineering fundamentals and the complex interrelations in advanced engineering. To transfer these approaches to e-learning, contemporary software and its suitability have been examined and compared to the educational aspects of computer games. While computer games combine the advantages and compensate the disadvantages of existing software, they mean an enormous effort of development facing specialised and rather small target groups. This paper outlines an approach to focus certain problems within the simulation core of a computer game. Making them accessible for targeted learning of engineering fundamentals. Using knowledge structure maps, activity of the underlying interactive structure can be guided to the generation of purposeful problems. This way complex simulation games cannot only be applied in graduate but also in undergraduate engineering courses.

**Keywords:** Educational use of simulation games, Engineering Education, Engineering Skills, situated learning, Ill-structured problem solving

# Designing Serious Games Using Nintendo's Wii Mote Controller for Upper Limb Stroke Rehabilitation

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**Abstract:** Given the fact that most current stroke rehabilitation systems employ relatively sophisticated or expensive hardware and software, one question of paramount clinical importance is whether the benefits obtained from these systems can be obtained with less sophisticated affordable systems. What now needs to be explored is the rehabilitation potential of commonly available computer games. Although commercially available platforms lack specificity in terms of software, hardware and performance metrics they often provide other equally important advantages such as mass acceptability, easily perceived feedback and most importantly affordability for unrestricted home use. Our solution is the development of a low cost rehabilitation glove using the capacity of the Infrared Receiver on Nintendo's Wiimote to pick up the signal from four diodes placed at the patient's fingertips. This compensates for the inability of previous low cost solutions to track fine motor skills. Four diodes per glove are used as it is only possible to track that number of separate Infrared Signals per Wiimote. Six initial games have been developed which elicit a range of rehabilitation movements from patients wearing these data gloves. Each movement is typical of those required in stroke rehabilitation and the receiver reads these signals and maps these movements onto game responses. This rehabilitation system will be tested using a randomized control trial with intervention and matched control groups compared on changes from baseline to post intervention. Sixty patients will be tested who range between 18 and 85 years, who have had a stroke, and are no longer receiving any other therapy. This rehabilitation system is designed to work with games that elicit the real rehabilitation movements that stroke patients have to perform many times. It is hoped that the patients in our study find these games engaging so that these repetitive exercises are more enjoyable to perform and that the system has a measurable clinical effect.

**Keywords:** Wii mote controller, upper limb stroke rehabilitation

# **A Game to Aid Behavioural Education**

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**Abstract:** Computer games are often seen as at best a mindless distraction and at worst a way in which children and young adults are lured into bad behaviours. A recent government advertising campaign caused great consternation among game manufacturers as they saw it as portraying computer games as a major cause in childhood obesity. At the same time many children who are exhibiting behavioural disorders (violent behaviours, attention deficit etc.) end up excluded from school and have to be helped to deal with these symptoms of their underlying problems. This treatment often involves a teacher in one to one and small group activities seeking to engage the children in discussion about their behaviour; the idea being to get the children to understand the relationship between their own and others behaviour, thoughts and feelings. Such children often find the activities difficult to engage with. However, computer games have already been shown to be useful tools in engaging such students in discussion. One aspect of this is that the children can gain a form of empowerment in their relationship with the teacher through the game. Another is the intrinsically motivating and engaging nature of games and the range of activities that can be introduced. A number of games are being developed to aid this study. This paper focuses on one game that is now in its test phase. The game is a 3D, super hero themed role-playing adventure based on exploration, collection and interaction with in-game characters. It has been designed for children aged 8 to 12 in the early stages of treatment for behavioural, emotional and social problems and has been built around concepts derived from the cognitive behavioural model. The game aims to allow educators/workers to introduce and discuss important topics with the child in a non-confrontational way; To aid in development of the child/worker relationship by providing a fun activity where the child is afforded control; To provide education aimed at developing coping strategies through learning about the relationship between thoughts, feelings and emotions, and by exploring techniques for recognising and questioning faulty thinking patterns. These concepts are explored through symbolic modelling of problem behaviours and associated cognition by in-game characters. The player has an active role in attempting to understand and find solutions to the problems faced by these characters allowing the child to become a part of the solution rather than the cause of the problem. The first stage of the testing was to present the prototype game to a group of professionals in the field. Their response was largely positive and many of their responses have been incorporated in changes in the design. Currently the game is being tested by a group of children and their responses are being used in the remodelling of the game.

**Keywords** Behaviour disorder, adventure game, mental illness

# User Modelling in Learning Games

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**Abstract:** Our research work deals with the development of new learning environments. We believe that Game-based Learning can significantly enhance learning. That is why we have developed learning environments based on graphical representations of a course. These environments allow us to set up experiments with students in our university. The emergence of online multiplayer games has led us to apply the metaphor of exploring a virtual world, a pedagogical dungeon, where each student embarks on a quest in order to collect knowledge related to a learning activity. We think that the way of acquiring knowledge during a learning session is similar to following an adventure in a Role-Playing Game (RPG). Although the students appreciate this approach, there is an obvious need for awareness, especially for the teacher. This lack of awareness is related both to the knowledge acquired by a particular student and to the behaviour s/he exhibited in the game. In the light of this statement, we consider that it is crucial to exploit indicators concerning these two aspects: the knowledge (success and failure for sub activities) and the behaviour (talkative, cooperative) of the different students during the pedagogical session. In our approach, we can calculate such indicators using the traces from the collaborative learning activity. We propose in this paper to gather all these indicators into a specific user model dedicated to learning games. The user model thus becomes a key object in our game architecture, and students and teachers may follow-up and evaluate the learning progression through the user model (UM). As the user model becomes central in this approach, there are crucial needs that must be satisfied. First, the UM must be updated with respect to the effective activity, and second, the different users must be able to visualise the result easily. We thus propose a way to visualize such user models directly in the game, making a complete immersion of the students and the teacher possible. Moreover, as we will see, these artefacts, representing learning progression, knowledge or behaviours may also be visible to other students and are additional elements that enhance collaboration. Finally, as the user model is an object known to the users, it can also be a reactive object, and in this paper we propose a way to express intentions by acting on the user model. For instance, a teacher can express his/her intentions for a particular student skill to be improved. The learning scenario will thus be adapted to take this constraint into account.

**Keywords:** User model, learning game, RPG, skills, learner profile

# Virtual Learning Landscapes to Enhance the Student Learning Experience

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**Abstract:** In recent years, Game Based Learning (GBL) has received considerable attention as an approach to improving the educational experience for students. In particular, Higher Education institutions have used GBL to help improve student engagement and retention. Research conducted at the University of Ulster over the past three years has demonstrated that enhanced representation and feedback techniques, inspired by game design patterns, can significantly improve student engagement in terms of both participation and performance. Extending the ideas from this work, in this paper we discuss the pedagogical implications of these results for structuring the learning process and enhancing a student's sense of identity within the learning context. We propose the use of a Virtual Learning Landscape (VLL), couched in a multi-user virtual environment (MUVE), where the landscape is symbolic of an educational programme and the multi-modal feedback experienced by a student within the environment is representative of their progress on a course. The proposed VLL framework uses game technology to provide an interactive virtual environment that students may traverse to gain better feedback compared to traditional means. Through dynamic interaction with a virtual environment the student can gain a better understanding about their educational strengths and weaknesses. The visual landscape allows for additional cues about particular aspects of the educational programme in relation to the overall context of the learning objectives. We perform a requirements analysis for the proposed VLL system and discuss core structural principles. The architectural design is presented and alternative learning components suggested.

**Keywords:** Virtual worlds, identity, feedback, engagement

# **Democratization of Creativity and Cultural Production in Virtual Worlds: A new Challenge for Regulation and Cultural Management**

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**Abstract:** This paper examines the use of online, three-dimensional, immersive virtual worlds, such as Second Life<sup>®</sup>, as an interesting platform and tool for cultural management, artistic development, knowledge exchange and cultural business. These contemporary computer technologies provide a new showcase for cultural promotion and creative production, as they connect artists and producers with an audience around the world, who, in turn, can access in real time a great variety of cultural content through just a few clicks. The various features of this emerging phenomenon all help to democratize culture, the arts and education, as they bring creations closer to consumers, thus reducing the need for intermediaries and breaking down social, economic and political barriers; this offers benefits to cultural industries, non-profit organizations, governments, collective and individual creators and artists. However, the numerous possibilities ushered in over the last few years not only bring benefits but also pose new challenges in terms of regulation. Indeed, this new stage for cultural and artistic expression and management may require new paradigms of control with a different focus, ones which can provide an alternative understanding of online cultural exchange in real time. Virtual worlds make culture more democratic, as it can be reached for free by a wider range of people in real time; furthermore, artists and creators are provided with an accessible showcase in which they can become better known and where they can interact more directly, immediately and closely with their audience. The possibility and ease with which anyone can create original content in the metaverse is an incentive for creativity, because it allows people to express themselves in original ways that enhance the contents of virtual life. Art thus finds new and different formats, and cultural management discovers new spaces to break into. At the same time, anonymity, privacy and intellectual property are all issues that need to be addressed. The regulation of virtual worlds may require different ways of thinking and the adoption of new paradigms which consider exchange, democratization, cooperation and sharing as essential ingredients of these new sets; as such, any rules must control but not restrict, thus avoiding anarchy at the same time as keeping interaction levels high. In the European Year of Creativity and Innovation it is important to consider the opportunities being opened up by these new technologies in the world of culture and education, as well as the possibilities that are emerging and which remain to be researched.

