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# **Proceedings of the 5th European Conference on Games Based Learning**

5th European Conference on Games  
Based Learning  
The National and Kapodistrian  
University of Athens, Greece  
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Edited by  
Dr. Dimitris Gouscos and Professor Michalis Meimaris  
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## Contents

<b>Paper Title</b>	<b>Author(s)</b>	<b>Page No.</b>
Preface		vii
Biographies of Conference Chairs, Programme Chair, Keynote Speaker and Mini-track Chairs		viii
Biographies of contributing authors		xi
The use of Games-Based Learning Within the Curriculum for Excellence: The Teachers' Perspective	<i>Aishah Abdul Razak, Thomas Connolly and Thomas Hainey</i>	1
Tactical Incident Commander - an Online Training Game for Incident Commander Training	<i>Per Backlund, Anna-Sofia Alklind Taylor, Urban Carlén, Henrik Engström, Mikael Johannesson, Mikael Lebram and Marcus Toftedahl</i>	9
Multivariate Assessment of Motivation and Emotion in Digital Educational Games	<i>Michael Bedek, Paul Seitlinger, Simone Kopeinik and Dietrich Albert</i>	18
Designing Serious Games for Education: From Pedagogical Principles to Game Mechanisms	<i>Francesco Bellotti, Michela Ott Sylvester Arnab, Riccardo Berta, Sara de Freitas, Kristian Killi and Alessandro De Gloria</i>	26
World of Warcraft in the Classroom: A Research Study on Social Interaction Empowerment in Secondary Schools	<i>Andrea Benassi, Caterina Orlandi, Matteo Cantamesse, Carlo Galimberti and Gianandrea Giacoma</i>	35
Specifying Collaborative Tools in Game-Based Learning Environments: Clues From the Trenches	<i>Mathieu Bodin, Jean-Charles Marty, and Thibault Carron</i>	46
Putting Edutainment in Practice: From Courseware Authoring to Logic Games	<i>Boyan Bontchev, Dessislava Vassileva and Vania Traicheva</i>	57
What Does it Mean to be a Game Literate Teacher? Interviews With Teachers who Translate Games Into Educational Practice	<i>Jeroen Bourgonjon and Thorkild Hanghoi</i>	67
Close the gap - Obstacles and Solutions for the Missing Educational Games in Graduate Education	<i>Thomas Bröker, Heinrich Söbke and Oliver Kornadt</i>	74
Conceptual and Technical Frameworks for Serious Games	<i>Bruno Capdevila Ibáñez, Bertrand Marne and Jean-Marc Labat</i>	81
Using Profiling to Optimise a Collaborative Session in a Learning Game	<i>Thibault Carron and Jean-Charles Marty</i>	88
Learning Chemistry Through Inquiry With the Game Legends of Alkhimia: An Evaluation of Learning Outcomes	<i>Yam San Chee, Kim Chwee Daniel Tan, Ek Ming Tan and Mingfong Jan</i>	98
Digital Game Literacy: The Difference Between Parents and Their Children	<i>Tsung-Yen Chuang, Nian-Shing Chen, Ming-Puu Chen, Chun-Yi Shen and Chia-Min Tsai</i>	106
The Golden Rules and the Blue Ocean Strategy of the Next Generation Innovative MMOG and Computer Game Environment Design	<i>Basel Dayyani</i>	114

<b>Paper Title</b>	<b>Author(s)</b>	<b>Page No.</b>
Comparing the Potential of Commercial Off-The-Shelf and Educational Video Games for Adult Foreign Language Education: An Experimental Study	<i>Frederik De Grove, Jan Van Looy and Peter Mechant</i>	129
Playing in School or at Home? An Exploration of the Effects of Context on Educational Game Experience	<i>Frederik De Grove, Jan Van Looy, Joyce Neys and Jeroen Jansz</i>	137
Utilising an Educational Framework for the Development of Edutainment Scenarios	<i>Ioannis Deliyannis, Andreas Giannakouloupoulos and Iraklis Varlamis</i>	145
The Place, Role and Importance of Motor Games in the Physical Education Lesson for Secondary School Pupils	<i>Mircea Dragu Corina Dobrota and Constantin Ploeşteanu</i>	152
Gaming for Sustainability: An Overview	<i>Carlo Fabricatore and Ximena López</i>	159
Assessing how Game-Based Learning is Perceived in Irish Education	<i>Patrick Felicia</i>	168
Accreditation! The Responsive Curriculum Game	<i>Rachel Forsyth, Nicola Whitton and Peter Whitton</i>	176
PCARD: Integrating Games Into Classrooms	<i>Aroutis Foster and Mamta Shah</i>	183
Advantages and Disadvantages of Storytelling in Teaching English at Academic Level: A Case Study in the University of Ploiesti, Romania	<i>Cristina Gafu and Mihaela Badea</i>	195
What Makes a Good Serious Game – Conceptual Approach Towards a Metadata Format for the Description and Evaluation of Serious Games	<i>Stefan Göbel and Michael Gutjahr</i>	202
Gender Differences in Motivations for Playing Computer Games: A Combined Analysis of Three Studies	<i>Thomas Hainey, Elizabeth Boyle, Thomas Connolly and Mark Stansfield</i>	211
Motivations for Playing Computer Games at Tertiary Education Level: A Comparison of Further Education and Higher Education Computing Students	<i>Thomas Hainey, Thomas Connolly, Liz Boyle and Mark Stansfield</i>	220
Do Students Trained Using Serious Games Become Better Sales Representatives? An Experiment to Study the Performance of Academic Serious Games	<i>Joseph Heili and Hélène Michel</i>	230
Influence of Learning Styles on the Acceptance of Game Based Learning in Higher Education: Experiences With a Role Playing Simulation Game	<i>Michael Herzog, and Elisabeth Katzlinger</i>	241
Outdoor Initiative Games Using Mobile Digital Devices – a Preliminary Game Design	<i>Hanno Hildmann and Jule Hildmann</i>	251
Towards Cultural Diversity Through Sports and Games	<i>Jule Hildmann and Güneş Turan</i>	261
Student Behaviors and Evaluations of Collaborative Learning Game	<i>Jason Holdsworth and Siu Man Lui</i>	268

