Preface

ABOUT THE SUBJECT

Computer games is a multidisciplinary area that presents an exponentially growing impact on the economy, creating huge business opportunities generating large investments and large returns, new employment opportunities for professionals of several areas, from designers to programmers, from psychologists to mathematicians, from managers to politicians, from marketers to investors; increasing offer of graduation and post-graduation studies by universities worldwide.

This domain claims for new professionals that are not yet enough at the labor market, but that higher education is already alert and preparing them. Simultaneously it is creating social impact on individuals and society, not always on a positive direction. Hence, opportunities and challenges must converge in order to take the maximum social, economical and educational profit of the emerging potential of this field.

Computer Games as Educational and Management Tools: Uses and Approaches is a collection of the most recent developments and applications of computer games as management and educational tools in all embraced fields of knowledge or disciplines related.

With the mission of discussing the main issues, challenges, opportunities and trends related to this explosive range of new developments and applications, in permanent evolution, the overall objectives achieved with the compilation of works at the readers' hands are: to present the new technological developments related to the requirements of this industry; to discuss the impact of computer games as educational and management tools; to present practical solutions and state-of-the-art technologies; to discuss social and individual impact; to provide guidance for further research and development; and to build a bridge between research and practice.

Throughout its 17 chapters, the book covers the following topics:

- The technological dimension, addressing: supporting technologies and tools; computing developments and requirements; communication tools and human-computer interaction.
- The business or industry dimension, including: emerging businesses; business opportunities and applications; studies of opportunity and impact; critical success factors; legal aspects and copyright issues.
- The human and social dimension, comprising; psychological aspects; behavioral effects and social effects.

ORGANIZATION OF THE BOOK

This book is a compilation of 17 contributions to the discussion of the applications and developments of computer games as educational and management tools.

These 17 chapters are written by a group of 44 authors that include many internationally renowned and experienced researchers and specialists in several disciplines included and a set of younger authors, showing a promising potential for research and development. Contributions came from all over the world and integrate contributions from academe, research institutions, and industry, representing a good and comprehensive representation of the state-of-the-art approaches and developments that address the several dimensions of this fast evolutionary thematic.

The first chapter, "*Games Development for Pedagogical and Educational Purposes*," presents research developed in collaboration with two higher education institutions. Today, high education programs can only be successful with the use of new technologies in the teaching/learning process, especially when there are special education requirements. Two experiments were carried out: (1) a set of billiard balls, for snooker game, simulated by using physics laws and, (2) aLJo 2009, a game whose aim is to achieve the correct sorting of a sequence to accomplish a common task. Both projects were developed by students with different backgrounds and from different engineering courses. The snooker game, an academic project, aims to demonstrate that, through a simple game, several areas of knowledge can be used. On the other hand, aLJo 2009 was developed considering a collaboration protocol between the university and the Parents and Friends Association of the Citizen with Mental Deficiency (APPCDM), to improve behavior and social skills in patients with mental impairments.

In recent years, the gap between educational theory and practice has been closing, but although there have been calls for 'reflexivity,' there has been little critical examination of its meaning. Proposed reflexive methodologies still perpetuate many traditional hierarchies, and fail to consider the creative nature of the educational process as such. Much research work also takes place within the commercial sphere, and post-processual ideas cannot advance educational practice unless they can be implemented in some type of an e-learning system. The second chapter, "*Multi-Vocality and Post-Processualism as Methodological Assets of the 'Collaboration Game'*" examines theoretical considerations of reflexivity, representation, subjectivity and experiential engagement to highlight their relevance to everyday educational practice and their potential to undermine existing suboptimalities in the classroom.

In Chapter 3, "*Human and Virtual Beings as Equal Collaborative Partners in Computer Games*," the authors envisage virtual beings engaging as equal partners with humans, providing richer emergent game play. In computer games, the development of artificial intelligence (AI) has been a very poor cousin to the investment in graphics and physics. For the most part, AI is confined to path finding algorithms and simple state machines. Taking human and virtual beings beyond current applications of AI in computer games means that intelligent entities within the computer game cease to be "props" in a human-centric story line, but become equal participants themselves within the computer game world, engaging with humans towards achieving goals in more dynamic and realistic ways. Computer games provide a compelling environment to study and enable virtual beings to engage with humans as equals. The authors investigate the requirements, design and implementation of virtual beings that participate in computer games as humans would; playing the game and creating rich new collaborative game play experiences in areas of education, training and entertainment.

Information literacy is a crucial attribute in today's knowledge society because it makes independent lifelong learning possible. Faced with a digital world where new tools for information seeking and the

spaces for information sharing are developing, academic librarians must respond to the changing learning landscape in order to help students acquire essential skills. Computer games, due to their cognitive potential and engagement capacity, can be used to promote and improve information literacy instruction. Chapter 4, "*Computer Games and Libraries*" consists of a review of available literature on these topics. It addresses the role of computer games in the teaching and learning process and aims at discussing its possible use as training tools for promoting information literacy in libraries.