**Keywords:** Virtual worlds, cultural management, virtual art, creativity, regulation, fair use

# Arguing for Multilingual Motivation in Web 2.0: a Games-Based Learning Platform for Language Learning

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**Abstract:** We have seen a significant change in education in recent years with the emergence of online provision, or eLearning, with its flexibility through both time and location independence. We are starting to see further significant change in education with the emergence of new, participatory technologies of information access, knowledge exchange, and content production, associated with the Internet and new media technologies, frequently described as social software or Web 2.0. One particular technology that has been explored in a non-educational content is the Alternate Reality Game (ARG), a form of interactive narrative, often involving multiple media and game elements, to tell a story that may be affected by participants' ideas or actions. As ARGs are inherently collaborative in nature they have the potential to be a useful vehicle for collaborative activities in an educational context. In this paper, we discuss the development of an Alternate Reality Game for supporting the teaching of modern foreign languages from a technical perspective and how we adapted the open-source Learning Management System, moodle, into a multilingual, collaborative gaming environment. We present the findings of a pilot of the ARG that was carried out in April 2009 and provide suggestions for how this platform could be developed further.

**Keywords:** ARGs, collaboration, social networks, modern foreign languages, moodle

# Modelling Players' Behaviours and Learning Strategies in Video Games

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**Abstract:** User profiling is a relevant research topic in both video games and educational software development. For the former, it helps to provide a more enjoyable experience that is tailored to users' preferences; for the latter, it aims to provide a learning environment that adapts to subjects' abilities, disabilities or learning preferences. The aim of this paper is to combine both approaches in order to create a model that accounts for both cognitive and emotional needs of the subjects, and that provides an environment where they feel immersed, empowered, motivated and willing to learn. Because people have different learning styles, needs and preferences, their motivation to play video games, their behaviour and their learning strategies can differ significantly. Unless these singularities are acknowledged, learning benefits on the part of the learner could vary greatly. Although several educational video games were based on Intelligent Tutoring Systems (ITSs), that included a flexible approach to learning and that adapted the educational strategies to learners' skills, very few researchers have tried and managed to model players' behaviours and learning preferences in video games. This paper presents an ongoing quantitative study that aims to profile gamers based on their personality traits. It is based on an online survey carried out with 33 subjects aged between 18 and 44. This survey includes four parts, each of them assess personality traits, motivation for playing video games, emotions sought while playing, preferred features and learning strategies. Following data collection, a correlation analysis was carried out in order to identify significant links between personality traits, in the light of the *Big-5* model, and other factors that can affect learning and emotions in serious games. Significant correlations were identified suggesting that the Big-Five model could be used for user profiling in video games in order to increase both learning outcomes and motivation.

**Keywords:** Education, video-game, user profiling, personality-traits, adaptive system

## **Animating DGBL in Pre-School, Primary and Special Education: Three Case Studies**

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**Abstract:** This paper reports on three digital GBL pilots which have taken place, respectively, in pre-school, primary school and special education settings, for project assignments of the “ICT in Education” MSc program jointly run by the University of Athens, the University of Thessaly and the Technological Educational Institute of Piraeus, Greece. The pilots reported have involved 9 educators and 44 students in total and have been based on freeware micro-games, some new games developed from scratch as well as the “Magic Potion” digital adventure tale developed by the University of Athens Laboratory of New Technologies in Communication, Education and the Mass Media within the EPINOISI project. Interventions have focused on animating the application of DGBL material in class and effectively documenting student reactions and attitudes. Conclusions have been drawn on the learning potential of successfully animated DGBL interventions and on the expectations of young learners towards the games employed. The first pilot concerns a pre-school intervention for learning basic math concepts. Four sessions have been organised with the participation of 10 pre-school students, using freeware micro-games from the Up To Ten and Poisson Rouge web sites and the Minisebran suite, as well as a simple Flash game designed ad hoc. A prototype code of conduct during gameplay has been put in place and a number of conclusions have been drawn by observing and evaluating student reactions and opinions, expressed by the students through drawing and talking about their likes and dislikes. The second pilot has involved application of DGBL material on linguistic topics, in order to investigate whether digital games can enhance the functional-communicational perspective of language. The intervention involved two primary schools with a group of 15 students each, and observation/discussion were employed for evaluating results. Conditions of communication were created in which the students used the language, collaborated to seek clues and information, formulated and evaluated hypotheses and expressed opinions. During the last part of the pilot each student group was asked to describe a language game that would serve as a challenge for the other group, and two such prototype games were developed in Flash. This activity gave the students the opportunity to express themselves and apply their knowledge on structure and use of written language, while at the same time providing a frame of communication and “competition” between the two schools. The third intervention focused on DGBL material for children with autism disorders (AD). Four children with AD were given access to DGBL material in order to investigate the potential of digital games to activate their attention, bring a playful character to the learning process and make more amusing the achievement of objectives.

**Keywords:** Digital games-based learning; case studies; pre-school; primary school; special education

# Student's Problem Appropriation in an Epidemiology Game

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**Abstract:** One of the most important conditions for effective learning in a game is the appropriation of the problem by students. This study aims to produce results on the conditions under which this appropriation occurs, particularly on the roles of teachers, computer environment and collaboration among students. While students dive in or step out of the game, we investigate empirically how they progress from playing the game to elaborating strategies. Our experiment takes place during biostatistics classes and is based on the laboratory of epidemiology (Ney and Balacheff 2008), a virtual hospital that immerses learners into a full-scale, persistent and distributed simulation combined with a gaming scenario. This laboratory was collaboratively designed by researchers, experts and teachers. It is used on one hand by medical students who design and implement an epidemiology study, consequently developing critical thinking on statistics and epidemiology studies and on the other by researchers who assess the conditions of learning with such a simulation. The laboratory design is inspired by recent work on embedded phenomena (Moher 2008) and participatory simulations (Colella 2000) and has four main characteristics. First, it provides an immersive learning experience lived by students who play the role of public health physicians. They experience an otherwise inaccessible professional situation by immersion into a phenomenon (occurrence of a nosocomial disease in a simulated hospital). Secondly, it is based on a distributed simulation implemented without the constraints of single screen boundaries. Indeed students interact with patients through a video-on-demand system on a web-based hospital, with the head of the hospital using their personal phone, or with the ethical committee by e-mails. Thirdly, it is a persistent simulation accessible continuously over several weeks and that evolves partly without student interventions. Finally, the simulation is combined with a collaboration scenario since students collectively design data collection campaigns, gather and interpret group-shared data in a decision making process, and submit together a paper to a simulated medical congress. Targeting second year medical students enrolled in a mandatory biostatistics course, our gaming scenario extends over 13 weeks accounting 32 tutored hours. In this study we will present preliminary results from a qualitative interaction analysis from classroom observations and a quantitative analysis of computer trails. These data were obtained during the first semester of 2009. In this context and according to Brousseau's Didactic Situations theory, we decompose student appropriation of the problem in different moments that we try to identify in the data collected.

**Keywords:** Appropriation, devolution, simulation, game-based learning

# **Development and Evaluation of a Game to Teach Requirements Collection and Analysis in Software Engineering at Tertiary Education Level**

**Thomas Hainey, Thomas Connolly and Liz Boyle  
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**Abstract:** A highly important part of software engineering education is requirements collection and analysis which is one of the initial stages of the Database Application Lifecycle and arguably the most important stage of the Software Development Lifecycle. No other conceptual work is as difficult to rectify at a later stage or as damaging to the overall system if performed incorrectly. As software engineering is a field with a reputation for producing graduates that are inappropriately prepared for applying their skills in real life software engineering scenarios, it suggests that traditional educational techniques such as role-play, live-through case studies and paper-based case studies are insufficient preparation and that other techniques are required. To attempt to combat this problem we have developed a games-based learning application to teach requirements collection and analysis at tertiary education level as games-based learning is seen as a highly motivating, engaging form of media and is a rapidly expanding field. This paper will describe the evaluation of the requirements collection and analysis game particularly from a pedagogical perspective. The game will be compared to traditional methods of software engineering education using a pre-test/post-test, control group/experimental group design to assess if the game can act as a suitable supplement to traditional techniques and assess if it can potentially overcome any shortcomings.