<b>Paper Title</b>	<b>Author(s)</b>	<b>Page No.</b>
What can Breakdowns and Breakthroughs Tell us About Learning and Involvement Experienced During Game-Play?	<i>Ioanna Iacovides, James Aczel, Eileen Scanlon and Will Woods</i>	275
Playability Design Pattern in Educational Video Game	<i>Amer Ibrahim, Francisco Gutiérrez Vela, José Luís González Sánchez and Natalia Padilla Zea</i>	282
Camaraderie, Cognition, and Meta-Cognate: Unpacking Trajectories of Becoming in WoW	<i>Azilawati Jamaludin, Mi Song Kim and David Hung</i>	290
Can Games Based Learning Assist Teachers in Achieving the Aims of Curriculum to Bilingual Students of Different Ethnic Minorities?	<i>Konstantinos Kalemis</i>	297
User-Generated AI in Sports Education	<i>Harri Ketamo, Cimmo Nurmi and Kimmo Kallama</i>	306
Experiences With an Approach to an Unobtrusive Assessment of Motivational States in Immersive, Narrative Learning Environments	<i>Michael Kickmeier-Rust, Elke Mattheiss and Dietrich Albert</i>	315
Designing Educational Exertion Games for Young Children	<i>Antti Koivisto, Kristian Kiili and Arttu Perttula</i>	322
Towards an Analysis of Cooperative Learning-Behaviour in Social Dilemma Games	<i>Johannes Konert, Viktor Wendel, Stefan Göbel and Ralf Steinmetz</i>	329
Designing a Large Multi-Player Simulation Game to Encourage Reflection and Critical Debate	<i>Stefan Kreitmayer, Stephen Peake, Robin Laney and Yvonne Rogers</i>	333
The Importance of Humans in Simulation: Allowing the Lure of Technology to Drive Development	<i>Colin Lemmon, Siu Man Lui, Vincent Ho and John Hamilton</i>	343
Can Autobiographical Memories Create Better Learning? The Case of a Scary Game	<i>Andreas Lieberoth and Frank Allan Hansen</i>	350
Story Decorated Learning Activity Generation in a Context-Aware Mobile Role Playing Game	<i>Chris Lu, Maiga Chang, Kinshuk, Echo Huang, and Ching-Wen Chen</i>	358
Computer Role-Playing Games as an Educational Game Genre: Activities and Reflection	<i>Dennis Maciuszek and Alke Martens</i>	368
Supporting Learning Role-Play Games Design: A Methodology and Visual Formalism for Scenarios Description	<i>Christelle Mariais, Florence Michau, Jean-Philippe Pernin, and Nadine Mandran</i>	378
Peer Group Learning During the Board Game Sessions	<i>Päivi Marjanen, Ilkka Mönkkönen and Majja Vanhala</i>	388
Introducing Component-Based Templates Into a Game Authoring Tool	<i>Florian Mehm, Stefan Göbel and Ralf Steinmetz</i>	395
Pass go Quickly: Use of a Board Game to Provide Efficient and Effective Training in Course Design Concepts	<i>Alex Moseley</i>	404