"*Games and Simulations in Distance Learning: The AIDLET Model*" discusses the selection and potential use of electronic games and simulations in distance learning supported by an operational model called AIDLET. The authors have developed a framework to facilitate the selection, repurposing, design and implementation of games and simulations, with focus on the practical aspects of the processes used in Open and Distance Learning (ODL). Whereas traditional learning is based on knowledge memorization and the completion of carefully graded assignments, today, games, simulations and virtual environments turn out to be safe platforms for trial and error experimentation (i.e., learning by doing/playing). New instructional models may require that rich interactive processes of communication are supported, that assignments are structured as game-like projects, and that a culture of interaction, collaboration, and enablement drives learning and personal development. In this context, the AIDLET model was set out and verified against a taxonomy representing the main categories and genres of games to meet the requirements of distance education teachers, instructional designers and decision-makers.

Today, digital games present themselves as one of the most common forms of entertainment, especially for children and teenagers, combining the playful factor with pedagogical advantages, promoting changes in terms of cognitive, behavioral and psychomotor skills in its users. The use of digital games in educational contexts encourages active, critical, autonomous and participated learning processes, overcoming some of the limitations presented in more 'conventional' methods, engaging players in non-passive forms of acquiring knowledge and skills. Aiming to demonstrate how digital games make the learning process possible by allowing the development of critical thinking, outlined during the act of playing, the authors of "*The Educational Value of Digital Games: Possibilities and Limitations of the Use of Digital Games as Educational Tools (The Spore Case)*" will proceed to a critical analysis of Spore, a game created by Electronic Arts in 2008, demonstrating how the player places himself in an active learning situation which is self controlled and self regulated, facilitating the comprehension of phenomena that are not a part of formal teaching.

The increasing complexity of by electronic games demands greater cognitive effort from their players. This has fostered some capacities in its players that could be used in teaching and learning. Chapter 7, "*The Pedagogical Potential of MMOG: An Exploratory Study Including Four Games and Their Players"* describes an exploratory study with two phases: the first one analyses four MMOG (Ikariam, OGame, Gladiatus and Metin2) and its pedagogical potential related to the development of problem solving skills, communication and interaction skills, and motivation to perform tasks. The second phase is a survey conducted to the players of these games about their motivation to play and their perceptions about its pedagogical potential. The results showed that all of the four analyzed games are motivating for the players, they have some pedagogical potential related to problem solving, and they improve communication and interaction skills. But the majority of the players felt some difficulties in accepting that they could transfer those developed skills to their scholar or professional life.

As discussed in "*Browser-Native Games That Use Real-World XML Data*," the rising tide of scientific data available on the web has the potential to help us consider the complex problems that concern us today, and simulation games can help us visualize, model and plan for alternative futures. However,

the modularisation of knowledge has limited communication across subject domains, and copyright legislation and business practices may need to change if the many new visualisation tools needed are to be interoperable and share common interfaces. A game standard and specification for the web, together with easy-to-use authoring tools for creating browser-native games that use real-world XML data could enhance communication and engage the public in the understanding of science and its progress.

Computer games have become an important part of the new digital economy, employing thousands of Information Technology professionals worldwide. Their role as a novel approach to reduce the distance between students and knowledge is also well documented. Chapter 9, "*A Multi-Disciplinary Approach to Designing Business Management Games*" describes a multi-disciplinary approach to designing a particular class of educational games: business management games. Authors argue that through a better understanding of the relationship between work-domain based decisions and processes, professional game designers can achieve effective results. The design approach was based on intensive collaboration and co-design meetings with business management researchers and professors. The result was a game called "SimCompany," aimed at teaching children about business management concepts, thus promoting an entrepreneurship culture in classroom settings. "SimCompany" proved effective as a teaching tool about business management concepts, and initial evaluation showed a positive increase in students' rate of learning when compared to traditional teaching methods.

Chapter 10, "*Creating Computer Games for Class Instruction*," aims to provide classroom teachers with the basic tools and fundamentals necessary to create instructional games targeted to specific courses and/or instructional objectives. By discussing the trends and issues related to today's teaching and learning environment, the authors review the benefits of using educational games in classrooms, and provide some strategies and guidelines for creating computer games for classroom instruction. Along with discussing the fundamental issues and considerations, the authors discuss some of the challenges and impact of computer games in classrooms. Additional examples drawn from literature are also included to illustrate the use of games in education and the strategies of effective instruction.

Chapter 11, "*RACEM Game for PC for Use as Rehabilitation Therapy for Children with Psychomotor Disability and Results of its Application*" introduces a PC simulation game to conduct a study with the main objective to train children with psychomotor disabilities (coordination, equilibrium and movements). The child interacts with simulated environments which contain the needed stimulus to develop the eye-hand coordination, the child responds to the game with mouse movements by means of audible orders. The main objective of this work is to enhance the child´s psychomotricity with more precise movements. Converting the game to a means for chidren's rehabilitation, this can be used in homes aided by parents. Another purpose is to have a didactical tool for professors of special education.