**Keywords:** Games-based learning, software engineering, requirements collection and analysis, evaluation, pedagogy

# **A Survey of Students' Motivations for Playing Computer Games: a Comparative Analysis of Three Studies in Higher Education**

**Thomas Hainey, Thomas Connolly and Liz Boyle  
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**Abstract:** Computer games are exceptionally popular and play an increasingly important role in the lives of children and adults. This popularity has captured the attention of educationalists interested to ascertain if the highly engaging features of computer games can be used to help people learn effectively. To properly develop computer games for learning it is important to have an appreciation of what motivates people to play computer games. This paper will present the results of a survey of students' motivations for playing computer games at Higher Education (HE) level and their views of what features of computer games may be useful for learning. The survey was performed at the University of the West of Scotland in March 2009. As well as presenting the results of the 2009 survey, the paper will draw comparisons on two identical previous studies performed in 2005 and 2007. The study will assess whether the game playing habits, motivations for playing computer games, motivations for playing computer games in a HE setting, attitudes and perceptions of students are consistent over a four year period.

**Keywords:** Games-based learning; computer games; motivation; game genres, attitudes

## **Arguing for Multilingual Motivation in Web 2.0: an Evaluation of a Large-Scale European Pilot**

**Tom Hainey<sup>1</sup>, Thomas Connolly<sup>1</sup>, Mark Stansfield<sup>1</sup>, Liz Boyle<sup>1</sup>, Joel Josephson<sup>2</sup>, Aisling O'Donovan<sup>3</sup>, Claudia Rodriguez Ortiz<sup>4</sup>, Nina Tsvetkova<sup>5</sup>, Bistra Stoimenova<sup>5</sup>, Sevda Tsvetanova<sup>6</sup>**

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**Abstract:** While there are some teachers who are dubious about the benefits of gaming in education, language teachers make great use of simulation/gaming methodologies and there are many supporting textbooks. While many of the simulations/games used are non-computer based, during recent years the computer game has become an important development in popular culture. During the same period there has been an appreciation that computer games can play a significant role in education. In this paper, we explore the use of one particular type of computer game called an Alternate Reality Game (ARG), a form of interactive narrative, often involving multiple media and game elements. We have developed an ARG to motivate secondary school students to learn a modern foreign language and have piloted this game across Europe in 2009. This paper presents a framework for evaluating games-based learning and provides both a quantitative and qualitative analysis of student performance in the pilot using this framework. The paper reflects on this analysis and provides directions for future research.

**Keywords:** ARGs, collaboration, social networks, modern foreign languages, evaluation

# **A Critical Reflection on the Potential of Mobile Device Based Tools to Assist in the Professional Evaluation and Assessment of Observable Aspects of Learning or (Game) Playing**

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**Abstract:** In the past few years a large amount of work has been done in the field of games based learning, mainly with respect to computer based applications. However there have been other, much older and traditional areas of (or related to) games based learning that have also received drastically increased attention from the research community in recent years. The public interest in matters concerning paedagogics has literally exploded, an observation reflected in the coverage by the mainstream media. In previous work the authors have reported on practical hands on studies from the classroom (J. Hildmann) or proposed a formalism designed to represent unambiguous descriptions of observable aspects of learning or (game) playing (H. Hildmann). In this paper aforementioned formal approach is linked to innovative approaches for behavioural evaluation of children and experiential paedagogics, in specific to initiative games. The background of the authors allows the merger of the theoretical contribution from the field of computing with the practical considerations, criticism and requirements of an expert "in the field", i.e. one of those professions that will ultimately be using these new approaches as well as judging and evaluating them.

**Keywords:** Adventure/initiative games, experiential education, behavioural psychology, social skills, mobile devices, computer based assessment and evaluation

# Promoting Social Skills Through Initiative Games in the Classroom and Assessing Their Effects

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**Abstract:** *Adventure or initiative games* are one of the methods frequently applied in experiential education, a holistic approach to facilitate personality growth, which has established itself in various educational contexts. The main goal of initiative games is to promote social and personal skills. Generally, a group of participants is presented with some kind of problem or challenge that needs to be mastered. This can take place in an outdoor or indoor setting and usually requires effective group interaction and creative thinking to be completed successfully. The lead author has examined the impact of initiative games in regular school lessons on the growth of social and personal competence in students over a period of three years. The aim was to test the efficiency of the approach within the restricting conditions of a classroom setting. The evaluation of the intervention was conducted with a combination of quantitative and qualitative methods. The findings suggest that the presented approach does in fact promote social and personal skills already after a brief intervention phase. Some of the methods chosen created certain difficulties in regard to the experimental setting. These difficulties are presented and we suggest ideas how computer based methods could be a valuable alternative for the evaluation of social skills and behavioural development in comparable settings.

**Keywords:** Adventure initiative games, experiential education, problem solving, social skills, personality growth

# **Videogames and Education: a First Empirical Research in the Basque Country**

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**Abstract:** In this paper we will present the main results of a research project about “videogames and education” carried out in the Basque Country in 2007-2008. In the first part of the paper, we present the results taken from the first research project carried out in the Basque Country in order to analyze the use of videogames. 435 teenagers from six different schools between 11 and 18 took part in the survey in June 2008. In the second part of the study we put forward a suggestion to work with videogames at school. We have tested this suggestion in autumn 2008 in two schools from the Basque Country. We have worked on a few games (*GTA-Vice City*, *Bully*, *GTA-San Andreas* and *Contra viento y marea*) with two main aims: to show teenagers to do a reflexive-critical reading of the screens that have become so important in their everyday life, and to explore the positive potential of videogames (especially serious ones). This paper also presents the outcomes of these experiments.

**Keywords:** Videogames, education, research project, Basque Country

# **The Motivational Power of Mini-Games for the Learning of Mathematics**

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**Abstract:** Computer games are part of many children's daily life. Playing computer games is done in leisure time. Nevertheless, there is also a growing interest in serious games, games that are made to learn or to train a skill that is useful outside the game. In this paper we describe the results from a six-week pilot-study on the use of the mini-game 'Crack the Number Safe' that is designed for exploring divisibility. We address the following questions: What are characteristics of mini-games like 'Crack the Number Safe' that motivate students to play? How gamelike are these games? What do individual students do and learn when they play 'Crack the Number Safe'? Outcomes show that children experience 'Crack the Number Safe' as a game. Most children like to play this game more than once. They play the game in leisure time. From the analysis of the 'think aloud' protocols recorded during game-play it is clear that children are able to use their prior knowledge about division and that in some cases they discover new division rules.

**Keywords:** Game-based learning, mini-games, mathematics education, division

# **New Teachership in Game Worlds**

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**Abstract:** It has been argued that we are moving towards a new generation of educational use of games. The third generation educational games stress the meaning of the teacher in game based learning by expanding the scope of the games from just playing to learning and teaching. Although, the shift towards third generation use of educational games has begun, the state of art of educational game research does not offer adequate foundation to design such games. In fact, it has been argued that some teachers are avoiding game based approaches because they are afraid to lose the control on learning process. Thus, the aim of this paper is to uncover the opportunities of third generation educational games and raise discussion about teachers' role in game based learning. The research is basically a meta study about authors' previous research in the area of educational games. In this paper, teachers' role has been approached from two perspectives: The first case is about teacher as a virtual agent in the game world and the second case focuses on how teacher can facilitate reflection both in the real world and in the game world. The cases are very different from a computational intelligence point of view, but the design of both games acknowledges a teacher as an important part of the learning process. The discussed approaches are meant to strengthen and speed up teachers' opportunities to receive detailed information about the learning process. With such solutions, teacher cannot only control the process, but he/she can use received information to master relatively large groups with numerous variances in skills. Finally, we argue that the user-centered design approach paying attention to both the needs of the students and the needs of the teachers would facilitate the diffusion of game based learning approach among teachers.

**Keywords:** Educational games, teachership, learning, reflection

# **Emergence in Digital Educational Games: a World of Incidents in a Universe of Rules**

**Michael Kickmeier-Rust and Albert Dietrich**  
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**Abstract:** Using computer games for educational purposes is a compelling idea that is increasingly adopted by researchers, developers, and educators. Still, digital educational games are at an early stage. A crucial factor that must be increasingly addressed by future research is a personalization of learning and gaming experiences in the rich virtual worlds of computer games. In the present paper we introduce an approach to combine frameworks of psycho-pedagogical adaptation, interactive storytelling, and emergent game design in order to provide the individual learners with tailored learning experiences without corrupting the game's storyline and without requiring massive content production.