<b>Paper Title</b>	<b>Author(s)</b>	<b>Page No.</b>
Massively Multiplayer Online Games as Activity Systems: The Relationship between Motivation, Performance and Community	<i>Sofia Mysirlaki and Fotini Paraskeva</i>	412
Edutainment in Virtual Environments: An Academy Supporting Collaborative Learning in Second Life	<i>Christina Oikonomou and Agis Papantoniou</i>	422
Assessing Game Experiences Caused by Educational Collaborative Game	<i>Kimmo Oksanen and Raija Hämäläinen</i>	431
Can we use Existing Pedagogical Specifications to Design Mixed Reality Learning Games?	<i>Charlotte Orliac, Sébastien George, Christine Michel and Patrick Prévôt</i>	440
Games' Usability and Learning – the Educational Videogame BeTheManager!	<i>Spyros Papaloukas, Kiriakos Patriarcheas and Michalis Xenos</i>	449
Best Practices in the use of Managerial Simulation Games-Based Learning	<i>Jindra Peterková</i>	457
User Centred Design and Development of an Educational Force-Feedback Haptic Game for Blind Students	<i>Maria Petridou, Peter Blanchfield, Reham Alabadi<sup>1</sup> and Tim Brailsford</i>	465
Educational Applications of Serious Games: The Case of the Game Food Force in Primary Education Students	<i>Provelengios Petros and Fesakis Georgios</i>	476
Serious Games in Formal Education: Discussing Some Critical Aspects	<i>Maria Popescu, Sylvester Arnab, Riccardo Berta, Jeffrey Earp, Sara de Freitas, Margarida Romero, Ioana Stanescu and Mireia Usart</i>	486
Teaching Information and Communication Technology With Digital Games	<i>Nikolaos Prassos, Stavros Sachtouris and Tsampika Karakiza</i>	494
Engaging Students in Developing a Stereoscopic 3D Educational History Game	<i>Vyzantinos Repantis and Sophia Delidaki</i>	502
Reflective Flow in Digital Games	<i>Lorenzo Romeo and Manuela Cantoia</i>	510
An Analysis of the Motivations for Playing Computer Games in a Secondary Education Context: A Comparison With Higher Education	<i>Eleni Rossiou and Thomas Hainey</i>	518
Teachers Roles in Serious Games: Incorporating Serious Games in the Classroom of Students With Intellectual Disabilities	<i>Maria Saridaki, Constantina Avlami and Constantinos Mourlas</i>	528
A Survey of Students' Improved Mastery of Game Playing Skills Through Informal Online Game-Based Learning	<i>Jim Scullion, Mark Stansfield and Thomas Connolly</i>	535
KanjiLearningLab: Memorizing Kanji in a Playful Way	<i>Tobias Sehlberg, Wolmet Barendregt and Neil Rubens</i>	543
The Effectiveness of Game-Based Learning on Students' Mnemonic Techniques and Perceptions	<i>Chun-Yi Shen, Ming-Puu Chen, Nian-Shing Chen, Tsung-Yen Chuang, and Ya-Ching Huang</i>	553
Game-Based Assessment and the Effect on Test Anxiety: A Case Study	<i>Jarka Smits and Nathalie Charlier</i>	562

<b>Paper Title</b>	<b>Author(s)</b>	<b>Page No.</b>
Settings Goals in Psychology Serious Game for Preschool Children	<i>Agnieszka Szczesna, Tomasz Grudzinski and Jakub Grudzinski</i>	567
Designing a 3D Collaborative Game to Support Game Based Learning	<i>Theodouli Terzidou and Thrasyvoulos Tsiatsos</i>	573
The Synergy of Three: Incorporating Games, Multimedia and Programming in Order to Improve Algorithmic Skills	<i>Angeliki Theodosi and Vassilis Papadimitriou</i>	582
A Case Study in Educational Game Designing: Junior Chemists in Action! An Educational Live Action Role Playing Game (LARP) Analysis With a Computer-Based Learning Element	<i>Eleni Timplalex</i>	595
Digital Games Evaluation and Educational Assessment - a Review and Proposal for an Open Methodological Framework (OMEGA)	<i>Panagiotis Tragazikis, Sotiris Kirginas, Dimitris Gouscos, and Michalis Meimaris</i>	604
Alleviating the Entrance to Serious Games by Exploring the use of Commonly Available Tools	<i>Peter van Rosmalen, Roland Klemke and Wim Westera</i>	613
Using Video Games and Brain Training Software to Modulate Human Time Perception	<i>Dionysia Verriopoulou and Argiro Vatakis</i>	620
What Happens off the Field? Proposing a Rhetorical Approach of the Affinity Spaces Surrounding Games	<i>Joachim Vlieghe, Jeroen Bourgonjon, Kris Rutten and Ronald Soetaert</i>	626
Digital Games in an age of Austerity	<i>Nicola Whitton</i>	632
Evaluation of Introducing Programming to Younger School Children Using a Computer Game Making Tool	<i>Amanda Wilson, Thomas Connolly, Thomas Hainey, and David Moffat</i>	639
Game Based Learning in Entrepreneurship: The Academic Business Planner	<i>Charalambos Xinaris, Adonis Kourtellis, Alexandros Kakouris and P Georgiadis</i>	650
METAFORA Learning Approach Processes Contributing to Students' Meaning Generation in Science Learning	<i>Smyrnaïou Zacharoula, Moustaki Foteini and Kynigos Chronis</i>	657
<b>PhD Papers</b>		665
The Optimal Level of Children's Participation in the Design of Games-Based Learning	<i>Matthew Bates, David Brown, Wayne Cranton and James Lewis</i>	667
Play to Become a Leader and a Citizen of the World: ARGs as Teaching Spaces for Personal and Social Change	<i>Natasha Boskic</i>	675
Peer Collaboration, Facilitator Intervention, and Learning Styles in Computer Game-Based Learning: Initial Findings From an Empirical Study	<i>Shiffon Chatterjee, Atasi Mohanty and Bani Bhattacharya</i>	683
Dynamic Virtual Learning Landscapes to Enhance Student Reflective Processes	<i>Barry Herbert, Darryl Charles, Michael McNeill, Adrian Moore and M Charles</i>	691
Merging Digital and Urban Play Spaces: Learning by Playing and Creating Location-Based Games in Secondary Education	<i>Jantina Huizenga, Wilfried Admiraal and Geert ten Dam</i>	703