Chapter 12, "*When Control Education is the Name of the Game*," relates to a serious game named ITS PLC, an interactive simulation tool aimed at control systems education and training that includes the latest technologies from the video and computer games industry, namely, real-time 3D graphics, physics and sound. The goal of the game is to make five virtual industrial plants work correctly by using an external and real programmable logic controller (PLC) running the proper software, which the trainee must develop. The main purpose of the chapter is to testify the excellent properties of ITS PLC as an educational tool throughout a collection of three success stories: the first one shows how virtual scenarios can be used to investigate real problems; the usage of ITS PLC in an "edutainment" scenario is the theme of the second story; the third case testifies the benefits of ITS PLC in introductory automation programs.

Computer game-based learning environments enable learning through experimentation and are inherently motivational. However, for identifying when learners achieve learning goals and providing suitable feedback, intelligent tutoring systems must be used. Recognizing the learner's affective state enables educational games to improve the learner's experience or to distinguish relevant emotions. Chapter 13, "*Affective Educational Games and the Evolving Teaching Experience*" discusses the creation of an affective student model that infers the learner's emotions from cognitive and motivational variables through observable behavior. The control-value theory of 'achievement emotions' provides a basis for this work. A Probabilistic Relational Models (PRMs) approach for affective student modeling, which is based on Dynamic Bayesian Networks, is discussed. The approach is tested through a prototyping study based on Wizard-of-Oz experiments and preliminary results are presented. The affective student model will be incorporated into PlayPhysics, an emotional game-based learning environment for teaching Physics. PRMs facilitate the design of student models with Bayesian Networks. The effectiveness of PlayPhysics will be evaluated by comparing the students' learning gains and learning efficiencies.

Business Simulators provide a simulated environment where different scenarios and decisions can be tested without risk. They are also used for education where they can help students to understand the main concepts and theory involved in business administration. In addition, business simulators can be used to carry out research in different scientific areas, such as psychology, financial planning, risk evaluation, or intelligent business. Chapter 14, "*Business Simulators for Business Education and Research: SIMBA Experience*," introduces SIMBA, a new simulator for business education and research. SIMBA has two main goals: one is to serve as a web-based platform for business education, allowing students to connect the simulator from any point on the web, permitting both classroom education as well as distance education; SIMBA architecture permits not only the connection of human business managers, but also software agents; the second goal of SIMBA is to provide an environment in which to design and test a multi-agent platform for the creation, development and evaluation of intelligent agents that can manage companies in the same way as humans.

The market favours the best-selling computer games regardless of their social and educational effects. Chapter 15, "*Educational Games*," discusses the present trends in educational games development, technologies related to them as well as their features, through representative examples of games used for education with respect to pedagogical, business, and social aspects. Benefits and limitations of introducing games in education are pointed out, and computer games for the disabled along with their pedagogical and social effects are presented. Recent research results on the implementation of video games in schools and educational game evaluation are also presented in the chapter, based on the experience in the development, implementation, and evaluation of several interactive e-learning educational exercises, as well as in the development and validation of several innovative computer games for the visually impaired.

Chapter 16, "*Evaluation of Simulation Games for Teaching Production (Engineering)*", reports on the evaluation methods and findings from serious games for teaching production/ engineering. Two serious games are considered: Cosiga, a new product development simulation game and Beware, a risk management simulation game. These two games cover the front and middle parts of the engineering process – from design to manufacture to sale. For the Cosiga simulation evaluations of the communication, cognitive change and situational awareness were performed. For the Beware game evaluation of communication, risk awareness and improvement of risk management skills were performed. The findings from the evaluations showed that serious games deliver learning outcomes. However, there are

drawbacks to their use that need to be taken into account. Principally, the high cost of development and the need for expert facilitators for running game sessions.

The last chapter, "*Can Computer Games Motivate and Sustain Learning?*" presents a critical examination of the use of computer games as motivation for learning by reviewing evidence from the literature dealing with computer games as learning tools. Factors and difficulties associated with games as instructional strategies are discussed. Evidence from the literature indicates that current methods of applying computer games into instruction are not guided by pedagogical principles. It is recognized that the design of educational games be based on learning theories. The current practice of viewing educational games as separate entity from all other educative processes is detrimental to learning. Although the results of scientific studies on game-based learning are inconclusive, the future of game-based learning is promising partly because games are generally engaging. The results of qualitative interviews reveal that the participants believe that computer games motivate them to have fun but not to learn.

EXPECTATIONS

Throughout these 17 chapters, the reader is faced with the discussions and confirmation of the relevance and impact of this hot topic, providing professionals, researchers and scholars with some of the most advanced research developments, solutions and discussions of computer games as education and management tools: uses, trends, approaches, solutions and case studies. It is expected to support a professional audience of top managers and computer games professionals (developers and creative individuals) and also an academic audience (teachers, researchers and students, mainly of post-graduate studies). It can support disciplines of post-graduate studies on Information Systems and Technologies related with computer games development under the design, psychology and management approaches.

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