**Keywords:** Competitive educational games, adaptation, personalization, interactive storytelling, emergent game design

# Learning is not Self-Evident: Conceptual Change Demands Time and Support

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**Abstract:** Most learning theories rely on an assumption that concepts change through enrichment of prior knowledge. Conceptual change, as a learning theory, states that change in conceptual structures could not be achieved through additive mechanisms involving only enrichment of pre-existing knowledge. Conceptual change is required, for example in acquisition of the concept of fraction because it requires radical changes in the pre-existing concept of natural number. The aim of this article is to study the conceptual change in the context of game based learning. The study focuses on the process of conceptual change trying to reveal playing patterns that facilitate and trigger it. In this article, conceptual change is studied through game designed to teach mathematics - number axis with decimal, fraction and percent numbers. Traditionally, the comparison between these numbering systems has been found relatively challenging. The overall aim of the study (N=369) is to broaden knowledge of the process of conceptual change in games involving teachable agents. The results clearly indicate that some of the learners had illusions of understanding about the number axis, but their high motivation and good metacognitive strategies lead to perception of the conflicting notions and finally resulted in more radical conceptual change. To summarize, the results of this study, as well as previous research, indicate that sufficient playing time, adequate prior knowledge, good metacognitive strategies, high motivation and game elements that trigger reflection support conceptual change. Thus educational games cannot be only supplementary amusement, but pedagogically well designed tools that should facilitate reflective processes both during and after the playing sessions.

**Keywords:** Conceptual learning, game based learning, mathematics learning

# **“One day I Will Manage FC Bayern Munich!” – How Sport Management Games Train Prospective Sport Managers, Development Of Competencies by Playing Digital Sports Games?!**

**Rolf Kretschmann**

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**Abstract:** Mass media continuously delivers breaking news on various sports. Among these sports, some sports might be more or less famous and popular. Undoubtedly, soccer is one of most famous and popular sports in the world. The huge amount of money involved and the number of worldwide fangroups indicate the high importance of this mass media spectacle. For instance, millions of people watch the world championships, while multiple people work hard behind the scenes to keep this business going. Moreover, soccer as a business enterprise seems to be still growing. Structures which have become as big as soccer naturally need to professionalize. Therefore, various professions tackle the demands of professional soccer. Among these professions, the so called sport manager plays a key role. The sport manager is responsible for serious decisions according to the present and future development of a soccer club. Someone holding that important position needs to be trained well, to be able to cope with the specific tasks within this specific field of work. For this purpose, university and higher education programs offer serious degrees to becoming a sport manager. Sport management even has become a distinct sub-discipline of sport science containing sophisticated scientific theory, content and methodology. Therefore, studying sport management opens the complex structure of the field of work in question that might appear quite simple in every-day conversation at first sight. At this point, digital games and the idea of integrating them into sport manager training processes come in. The immersive and engaging characteristics of digital games are leading current pedagogical discussions about digital media. Game scientists, (pedagogical) researches, and practitioners continue to attempt to embed digital games in pedagogical settings. They consider these games to be so called “serious games”. The idea of serious games is that a digital game is not only played for fun and entertainment, but to employ the specific game-play for serious learning outcomes in a specific field of learning or work. Hence, the question arises, whether, and if so how, a digital sport management game can assist prospective sport managers and students of sport management at the introduction to this complex field of work. To tackle the research question, it is necessary to investigate the profession of sport managers in “real” life and compare the game-play of a digital sport management game to them. Therefore, the best selling and most famous so called COTS (commercial off-the-shelf) game “FIFA Manager 09” by EA Sports is picked to be the subject of analysis. In conclusion, “virtual” sport manager-competencies actually match “real-world” sport-manager competencies well. However, further research will be needed, especially empirical studies.

**Keywords:** Digital sport games, game-based learning, serious games, sport computer games, sport pedagogy, sport management

# **Jirafa Learning World – Massively Multiplayer Online Role-Playing Game for Primary School Math Education**

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**Abstract:** Jirafa World is a project started in 2008 to develop an massively multiplayer online role-playing game (MMORPG) for children aged 6 to 10. The project is made in collaboration between game developers from Jirafa AB, researchers from Malmö University and teachers and children from Björnbodaskolan primary school in Stockholm, Sweden. The project has been granted financial support from Vinnova, the Swedish authority for innovation systems. The main objective of the project is to develop an online educational game and to demonstrate its ability to motivate children to learn Mathematics. There are several unique properties of this project: The development process is extremely user centered. The main story line and content of the game will be developed in a series of workshops with children in Björnbodaskolan during the spring of 2009. The children will truly be co-creators of the game. Researchers, teachers and game developers will work in close collaboration throughout the development process. All roles are seen as key to develop a game that will have high entertainment values and invoke the children's interest to learn more Math. The project will actively involve the parents of the children and find ways of including the parents as co-players. The main reason for this is that the parents' involvement is seen as a very important motivating factor for the children. The first version of Jirafa World will be developed by October 2009 and tested in several primary schools in Stockholm during the autumn. Prior to this project, Jirafa AB and Björnbodaskolan primary school have been collaborating on the development of a series of educational mini-games that have been developed according to the national knowledge goals in Mathematics and Swedish. These mini-games were included in the school curriculum during the autumn of 2008 and resulted in very interesting findings regarding the ability of children to learn through educational games and the individual differences between children regarding motivation and learning styles in relation to educational games.

**Keywords:** Game, mathematics, K-6, educational, MMORPG

# Story Patterns for the Design of Game-Based Learning Experiences

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**Abstract:** The paper presents a step towards a catalogue of storytelling patterns intended to facilitate design of motivating educational game content. Designers will find reusable best practises regarding plot construction for game quests or missions. To arrive at a first version of a catalogue, we carried out an empirical, qualitative search for recurring plot sequences in two corpora, (1) award-winning TV commercials, (2) feature films related to education and growing up. The results are a first step towards a catalogue of patterns. As a first trial in a blended-learning course at our university indicated, designers of educational game content can already use our patterns when transforming traditional eLearning into a game-based approach. In the context of this task, three major questions arise. The first question is how the transformation can be realised. There is a need for reusable heuristics, based on prior experiences and on research in eLearning as well as in games. The next question is how to evoke intrinsic motivation, immersion, and flow in a potentially extrinsically motivated learner. Strategies are needed for enabling meaningful learning experiences to make the promises of educational games work. A final important question deals with avoiding that a playful environment dissolves a carefully laid-out knowledge structure. Game design needs structure as well. To address these issues, we began constructing the pattern catalogue. Employing the psychological concept of 'script' and focusing on the storytelling dimension of narrative educational games, we identified 37 recurring meaningful plot sequences in Corpus 1, and 70 in Corpus 2. Of these results, 13 patterns were evident in both corpora. As an illustration of our findings, we present seven patterns from this intersection using a semi-formal pattern language, and discuss how the results relate to gameplay and learning in digital educational games.

**Keywords:** Game-based learning, storytelling, design patterns, scripts

# Fort Ancient, Ohio: a Curricular Approach to Developing Mobile Games for Tourists

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**Abstract:** This work in progress presents a course that was developed for digital design students who have received no prior training in game theory or production methods. The curricular goal is to teach creative thinking skills, collaborative learning models, iterative design methodology, and simple objective-c programming. The students were asked to develop a series of simple games that promote learning and social interaction among visitors at the Fort Ancient archeological site. The Fort Ancient archeological site is a collection of American Indian mounds built by the Hopewell Indians (100 BC-500 AD). With three and one-half miles of earth walls, the 100-acre complex is the largest prehistoric hilltop enclosure in the United States. Located near Cincinnati Ohio, it is now a state historical park and designated as a National Historic Landmark. The challenge was to develop mobile games that encourage visitors to interact with each other as they explore this large landmark. Because there is limited signage available at the Fort Ancient site, students also addressed problems with way finding and lack of historical information at the site. The 10-week course included a brief overview of game theory with assigned activities that explored various aspects of game design such as balance, feedback loops, and other core game mechanics. After these exercises were complete, students performed on-site research, ideation, and development. The development process included writing a game treatment, paper prototyping, and simple user testing. While the students performed these tasks, they were given a series of class labs on objective-C programming and iPhone development. The final project involved developing a poster and a working prototype of their game. Currently, the students are collaborating with the Center for the Electronic Reconstruction of Historical and Archeological Sites (CERHAS) at the University of Cincinnati in an attempt to expand the topic to include other historic landmarks on the Ancient Ohio Trail. This process will also include further development and refinement of initial student projects with extensive user testing and analysis.