<b>Paper Title</b>	<b>Author(s)</b>	<b>Page No.</b>
I Play, Therefore I Create: Constructionist Video Games for Empowered Communities of Learners	<i>Vittorio Marone</i>	710
A Review of Scaffolding Approaches in Game-Based Learning Environments	<i>Javier Melero, Davinia Hernández-Leo and Josep Blat</i>	717
Leadership in a Networked World: The Case of Massive Multiplayer Online Environments	<i>Sofia Mysirlaki</i>	725
<b>Work in Progress papers</b>		733
Model of Firearms Simulator Based on a Serious Game and Sensor Technology	<i>Dimitar Bogatinov, Slavko Angelevski and Vladimir Trajkovik</i>	735
Using Digital Games to Teach the Hero's Journey as a Model for Change and Innovation Management	<i>Carsten Busch, Florian Conrad and Martin Steinicke</i>	740
Non Verbal Behavior Analysis in Gaming and Game Based Learning	<i>George Caridakis and Kostas Karpouzis</i>	745
Exploring the Benefits of Digital Interactive Games on People's Health	<i>Patsi Charikleia, Panagiotis Antoniou, Sofia Batsiou, Evaggelos Bebetos and Antonis Lymnioudis</i>	750
Early Childhood Post-Educated Teachers' Views and Intentions About Using Digital Games in the Classroom	<i>Dionissios Manessis</i>	753
Concept of a Gaming Platform for Domain-Specific User-Created Content	<i>Heinrich Söbke, Christiane Hadlich, Thomas Bröker and Oliver Kornadt</i>	759
The Investigation of the Influence of Exergames on the Balance of Deaf Children	<i>Nikolaos Tzanetakos, Panagiotis Antoniou, Marina Papastergiou and Nikos Vernadakis</i>	767
Model of Social Believable NPCs for Teacher Training	<i>Harko Verhagen, Magnus Johansson and Mirjam Eladhari</i>	771
Learning by Playing	<i>Thomas Wernbacher, Michael Wagner, Doris Rusch and Joerg Hofstaetter</i>	775
A Pilot Survey Investigating Trainee Doctors Attitudes to the use of Serious Games in Musculoskeletal Disease Education	<i>Andrew Wilson, Andrew Filer, David Carruthers and Stephen Young</i>	778
<b>Non Academic Papers</b>		783
Integrating Game Mechanics and Pedagogy: The Design and Production of Prospero, an Exploratory Speech Production Game	<i>Matthew Jewell</i>	785
A Letter - A Story: Interactive Games Digital Environment as Part of a Multimedia Learning Package	<i>Sophia Mandouvalou and Aristarchos Papadaniel</i>	793

## Preface

These proceedings represent the work of researchers participating in the 5th European Conference on Games-Based Learning, which is being hosted this year by the National and Kapodistrian University of Athens, Greece, with the co-operation of the Hellenic American Union.

The conference will be opened with a keynote from Professor Sara de Freitas, Serious Games Institute, University of Coventry, UK on the topic of "The Gamification of Life: Building social communities through games". The keynote address on the second day is delivered by Professor Nikolaos Avouris, ITRLab Human-Computer Interaction Group, University of Patras, Greece.

The ECGBL Conference constitutes a valuable platform for individuals to present their research findings, display their work in progress and discuss conceptual advances in many different branches of games-based learning. At the same time, it provides an important opportunity for members of the GBL community to come together with peers, share knowledge and exchange ideas.

ECGBL has evolved and developed over the past five years, and the range of papers accepted in this year's conference ensures an interesting two-day event.

Following an initial submission of 165 abstracts that have undergone a double blind peer review process, 78 research papers, 8 PhD research papers, 10 work-in-progress papers and 2 non-academic papers are published in the ECGBL 2011 Conference Proceedings, representing research results from Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, FYROM, Germany, Greece, India, Ireland, Italy, Oman, Poland, Romania, Russia, Singapore, Spain, Sweden, Taiwan, The Netherlands, UK and the USA.

We hope that you have an enjoyable conference.

Assistant Prof. Dimitris Gouscos  
ECGBL 2011 Programme Chair  
October 2011

Professor Michalis Meimaris  
ECGBL 2011 Conference Chair

# Serious Games in Formal Education: Discussing Some Critical Aspects

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**Abstract:** Innovation in technology together with evolution in pedagogical approaches is encouraging increased integration of technology-supported interventions in mainstream teaching practices. One area attracting particularly close attention in this respect is Serious Games (SGs), which offer considerable potential for facilitating both formal and informal learning experiences in supported and standalone contexts. Advances in technology and in technology enhanced learning are raising learners' expectations for immersive and engaging game-based experiences. This trend is underpinned by the emergence of young learners adept at using digital technologies and the internet; there is an attendant risk that, as students, they may be alienated by traditional education and its failure to engage them fully in a lifelong learning process and prepare them adequately for the challenges of the 21st Century. SGs would appear to offer an attractive solution in this regard. However, there are a number of inhibitors preventing their wider take-up in mainstream education, with the result that the considerable potential on offer has yet to be fully exploited. This situation is the background for the joint efforts of partners in the Games and Learning Alliance (GALA), an EC-funded Network of Excellence on SGs, especially the sub-group dedicated to the pedagogical dimension of SGs. In its discussions on the key challenges for more wide-scale and effective SG use, the group has focused in particular on aspects related to the central role played by the educator in formal education settings. Specifically, discussion has focused on the challenges posed when educators are called on to modify their practice, adopting the new roles and approaches demanded for effective SG deployment. This paper presents the outcome of the group's exploration. It frames the question of the educator's central role by drawing on research work that, in the view of the different authors, embodies the major references for shedding light on this multi-faceted aspect. As well as the new role that the educator assumes in games-based learning environments, particular attention is also dedicated to the innovative pedagogical approaches that can be applied to SG deployment, especially those inspired by peer collaboration.

**Keywords:** game-based learning, serious games, pedagogical issues, formal learning

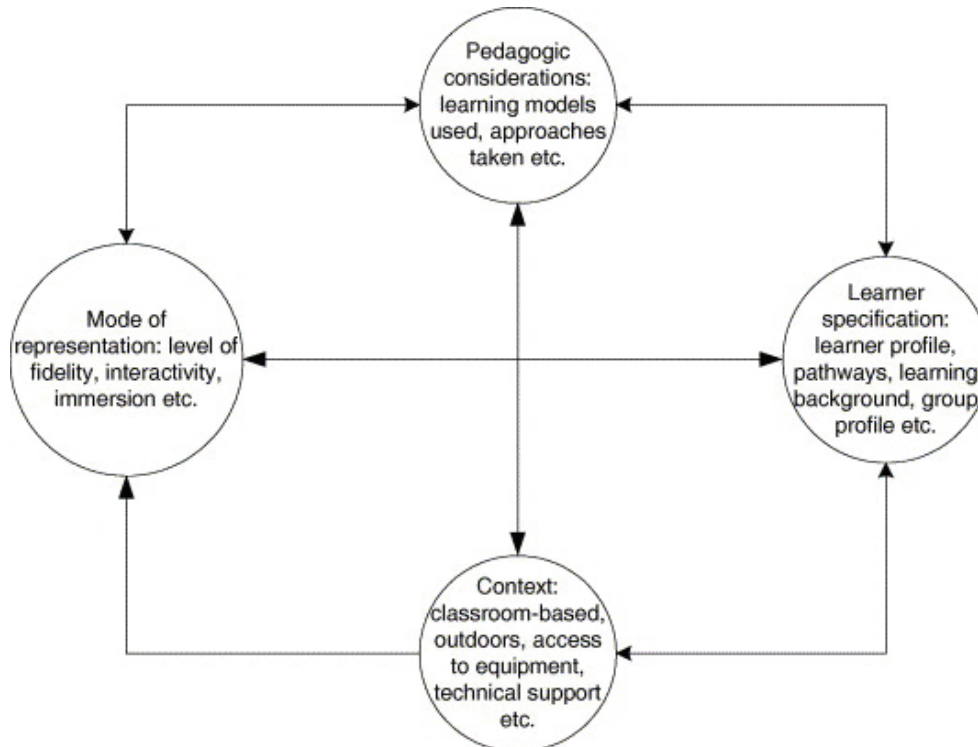
## 1. A glance at Serious Games deployment for educational purposes

Over recent years considerable interest has been devoted to the pursuit of learning through, and with, digital games and particularly so-called Serious Games, namely games that "support learning in its broadest sense" (Stone 2008). Many studies have pointed to the positive qualities of Serious Games (SG), such as their persuasiveness and motivational appeal, which can support immersive, situated and learner centred learning experiences. Proponents of SGs see them as a means for active construction, rather than passive reception, of knowledge and as prime opportunities to practice the kind of soft skills considered crucial in the knowledge society, such as problem-solving, decision-making, inquiry, multitasking, collaboration, creativity (David & Watson 2011; Gee 2003; Aldrich 2009). While some detractors remain sceptical (Foster, Mishra & Kohler 2010), most agree that they do have potential for learning, although there are inhibitors to uptake in formal education (Williamson 2009; Sandford et al. 2006; BECTA 2005).

Further support for the validity of games-based learning approaches can be drawn from correspondence with established learning theories such as those proposed by Gagne. Each of his five categories of learning (verbal information, intellectual skills, cognitive strategies, motor skills, attitudes) finds a strong connection with SGs. Furthermore, his well-known “Nine Events of Instruction” are ideally suited to learning with SGs (Van Eck 2010).

While games cannot be considered the panacea for all educational situations, they may offer a new instructional technology with great potential (Gibson 2006). Much of this potential is identified in the effective manner in which SGs engage users, transforming them into proficient and ultimately successful (winning) players. In this sense games succeed precisely by employing effective pedagogical approaches such as situated cognition, cognitive disequilibrium, and scaffolding to teach *what* is needed, *when* it’s needed without compromising the essential fun factor that ultimately lies at the heart of any game’s success (Van Eck 2010; Bopp, 2006). Over the last few years the focus of SG-oriented research work has concentrated on how to strike a successful balance between game playability and instructional design. These efforts have given rise to models and frameworks such as the four dimensional framework (de Freitas & Oliver 2006), the exploratory learning model (de Freitas & Neumann 2009), multimodal interface architecture model (White et al. 2007; Arnab et al. in submission) and the game-based learning framework (Van Staaldunen & de Freitas 2010).

In particular the four dimensional framework (fig 1) advocates the use of pedagogy, an emphasis upon learner modelling, the required amounts of fidelity, interactivity and immersion in the representation of the game, and consideration of the context within which learning takes place (Rebolledo-Mendez et al. 2009; de Freitas & Jarvis 2008). Each of these four dimensions encompasses aspects that are essential not only for game design and evaluation but also for effective adoption in educational processes. Learning specification involves elicitation of the characteristics defining the learner population so that the intervention can be tailored to meet requirements and optimise outcomes. Representation regards key attributes of SGs such as immersion and interactivity which, when successfully implemented, can open the way to the sorts of flow-driven learning experiences recognised as being among the chief potentials of game based learning (Csikszentmihalyi, 1990). Context is a key consideration in technology enhanced learning generally; as discussed in the following section, context plays a particularly important role in shaping learner expectations as far as SGs are concerned. Pedagogic considerations represent the cornerstone of any instructional intervention, encompassing models and approaches (e.g. associative, cognitive, situative) adopted in pursuit of learning objectives.