**Keywords:** Educational games, archeology, group learning, game design

# **Serious Games – Research and Design for Game-Based Language Learning in a Global Perspective**

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**Abstract:** This paper presents and discusses methodological and empirical approaches to researching game-based learning in the context of an ongoing research project in *Serious Games on a Global Market Place* (2007-11). In this project academics work with companies to explore, build and implement game prototypes, using the products and experience of commercial game designers to develop knowledge about serious game challenges. One aspect of this research consists in exploring how a game-based platform for teaching and learning English online, [www.Mingoville.com](http://www.Mingoville.com), can be developed for classroom teaching and learning locally as well as globally. Research methods used in the study are comparative studies in Denmark and Portugal within an ethnographic research tradition. In the paper we are proposing that Mingoville as a learning environment emerges and participates in a variety of local learning contexts, all of which add meaning and educational significance to the platform. We are using these different enactments of Mingoville to explore and discuss how the study and design of game-based learning can be approached and interpreted in a global context. Inspired by Pelletier (2008) we are asking how Mingoville.com becomes playable (or not playable) in different local school contexts, and how these empirical interpretations and translations of Mingoville can be researched. Findings indicate that the playability and researchability of the game studied is significantly affected by contextual issues such as the ways in which technology becomes available and accessible to teachers and pupils, as well as by local and national policies of education and technology.

**Keywords:** Game-based language learning, comparative studies of games, global game studies, game design, research methodology

# Development of an Educational Immersive Environment for Primary School Literacy Education

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**Abstract:** There is currently a growing movement in the research of the application of computer game technology to produce materials suitable for education and training. This research to date has a narrow application-based focus, such as in the military and medical sectors, yet this research is broadening to applications in tertiary, secondary and primary education. This is significant since our current school children are 'Digital Natives', whose lives embrace this technology. It is our belief that they may benefit from learning within Educational Immersive Environments (EIEs), single and multiplayer environments which use computer game technology but which are neither computer games nor are designed according to computer game design principles. However, we acknowledge that computer game design principles can be of help in designing a captivating, motivating and 'fun' learning experience. This paper reports on a year-long research project developing an EIE suitable for Primary School Literacy Education, using the commercial game-engine "Unreal Tournament 2004". The project involved working closely with a local primary school in Worcester, UK. Our design process was based upon Constructivist and Experiential learning theories and included elements of instructional design principles (IDP). A mapping was made from these theories and principles onto the "affordances" of the game engine. We suggest that this mapping may form a significant part of establishing a theoretical basis for EIE design. The EIE content was informed by the teacher/practitioners and from consulting the Primary National Strategy Framework and web based resources. An iterative development methodology was employed involving the teachers at each key stage of the development process. A small-scale evaluation of the EIE was conducted using teacher-questionnaires and pupil observations. This revealed some significant indicators. The potential effectiveness of the EIE was judged by teachers and pupils to be high. Pupils showed a high level of motivation and engagement due to the freedom to roam, autonomy of choice and level of interactivity. However, we have reflected on shortfalls of the EIE indicated by the evaluation. Three concerns emerged: First, a possible conflict exists between giving the learners freedom of movement and choice of tasks, and the need for structured guidance. Second, the need to critically assess mechanisms of information delivery, especially related to structured guidance. Third, the need to review the separation of 'learning' and 'fun' spaces.

**Keywords:** Computer games, primary school literacy, educational immersive environments, vcop, education theory, instructional design, unreal tournament 2004

# Motivation in Alternate Reality Gaming Environments and Implications for Education

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**Abstract:** Alternate Reality Games (ARGs) are being used increasingly in Higher Education to provide a stimulating context for student learning. By combining a narrative with puzzles that are solved by a community, both online and in the real world, they offer the opportunity to create problem-based learning experiences where students can work together to discover secrets and solve mysteries. Some players become highly engrossed in these games, expending large amounts of effort in solving challenges or creating artefacts. In the context of education, however, while high levels of engagement are seen in many students, it is certainly not universal. This paper draws on four case studies of the use of an ARG-based learning environment to examine what can be learned about motivation, and how this could be used to influence student engagement in learning. This paper first explores the literature on motivation with games and learning, and presents a model for understanding motivation with ARGs as a distinct genre. Then four cases studies are used to explore different ways in which motivation can be facilitated in educational ARGs (and activities that are inspired by ARGs). This includes two of games to support student induction, an online problem-solving course to teach Historical research skills, and the first charity ARG, presenting a comparative study from a related sector. Each of these cases will be described and the lessons learned with respect to motivation highlighted. Finally, the paper will explore and discuss overarching issues raised in the case studies. In particular: pros and cons of competition; appropriate levels of challenge for motivation; increasing participation levels and the niche ARG aesthetic; assessment; and ways of increasing learner autonomy. In all, this paper hopes to provide an insight into what can be learned about motivation from alternate reality games.

**Keywords:** Alternate reality games (ARGs), motivation, engagement

## **The Truth About Alternate Reality Games: Args in Educational Method, Args as Educational Method**

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**Abstract:** To use the contemporary catch-phrase, in *post-method* times it is either an anachronism or arrogance to propose any one language-teaching method. Unlike their theoretical colleagues, teachers have long been eclectic in their approach and sceptical of blanket methods. Conversely, although theorists may of late be busy be deconstructing pedagogic philosophies, teachers have always retained a healthy respect for anything that works, particularly that which is empirically proven. For that reason, in this paper we will consider the benefits of ARGs, (Alternate Reality Games) to teaching method, or, indeed, ARGs as a teaching method in themselves. Among other ARGs cited, we make particular reference to the Tower of Babel, a game developed by the ARGuing project, innovative in that it has been developed to incorporate Web 2.0 technologies to learning tasks, and designed not just by experts in games but also by educators for educational ends. As we discuss, results from the final pilot demonstrate not just that ARGs work, but that they work tremendously well.

**Keywords:** ARGs, motivation, collaboration, social networks, education, method

# The Role of Games in Facilitating Preparation for Future Learning

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**Abstract:** This paper, after exploring the importance and relevance of learning transfer to the development of and research into games for learning, presents a reconceptualisation of learning transfer as “preparation for future learning” (Bransford & Swartz 1999) and goes on to describe efforts to develop a web-based space game to facilitate learning transfer in this sense to a series of novel learning tasks presented as part of an innovative interactive astronomy exhibit for children. Discussion is offered with regard to the game design and development process – the latter based on the Adobe Flash CS3 environment – and with regard to results of the pilot of a “proof of concept” game prototype with a group of 26 boys aged 10-12. Some initial conclusions are drawn with regard to necessary improvements to both game design and research design; issues such as frequency of practice and cognitive fidelity are proposed in closing as important conditions for game-based preparation for future learning.

**Keywords:** Arcade games, asteroids, astronomy, serious games, games for learning, learning transfer, preparation for future learning, Flash CS3, learning transfer from games

# Storytelling and Serious Games for Creative Learning in an Intergenerational Setting

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**Abstract:** In this paper a concept based on an innovative combination of Storytelling and Serious Games to promote knowledge sharing in an intergenerational setting is presented. This work is being carried out in the scope of the “E-VITA: European Life Experiences” project, which aims at developing and testing Serious Games that allow younger generations to “live” true stories told by older people. Thus the complexity of the past can be experienced directly and understood while playing a game that once was a very individual, real story, resulting in a very innovative way of creative learning. The authors are designing an approach that allows transposing life-experiences collected from the narratives of older citizens to Serious Games to promote Game-Based-Learning that is most motivating for younger generations. The historical timeframe is set before the European Union was established (1993). The stories potentially relate to different topics like work, holidays, migration, and any kind of cross-border experience, both from the cultural and the practical point of view. Besides the occurrences also the emotive side of the involved characters is being considered and integrated through the Storytelling approach. The chosen methodology offers gamers to actively be engaged in the past happenings and to directly live the experience as the main character. To elicit profound insights into the historical situation and about the dynamics regulating the setting, it is fundamental to catch expectations of the younger generation and to address them in such a way that these potential players feel attracted by the games: their creativity must be able to run free, while they are involved in the story. To reach this objective, a participatory design approach was chosen. In the scope of E-VITA the different actors are involved in the design process. One on the one side seniors telling stories based on life-experience and on the other side potential gamers, namely teenagers and young adults are asked to actively participate in the design of the Serious Games, by expressing preferences and expectations and give feedback through all the stages of the design process. In this paper the outcomes of the first round involving potential users in the game developing process is presented in detail and the follow-ups are briefly discussed.