**Figure.1:** The four dimensional framework

## **2. Contextualizing the use of SGs**

The most fundamental distinction that can be made with regard to the context of SG use is between formal and informal settings. To date much of the attention dedicated to SGs has regarded their design for, and use in, informal settings. Here, learning results from “daily work-related, family or leisure activities” and “is in most cases unintentional from the learner’s perspective” (Tissot 2004). In a recent wide-scale survey, the majority of students questioned expressed the view that they did not mind using games with overtly educational objectives in an informal setting (Dunwell et al. 2011). The issue of expectation is an important one to consider both in SG design and deployment; however, as this finding suggests, players are not necessarily put off by overtly educational objectives as long as game playability is good.

While the initial spotlight has been trained mostly on informal contexts, a growing body of experience is being accrued in the deployment of SGs within formal education settings as well. The pervasiveness of games is encouraging many teachers to look at their use in classes and, helped by the simultaneous bottom up push from students, games are more likely to become a part of the curriculum over the coming years. While games will certainly not replace the teacher, as some fear, they can open the way to more creative approaches that could have a significant impact on teaching practices.

To date experiences in SG deployment in educational settings have mostly regarded the use of COTS (commercial off-the-shelf games). Only to a lesser extent has it involved digital games purposely designed to pursue a more overtly educational agenda, related in some way to curriculum (or cross-curriculum) concerns. COTS games are increasingly being considered for education purposes, given their popularity, validity and cost-effectiveness with respect to developing SGs ad-hoc for supporting specific curricular activities. A number of successful deployments in formal education settings have been documented. One example is Blunt’s adoption of COTS management simulation videogames (Industry Giant II, Zapitalism and Virtual U) for business studies (Blunt 2007). Other COTS games already being used in the classroom include Civilization (history), Age of Empires II (history), CSI (forensics and criminal justice), The Sims 2 (making complex social relationships), Rollercoaster Tycoon (engineering and business management), and SimCity 4 (civil engineering and government). For some of these there is a clear match between the game’s explicit content and classroom subject; for others, a match is sought between the aims and skills involved in the course of study and the game’s underlying strategies and gameplay. Other noteworthy initiatives that have used these and other COTS include Learning & Teaching Scotland’s Consolarium, the Institute of Play’s Quest to Learn Middle School in New York, North West Learning Grid’s DiDa program in England (Derryberry 2007) and Futurelab’s Teaching with Games project (Sandford et al. 2006).

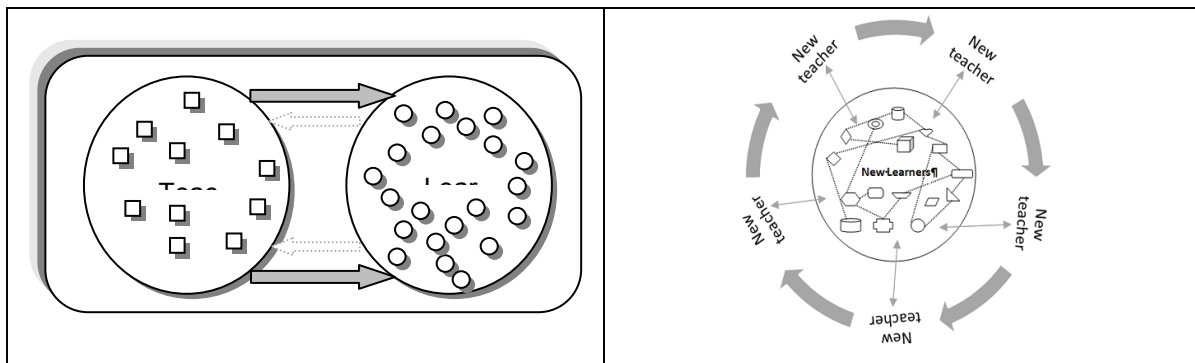
While such experiences indicate that games have strong potential for improving learning, there is still a relative lack of solid and reliable research findings about integration of SGs into teaching and learning. This leaves questions unanswered and as a result the potential remains largely untapped in mainstream formal educational. In order to understand how games can best be exploited within a formally structured educational context, we need to look not just at the *nature* of the game as such but also at *how* the game and its characteristics can be adopted and leveraged to enhance learning within the structural, organisational and cultural constraints of institutional education (Johnston & Whitehead 2008).

This entails broad consideration of ICT-supported innovation in formal education, which is informed and driven by a multiplicity of interrelated factors like new tools and pedagogies, as well as the new organisational roles and relationships that are shaped by learner-centred and collaborative approaches to the learning process.

### **2.1 The new learning panorama and the use of SGs in formal educational settings**

The educational panorama presently defined as “new” by most researchers (Ala-Mutka et al 2008) has been (and still is) deeply influenced by the availability of new ICT tools, and learners are now more adept at using these tools. As stated above, SGs can play a major role here in instilling innovation in learning processes: they present immersive educational worlds (de Freitas and Neumann 2009) where students can be more deeply and actively involved in educational activities.