**Keywords:** Serious Games, storytelling, creative learning, intergenerational knowledge transfer, participatory design approach, motivational requirements

# Developing Games for Higher Education

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**Abstract:** “Serious” games aimed at professional training or teaching students in further and higher education have recently seen a surge in demand. With trainees and students expressing continuous disapproval of traditional teaching methods who fail to attract and / or maintain the interest of the attendees, educators are looking at games to offer a solution. Over the past decade there has been a considerable improvement in the way role-playing games have embraced education at higher levels. Despite major breakthroughs and achievements there is still the feeling the expectations have not been fully addressed and there is much room for improvement. Educators and students look at the way players / students engage with the game and how this fulfils the needs and meets the ever rising expectations of gamers as these are fuelled by experience with entertainment games. Achieving the educational objectives as well as maintaining the entertainment value through advanced playability of the game is the primary concern of the developers. Seeking ways of engaging the user in the development process and ensuring that the game undergoes rigorous review sessions and extensive testing throughout the development cycle is a way forward. Trying to do this within a restricted budget and time for development and without compromising the educational content and value is the main challenge. Test-Driven Development is a methodology currently employed in many disciplines of computing, including the games industry with notable levels of success. Exploring its use and effects on developing games for higher education is the key theme of this paper. The author reviews two educational game development projects that have been implemented under his direction and management. He discusses the use of TDD and story-test-driven development in the more recent of the two projects and highlights the effects of the approaches, with projections as to future developments.

**Keywords:** Educational games, games in HE, test-driven development, story-test-driven development, games development

# Does Game-Based Learning Exist or is it Merely Game-Based Teaching?

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**Abstract:** With increased interest by academic institutions in game-based learning, and the introduction of cognitive training games into the classroom, the question should be asked what the students are learning through playing these games. Some suggest that an increase in cognitive skills such as working memory ability, significantly improves academic ability, and that cognitive skills are greatly improved by playing computer games. However, others state that games do not foster learning at all, cognitive skills nor knowledge acquisition, and it is purely the context in which they are used that stimulates any learning to take place. This paper discusses the question of whether the game playing increases player's cognitive skills or if people with high cognitive ability immerse themselves in the games environment. Findings from independent studies that relate cognitive abilities to playing computer games are detailed and the player's perception of learning from games is also noted. This paper suggests that the meta-game surrounding game play is paramount to learning and hence explores the value of collaborative role-play environments for Game-Based Teaching (GBT). The creation of role-play scenarios is discussed and a comparison of available e-learning platforms is provided.

**Keywords:** Game-based teaching, cognitive abilities, collaborative learning, e-learning platforms

# Game-Based Teaching – Dimensions of Analysis

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**Abstract:** Games are often classified as if they were entities with only objective characteristics. Games thus seem to consist of rules, goals, options etc. However these characteristics do not make sense independently from playing persons. The player's perception of the game is rather added as an external super-characteristic. Particularly concerning educational games this approach is not satisfactory. The focus on learning requires even stronger to take account of the player/learner and the kind of his immersion into the game. There are of course less objectivist approaches to games which differentiate games according the basic playful experiences they provide. Differentiations are also not sufficient to analyze games regarding the implied learning processes. Thus it is necessary to find an integrative way to describe games between the basic affective/motivational experiences they provide, their seemingly objective outlooks, and their educational function. For this purpose we distinguish four dimensions of meaningful interaction with games: fact, time, social and education. The fact dimension of interaction relates to the 'objective' characteristics of the game, i.e. its rules, the roles, goals etc. This dimension includes learning because game experience is dependent on the level of learning/understanding of the rules etc. The time dimension relates to temporal aspects like the representation or story or an action in a game, which gives a certain meaning to roles, goals etc. To understand this meaning cultural/social learning is involved. The dimension of social interaction implies where, when, how ... to cooperate or to compete with potential other players, i.e. processes and decisions which are cognitively demanding. Concerning educational games there is a crucial fourth dimension which has to be taken into account: The educational dimension of the transfer from inside of the game to its outside. What is transferred (skills, knowledge, social competences) is part of the game and then of the outside. However in relation to this fourth dimension there is also an occasional paradox which refers to the possible contradiction of the two goals inherent in educational games: playing and learning. The player/learner knows that he ought to learn while playing or vice versa.

**Keywords:** Game based learning, game analysis, game design, play anthropology

# Evaluating Serious Games in Higher Education: a Theory-Based Evaluation of IBM's Innov8

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**Abstract:** With the emergence of new technologies on a continual basis, it is imperative that Educational Institutions integrate these new technologies as subject matter and learning tools in their curriculums. One of these emerging technologies is Digital or Serious Games, and is receiving widespread attention from educational institutions because of its multi-faceted application potential. The success of Serious Games within an educational environment is, amongst other factors, due to their engaging and entertaining nature. Learners are also more comfortable with Gaming technologies because they are already familiar with similar technologies on a day to day basis. There are a number of Serious Games currently being used by educational institutions in this regard, one of these being IBM®'s Innov8. Innov8 is a serious game which was developed by IBM® as part of their Academic Initiative programme. The author's institution registered for the programme specifically to gain access to Innov8 as they wanted to explore the possibility of implementing relevant Serious Games across its Information Systems curriculum. The game employs a first-person role-playing approach where the player assumes the role of a consultant within a company that is experiencing challenges. The two primary aims of the game are to teach players who come from a more technical background about business processes and more specifically about Business Process Management (BPM, while at the same time immersing them in a three-dimensional world which is closely aligned to real-life scenarios. The author's have conducted an extensive evaluation on the first version of Innov8 for use within their university's Information Systems curriculum. The purpose of this paper is to explain the evaluation criteria that were used as well as highlighting the findings of the evaluation. This evaluation draws from established theoretical frameworks, from the education and psychology fields including: Bloom's Taxonomy, Gagne's Event's of Instruction and Keller's Attention Relevance Confidence Satisfaction model.

**Keywords;** Serious Gaming, Bloom's Taxonomy, Gagne's Event's Of Instructions, Keller's ARCS Model, Innov8, Digital Game-Based Learning

## 3I-Approach for IT Educational Games Development

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**Abstract:** The problem of training highly skilled software engineers is currently under discussion. Analysis revealed that educational game development for software engineers is a very promising and perspective research area, but there is still a huge demand for educational games for software engineers. We suggest a 3I-approach for IT educational games development. It is based on three I's: course material must be *Introduced* through a game world; learners must see *Interpretation* of solutions in a game context; learning results must *Influence* game results. We use this approach for IT educational games, though it could also be used in the other areas. In our approach the learning process is represented in a game in the form of a spiral. We elaborated a game-related course description for use in learning games and techniques for the integration of learning components into a game. We applied our approach in the development of educational games for learning programming languages, because it is a fundamental subject for software developers. We developed a game called 'Graviman' for learning Object-oriented design and the C++ programming language. We use two techniques for checking programming code: verification (checking source code using corresponding rules) and running (executing source code and checking the result). The verification method is based on regular expressions. A specialized library has been developed for matching program code. For visualization of a runnable solution the code of the solution is compiled and then executed. A player can see the result of his coding directly through game character behavior. Game architecture is based on common game engine architecture, but it is extended for use in educational games. It consists of two high-level subsystems: a game engine and a learning engine. The game engine is based on the graphical engine Ogre3D and enlarged with game logic and an advanced user interface (for advanced text display and editing). We consider that using this approach allows the creation of attractive learning games that can be used at universities and schools and also for individual learning. Using such games can help students to gain and improve knowledge and skills in computer science, and can also raise the motivation to study.

**Keywords:** e-Learning, computer games, educational games, software development

# Interactive Whiteboards and Computer Games at High School Level: Digital Resources for Enhancing Teaching and Learning

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**Abstract:** The general potential of computer games for teaching and learning is becoming widely recognized. In particular, within the application contexts of primary and lower secondary education, the relevance and value of computer games seem more accepted, and the possibility and willingness to incorporate computer games as a possible resource at the level of other educational resources seem more frequent. For some reason, however, to apply computer games in processes of teaching and learning at the high school level seems an almost non-existent event. This paper reports on study of incorporating the learning game “Global Conflicts: Latin America” as a resource into the teaching and learning of a course involving the two subjects “Danish language learning” and “Social studies” at the final year in a Danish high school. The study adopts an explorative research design approach and investigates and analyses the learning and social effects that appear in the classroom as a result of this approach. The many interesting findings suggest that the incorporation of learning games at the high school level has much uncovered potential to offer processes of teaching and learning.