As proposed by Ott (2011), figure 2 contrasts the traditional learning situation in formal educational contexts (left) with that (right) typified by the new learning community.



**Figure.2:** Traditional relationship between teachers-learners (left) vs. the new learning community (right)

In the former, teachers mainly act as the information providers and students the recipients, with a prevalently unidirectional information flow between the two groups. In addition, the two groups are strictly separate and their respective members (teachers/learners) are depicted as being similar / identical to each other (teachers-squares; students-circles) since the (reductive) nature of the information transmission-reception paradigm attributes little real value to the actors' individual characteristics.

By contrast, the second picture represents a vision that is both learner centred and based on dynamic collaboration among all the actors involved. Here learners are represented in different shapes, instantiating the value of their individual differences. They assume the central position, are peer linked (work together, cooperate, network) and have reciprocal, frequent interactions with teachers, who also work in a team and not in isolation.

Against the background of this new learning panorama, we take a brief look at the challenges to wide-scale take-up of SGs in formal education, examining key aspects such as the educator's role, curriculum issues and pedagogical approaches.

### **3. The key role of educators and curriculum issues**

Facilitating educational processes with technology is a multi-faceted process. SGs in particular have been looked at as educational tools that enhance knowledge transfer, offer good hands-on practice and enable both teachers and students to get a new perspective on learning. SG-based learning activities lend themselves to different pedagogical approaches and didactic concepts.

In order to exploit this potential fully, educators are called on to possess a range of competencies and assume a variety of roles; they need to be knowledgeable in the SG's content and mechanics, to be instructional designers, subject matter experts and pedagogically open to new ways of designing curriculum and tailoring classes assisted by technology.

Successful adoption of SGs is not only a question of identifying a suitable game for a given subject, but also of knowing what subjects and skills can benefit from a games-based approach, when and how an SG is best deployed, what stage of the learning path is most appropriate, and how to manage contextual factors. Ignoring these factors would not only jeopardize achievement of immediate learning goals, but could compromise the class as a whole. In shifting away from traditional educational approaches, teachers not only need to think outside the box but also to be multi-skilled, IT-knowledgeable, brave, curious and trans-disciplinary. Considering the educational effectiveness of SGs means taking into account a multiplicity of factors: the actors, the stage and the play.

It is important for teachers to be able to "easily augment the game with instructional activities that preserve the context (situated cognition) of the game, e.g. by extending the goals and character roles of the game into the classroom (Van Eck 2006). This means that teachers need to know the game well, propose specific learning paths, verify their effectiveness, and most importantly set the gaming experience in a sound overall educational framework. This work is crucial when we consider that

“such games may not always meet the individual requirements of lecturers whose courses are tied to specific learning outcomes” (Rooney et al. 2009).

When using games, teachers are no longer solo voices in a concert; education with SGs shifts from “learning by listening” to learning by doing, in which students are actors and the teacher is the director on the stage (Garris et al 2002) who fosters participation and engagement, providing support, feedback and assessment. As well as playing a key role in support strategies, the teacher is also central in the critical phase of debriefing, where all the threads of the process are tied together. While some authors consider that games may substitute a teacher in cases involving specialized topics and particular cost/time/space barriers, it is highly advisable that educational activities should make reference to an educator, if only for guidance (Egenfeldt-Nielsen 2006).

The best teacher will blend enthusiasm for using games with knowledge to be constructed so as to render a meaningful learning experience for each student. Indeed, “not only should teachers know the game well, propose specific trajectories to the students and verify effectiveness” (Bellotti et.al 2010), they also need to be mediators and foster post-game discussions: “the teacher can pop up some things from the game” and ask the students what they think about a situation or what made them act the way they did, as discussions lead to reflection (Whitton 2010). Learning goals are most successfully attained when the teacher has a clear sense of the task set, his mediation, and the type of game selected.

The curriculum is an embodiment of an educational system, be it K12, HE or company training. It is a complex and evolving set of rules, experiences and documents, a complex pedagogical project that contains design, practice and assessment stages, guidelines on practice and the competences to be formed, along with assessment types.

When designing a curriculum based on competences, one must carefully consider the 21<sup>st</sup> century curriculum, which is outcome based, centred on what students know and can do. It is a curriculum focused on the upper levels of Bloom’s taxonomy - analysing, evaluating, creating (Krathwohl 2002); it is research driven and based on active learning. The student is no longer spoon-fed, but actively helps himself from the educational chunk, under more or less guidance according to age and moment of the lesson. It is a curriculum connected to students’ interests, experience and talent, and relates to the real world. It allows for a certain degree of student freedom of choice in selecting what to learn, and when and how to do so, according to the learner’s cognitive and metacognitive abilities. As games have already been labelled as valuable instructional methods and teaching strategies (Gredler 1996), considerable benefit would be gained from aligning games with the curriculum. However, introducing SGs into the curriculum requires careful consideration by decision-making bodies and teachers alike. Research has yet to present clear guidelines to help educators incorporate games in their practice in such a way as to ensure a smooth continuum from theory/planning to deployment and evaluation.