**Keywords;** Interactive whiteboards; teaching/learning in high school; computer learning games; digital dialogic learning

# Deep Learning and the use of Spore™ in A-Level Biology Lessons

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**Abstract:** This paper examines the perceptions of sixth-form students towards the use of Spore™—a commercial electronic game— in their biology lessons. Findings of a focus group showed that the students welcomed the use of Spore™ as a medium of deep learning, although they regarded this as more beneficial to younger pupils. Two themes were found in their views on how the game relates to biology studies, which are the concepts of evolution and of a selective framework. The paper presents a comparison between the perceived advantages of game-based learning and the normal learning approach and how the students see teachers who use technology in teaching. The paper discusses the knowledge and skills associated with deep learning which were demonstrated by the students in the discussion. A gap was identified between the perceived usefulness of Spore™ in learning about the concept of evolution in biology and the possible desired learning outcomes. The paper considers the proposition that bridging this gap could be a form of deep learning—an approach that could develop meta-learning skills in biology.

**Keywords:** Deep learning, spore, A-level, biology, game-based learning

## Arguing for Multilingual Motivation in Web 2.0: a Tool for Facilitating Plurilingualism

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**Abstract:** There are several purposes that Alternate Reality Games (ARGs) can be used for and facilitating plurilingualism is definitely one of them. In the age of ICT-based communication, Alternate Reality Games (ARGs), interactive narratives, often involving multiple media and game elements used to tell a story that may be affected by participants' ideas or actions (Connolly *et al*, 2008), are known in non-educational settings but can serve as a teaching and learning tool that can contribute to activating the use of modern foreign languages in authentic situations, something that classroom teaching lacks. This paper aims to examine various educational and social aspects of games-based learning with a special focus on multi-channel communication between speakers and learners of different European languages. In this paper, we explore further the use of web-based foreign language learning and the questions that it poses. What has to be done so that ARGs can achieve their educational objectives? How can we best use their potential as a powerful motivator for acquiring more than one foreign language? With the context of the Tower of Babel ARG developed as part of the EU Comenius project, ARGuing for multilingual motivation in Web 2.0, this paper presents an analysis of the opportunities that an ARG provides, but it also discusses the issues that educators and game developers should be aware of and cater for.

**Keywords:** ARGs, plurilingualism, motivation, communication, social networks, modern foreign languages

## **ARGuing for Multilingual Motivation in Web 2.0: the Teacher Training Perspective**

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**Abstract:** Not only is it necessary these days to bring *technology* into classrooms, to suit teaching to the actual needs and the skills learners bring from the 'real world', but it is of paramount importance to equip their teachers with the tools to mediate successfully in the process of acquiring knowledge and developing competences in a changing educational environment. Drawing on the experience gathered while designing and running a teacher training course for teachers of modern foreign languages in their preparation to run the Tower of Babel Alternate Reality Game (ARG) (a specially developed game to suit the contemporary needs of motivating students to learn and use more than one foreign language) the authors shall concentrate on the why's and how's of helping teachers cross the boundary between the classrooms they are familiar and comfortable with and an e-learning environment. They will reflect on the different stages that teachers undergo in this process using their observations as well the gathered quantitative data paying particular attention to teachers' reactions and recommendations. They will also focus on drawing some conclusions about the possibilities and requirements that on-line teaching and learning pose.

**Keywords:** ARGs, motivation, collaboration, social networks, modern foreign languages, plurilingualism, teacher training

# Welcome to my World: Induction to Games for Learning

**Anna Warren, Fiona Littleton and Hamish Macleod**  
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**Abstract:** Game-informed, or game-based, approaches to learning are often characterised as being fundamentally student-centred in nature. While this may be so with respect to the conduct of the game-informed activity, engaging learners in the first place with a playful activity in the context of what they see as the serious business of study may present some challenges. That is, if students are to benefit maximally from playful learning, there is a matter of induction and orientation that the teacher or mentor will have to consider. Although many academics may remain sceptical about the potential value of game-informed approaches in education, it is widely believed that students will be universally accepting of such approaches, but this may not always be the case. Some, particularly mature learners, may import negative perceptions of the domain of digital games gathered from the media. Some, while essentially being neutral with respect to the cultural role of digital games, perceive no association (or may even assume a negative relationship) between play and study. Neither does enthusiastic engagement with the digital game culture for recreational purposes prepare people to accept their role in education. This paper seeks to explore the nature of reticence, unpreparedness and contrapreparedness of learners and teachers to engage with digital games, game environments, and virtual worlds, in the context of their academic lives. It then describes ongoing work to develop practices of induction that teachers may utilise to help and support them. Two examples in particular will be used. First we draw upon experiences of introducing a range of different groups of learners and teachers to the virtual world *Second Life*. Secondly we consider insights gained in the process of developing an integrated “taster” experience of the game environment *World of Warcraft* designed for those wishing to explore the game’s educational relevance. These experiences have emphasised the fact that there can be no “best practice” approach to induction, but rather that the induction experience must be sensitive to the needs, aspirations and previous experiences of the learners, as it seeks to scaffold their explorations.

**Keywords:** Games; virtual worlds; induction; World of Warcraft; Second Life

# **A Design Proposal of a Game-Based Professional Training System for Highly Dangerous Professions**

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**Abstract:** Recently, modern society frequently faces local wars, terrorism, earthquakes, fire accidents, epidemics and coal mining accidents. Members of highly dangerous professions must obtain rigorous training so that they could bear the great historical mission. Generally speaking, these professions include armed forces, special police force, fire department, astronauts and mine disaster rescue troop. The game-based professional training systems for highly dangerous professions have their own distinct requirements. The aim of game-based learning systems is not only the study of declarative knowledge, but also entraining procedural knowledge through repeated practice until it becomes an automatic skill. The result of highly dangerous professional training is extremely important, since if a trainee does not master the basic knowledge and skill, they could be in grave danger; the trainee's mental qualities should be continuously prompted by the training system so that they could be act intuitively under the most execrable circumstance. Based on requirements analysis and taking the case of mining rescue into account, we divide the whole training system into three parts: machine learning subsystem, brain information subsystem and credit-assignment subsystem. The machine learning subsystem (as know as serious game subsystem), contains the audio-visual coherency analysis, semantic annotation of a scene based on association memory, cooperating management of audio-visual cross-modal signals, personalization rendering of a scene. The brain information subsystem includes functions for receiving, storing and analyzing trainee's trial data based on visual and auditory signals from EEG, sEMG and psychological tests. The credit-assignment subsystem involves trainee's profiles and effect evaluation which are sent from brain information subsystem to machine learning subsystem, while the plan of knowledge learning, the result of skills training and consequence of the desensitization trial are sent as the feedback to brain information subsystem. Therefore the whole framework works as a reinforcement learning system. The kernel of this system is the cooperating learning schema of audio-visual cross-modal signals. Furthermore, in this system the main visual signals contain scene textures, 3D character animation, 3D scene animation, while the main auditory signals contain the realistic sound, the on-the-spot orders, the on-the-spot yells and background music. In the light of cognitive principles, the following factors should be considered when a game-based leaning system is designed: 1. The working memory including phonological loop and visuo-spatial sketchpad act as two slave systems, play the role of dual sensory channels so that semantic coherency of the visual and the auditory data could be combined with the prior knowledge to be formed as long-term memory; 2. A goal of cooperative learning for audio-visual cross-modal signals is to create an approach which can process verbal information(like the realistic sound and the on-the-spot orders) and non-verbal information(such as 3D character animation as well as 3D scene animation) from the two separate subsystems; 3. Schema acquisition (based on Theory of Cognitive

Load -TCL) should be a primary means of learning, and the automation of cognitive process (including declarative knowledge procedural knowledge) will be used to reduce working memory load.

**Keywords:** Game-based professional training, highly dangerous professions, audio-visual coherency, working memory, theory of cognitive load

# **Research in Progress Papers**



# Experiences of Promoting Engagement in Game-Based Learning

**Marie-Thérèse Charles, David Bustard and Michaela Black**  
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**Abstract:** There is a growing belief that techniques from digital games can improve student engagement in learning, resulting in improved success rates and a more rewarding experience for everyone involved. In practice, of course, success is never guaranteed because of the difficulty of addressing the many factors affecting the outcome. The main purpose of this paper is to clarify those factors as a basis for developing guidelines to help improve the chances of success. The ideas presented are based on the positive experience of using an engagement game in the teaching of first year programming and a more problematic experience of extending the approach to encourage students to seek one-year work placements. The paper starts with a summary of the first year engagement game, outlining its approach, results, and the lessons learned from the exercise. This is followed by the description of a substantially different game for second-year students, who undertake a full-year work placement in their third year of a four-year Computing degree. Again lessons learned from the experience are reported, with suggestions for further experimental work outlined.