#### **4. A walkthrough of new pedagogical approaches relevant to SGs**

The use of situated cognition as a learning model enables educators to bridge theory and practice by placing students in environments that resemble the context in which their learning will actually be used (David & Watson 2011). SGs enable situated learning as a means of thinking differently about the transfer of learning and of facilitating learning in the same context in which it is applied through social processes of knowledge co-construction (Leemkuil et al. 2003; Souza e Silva & Delacruz 2006). In this respect SGs yield a series of benefits (Gee 2003; Aldrich 2009): students learn about the conditions under which the new knowledge can be applied; they are more prone to engage in problem-solving; they can experience the implications of the knowledge gained; and they can structure knowledge in ways that are appropriate for later use, since they are using the new-gained knowledge in context.

Deep reasoning and learning is stimulated by problems that create cognitive disequilibrium, such as obstacles to goals, contradictions, conflict, and anomalies (Newman & Newman 2007). SGs create circumstances where students can experience the discrepancy between something new and what they already know or believe. Gameplay can address specific pedagogical objectives for communication, education and training, and situate learners in virtual realities so that they can handle complex problems and tasks; learners face situations requiring them to apply their theoretical knowledge in practice.

Expertise is developed through experience, and experience is gained through practice. Because scaffolding is an effortful process full of challenges, it will take time to master. Scaffolding is not a stand-alone approach to instruction, but one element within the philosophy and techniques that guide teaching (Walqui & Van Lier 2010). Scaffolding of instruction activates the role of teachers as assistants of the learner's development and as providers of support structures that enable learners to get to the next level. Students need guidance to develop their individual thinking and SGs have the potential to lead to the generation of valid understanding of the subject taught.

#### **4.1 SGs and collaborative learning: focus on collaboration**

In the new learning panorama outlined above, teachers and learners collaborate to achieve learning goals. Interest in collaborative learning has grown in recent decades, supported by studies showing how peers really learn while performing group activities. Learners can build on each other's knowledge and provide mutual feedback (Dillenbourg et al. 2009). Advantageous peer interactions such as providing and receiving explanations, co-constructing ideas, and negotiating meaning can be found in collaborative learning environments.

In the world of SGs, new technological functionalities have recently emerged that have led to the development of engaging collaborative game environments for learning. Accordingly, collaborative SGs should be taken into account as potential multi-sensorial learning tools that combine the benefits of collaborative and games based learning. Following Gee (2005), collaborative games not only allow individuals to participate in the same game, but open up a field for learners to construct understandings by interacting with information, tools and materials as well as collaborating with others.

There are still few examples of SGs that embed a collaborative pedagogical approach. One is Gersang, a pedagogical adaptation of a commercial Massively Multiplayer Online Role-Playing Game (MMORPG) (Kimet al. 2009). Deployment of this game in a middle school classroom permitted a qualitative and economic solution for enhancing students' social problem-solving abilities through think-aloud and modelling processes. In higher education, Baker and colleagues (2004) designed and tested Programs and Programmers, a dyad game intended to help software engineering students gain better understand of software development processes through active, collaborative and competitive gaming practices. Mawdesley (2010) aimed to study how the introduction of two different SGs could improve the learning experience in an applied construction project management program: the Mug Game and Canal Game case studies revealed significant improvement in the communication and presentation skills between peers that had used those games. Chang and colleagues (2009) developed and implemented SIMPLE, a SG environment for management students designed to raise teaching effectiveness and improve classroom practice. Some interesting results could be seen from collaborative playing experiences; students developed internalized knowledge and appeared more interested in the real world applications of the concepts practiced. These experiences showed how deployment of both COTS and SGs can help students practice and improve metacognitive processes and lead to more concrete problem-solving behaviours among peers.

To make collaborative learning effective in terms of learning outcomes and reduced organizational loads, guidance and a scaffolding process are required (Kreijns et al. 2003). This applies especially to SGs, where students' cognitive load should be devoted to the activities leading to attainment of learning objectives.

An interesting term that shows up when introducing SGs in management education is "coopetition", defined as collaboration within the group and competition between groups (Fu & Yu 2008). Competing while cooperating to win a game can be regarded as a successful learning strategy, as it stimulates different types of knowledge acquisition (Ke & Grabowski 2007). Competitive learning environments encourage students to develop higher analytical skills, while collaborative learning situations prompt students to demonstrate higher synthesis skills. Competition and collaborative pedagogies have proved to be effective techniques for enhancing learning performance in face-to-face learning environments.

#### **5. Conclusive remarks**

This paper reports some key challenges in the adoption of Serious Games within formal education. These are examined from different perspectives as part of a joint exploration into the topic conducted



by a group of partners in the Games and Learning Alliance (GALA) who are investigating the pedagogical dimension of SGs. The ultimate aim is to provide useful indications and support to help SGs become more widely and effectively adopted in formal educational settings. The kinds of support that may be given in pursuit of this aim could include: better training for tutors, simpler tools for tutors to author learning game activities, dedicated web based communities and resources for practitioners, more institutional support structures for tutors, and wide-scale access to case studies and existing game content. In the near future game-based environments are likely to become even more immersive, both in terms of technology and game design. Other developments on the horizon include tools for tutors to create tailored learning scenarios, intelligent tutoring environments that allow tutors and students to author and choreograph experiences (de Freitas & Neumann 2009), learner game creation (Vos, Meijden & Denesen 2011) and integration of metacognitive tools, especially in support of collaboration. Given these future directions, the issues brought to light in this discussion are destined to take on even greater significance, as educators are likely to require a range of support options to help them gain solid understanding of how best to exploit the new opportunities on offer.

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