**Keywords:** Games-based learning, student engagement, success factors

# **Game-Based Assessment: can Games Themselves act as Assessment Mechanisms? A Case Study**

**Nathalie Charlier and Geraldine Clarebout  
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**Abstract:** Effective assessment of practical skills is a challenge for large-size classes. To reduce the time-consuming burden of staff members without compromising the quality of the assessment, a case study was set up to investigate whether games can be considered as suitable and valid tools for summative assessment. Using a traditional exam as bench-mark, a boardgame format was experimentally trialed to assess students' knowledge, skills and attitudes at the end of a first aid course in a pre-service teacher training programme. Twenty-eight master students were randomly assigned into two groups. Two assessments, a game-based assessment and a traditional test, were applied on both groups in opposite order. One group started with the game, the other group was assessed by the traditional test. This latter consisted of a paper-and-pencil test in combination with a skills assessment. Both parts were assessed by an expert evaluator. The written test was marked using a scoring key, the skills assessment was scored using an observation matrix. In the game-based assessment, the focal point was peer assessment. Students were placed in the role of judge over other students' efforts. Similarities between both assessment types included individual testing, content, type of questions (true/false, short answer and essay questions) and demonstrations, and the use of checklists for skills assessment. The assessment methods differed in type of assessor (peers or expert), assessment format (written or oral test, both in combination with skills assessment) and feedback availability. A survey investigating students' preferences on playing games was taken just before the first assessment and analysis indicated that most students preferred to play games in general. Both groups performed equally in the game-based assessment as well as in the traditional test, in spite of opposite order of the assessments. Overall, students performed significantly better on the game-based assessment than on the traditional test, presuming beneficial effects of gameplay, peer assessment, peer feedback and oral defence.

**Keywords:** Assessment, game-based, summative evaluation, health education

# Harmonising Culture in Co-Operative Business Ventures: Using a Simulation in a Metaverse

**Emma Dai and Jay Bal**  
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**Abstract:** In recent years, there has been and continues to be an increasing number of company mergers and takeovers. However, many of them such as the AOL – Time Warner, merger destroy shareholder value instead of increasing it. Mirvis (1992) and Vansina (1992) observe that approximately half of all company mergers fail at some stage of the integration process with the blame generally going towards the inability to reconcile two different organizational cultures. Dealing with the human elements of a merger there is often a lack of understanding on how to integrate organizational cultures of the existing firms. Not only is the concept of organizational culture one that is hard to tackle due to its vague and subtle meaning, but also an issue which is hard to manage due to the large amount of resources often required when dealing with human issues. While attempts have been made in the past to manage culture, they have been notoriously difficult to execute. However, innovations in information technology have provided new opportunities for employee training and education which go beyond the traditional seminar and discussion such as employing low-cost simulations using virtual worlds as a platform for communication and interaction. Using a qualitative approach based on the interpretation of previous research, elements from a variety of subject areas will be investigated in order to suggest an outline for the creation of a prototype application. Looking first at the composition of organizational culture and its manageability, an attempt was made to analyze culture to the extent that key dimensions can be identified. Due to the difficulty of tackling the culture problem as a whole, it has been tackled by targeting cultural dimensions by drawing upon experiences and learning objectives from existing serious games, commercial and educational, in order to identify the necessary specifications for establishing a simulation aimed at changing organizational culture. Consequently, an attempt will be made to enhance elements borrowed from traditional games into one simulation using key elements in behavior modification and drawing upon theories in education and learning, to achieve an ultimate goal of providing the outline for an innovative prototype scenario for SME and large organizations, capable of dealing with the culture problem in mergers and acquisitions. At current stage, virtual worlds and metaverses not only provide the ideal learning environments for tackling a group problem such as culture, but also they potentially do allow for the creation of complex extensive games. If one takes some of the key components of organizational culture and compares them to the learning objectives of some traditional games, it can be established that the ideal simulation needed to tackle the problem of culture within organizations, consists of a mixture of processes, random events, role-play and adaptable reward structures, conditioning and ultimately a complex emulation of reality.

**Keywords:** Organizational culture, serious game, virtual world, metaverse

## **Aspects of Social Games in 3D Spaces Considering Usability and Accessibility**

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**Abstract:** Many established usability patterns from 2D applications do not apply in 3D; users familiar with completing dialogues in 2D applications, using links on Web-pages and alike find it difficult to recognize similar interaction options in 3D and trigger offered events and vice versa. Re-using widely known social games or TV quiz-shows can partly help resolving the challenge but participants from a different cultural background might not be familiar with the specific game or show. In language learning this issue emerges quite often because the trainer and students usually are coming from different cultural backgrounds. A careful game-design which reuses a lot of existing "common sense" has proven to be beneficial to keep participants motivated and engaged. Moreover, fostering motivation seems to be one of the crucial success factors in game design. Simplifying access to and usage of a 3D platform is a significant hurdle preventing potential participants from joining in. In this paper we focus on participants' motivation, individual ownership, gains in reputation and personal network, flexibility and applicability of the learning content to the "today's" situation of the participant.

**Keywords:** Social games, 3D spaces, usability, accessibility

# Using Games Classifications to Support the Design of Learning Games

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**Abstract:** To reinforce learners' motivation while maintaining reasonable cost levels, the professional training sector is now focusing on Learning Games. Our work concentrates more specifically on role-playing games that use computers as the supporting environment for remote group work. This initial choice is based on the well-known benefits of role-playing games in various areas of professional training. It is also explained by the fact that role-playing games can respond to key issues identified in the use of Learning Games such as the need for flexibility and the will to use group work situations. Our goal is to provide designers with models and support tools to help them build a technological and human training device geared towards creating a collective learning experience based on role-playing games. The specification of the support tools under consideration is based on results of previous work on the sharing of learning scenarios. It also requires a homogenized description of the provided games scenario models. This paper outlines the methodology used to construct a description grid for game scenarios. It presents in particular our study of existing game classifications so as to establish a set of criteria to constitute the grid. Seven classifications were selected. Each one is presented in this article and the relevant elements for our grid are brought to the foreground. The main features of the resulting description grid and its organisation are explained. A practical example of the grid is provided at the end of the article. This allows the description of a role-playing game used in professional training to be formalised and its structure to be revealed. As a conclusion, issues and needs raised by the tests of the grid are discussed. Further applications of the description grid are mentioned at the end of the paper: for example, its capacity to describe role-playing games scenarios so as to facilitate their adaptation for contexts of use different from the initial one (distance learning vs. face-to-face learning).

**Keywords:** Professional training, learning games, computer-supported design, role-playing games, learning scenarios



# Poster



## **Serious Game Platform for Nutritional Education; Memory Game Acceptability and Playability results**

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**Abstract:** Obesity is a chronic, complex and multifactor disease which usually appears in childhood and adolescence; currently it is an important public health problem according to the European Association for the Study of Obesity (2003). Nutritional and healthy lifestyle knowledge is a fundamental component in the treatment of obesity, even more important in children. Educative computer games (serious games) bring together learning and play, making the process of learning new concepts, skills, etc. more attractive for children. Different studies show that serious games accelerate the learning process and improve the motivations levels (Garris,R; Ahlers,R; Driskell,J. 2002). The advantages as an educative tool is that use a language according to childhood (internet, computer games), big flexibility (controlled by the clinician) and adaptability (the targets can be modified according to the clinic objectives), and reinforce learning turning it more fun. Our team has designed an educative platform game to improve nutritional knowledge in overweight children. “The ETIOBE Mates” is an educative platform game composed by three games: the Memory game, the SuperETIOBE game and Healthydiet Plate game. The three games are designed to work different components of nutrition literacy. The Memory game is an educative game, with additional component that promotes visual memory. The gamer should turn up two cards that represent products or healthy activities, and try to select their pairs. After few choices appear a question that should be answered in order to continue playing, all the questions are about nutritional knowledge. The gamer should finish the match in limited time. After three errors the game is over. The objective of this poster is to present results of research in playability and acceptability of this game. Fifty children (12-14 years old) have been recruited from Secondary Schools and have been invited to play with Memory game during two weeks. After the two weeks they fulfilled a questionnaire designed for this research. This work is in progress at this moment. This poster will show the results about the Memory game playability and acceptability. It is expected to find that the game is easy to play with, it is accepted for the children and it will improve their motivation levels to learn nutritional knowledge. In the future is being planned a study in which the game will be applied to a general population of children (school) and clinical child population to test the effectiveness and efficiency of these kind of games to learn nutrition knowledge in comparisons with the traditional oral learning (class teacher) or written learning (on paper).

**Keywords:** Obesity, serious games, education