



SIMULATIONS AND GAMES IN MANAGEMENT EDUCATION: TOWARDS A MULTI-DIMENSIONAL EXPERIENCE

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Abstract

Games and simulations have been used in the field of education for many years, particularly in the areas of business, training staff in financial and economic skills, combat training and war gaming. Internet-based games are also commonly used in the areas of education, business and policy to provide a safe but realistic experience of the real world. This paper explores some of the rationale that a team of lecturers at the Lisbon School of Accounting and Administration (ISCAL) think should underpin simulation and game usage in an educational context, specifically in management education. Our aim with this work is about promoting learning and knowledge building through one of the latest evolved socio-cultural artifact: online simulations and games.

Key words: *Simulation Management. Online Games. Training. Business. Internet.*

JOGOS E SIMULAÇÃO NA FORMAÇÃO EM GESTÃO: UMA EXPERIÊNCIA MULTIDIMENSIONAL

Resumo

As simulações e os jogos têm sido utilizados na área educacional há já muitos anos, em particular nos campos da gestão, formação de colaboradores em competências financeiras e económica, treino de combate e jogos de guerra. Os jogos baseados na internet são também frequentemente utilizados nas áreas da educação, negócios e política no sentido de fornecer uma experiência do mundo real segura mas real. Este artigo visa explorar alguns dos conceitos e modelos fundamentais que uma equipa de docentes do Instituto Superior de Contabilidade e Administração de Lisboa (ISCAL) pensa serem estruturantes na utilização de simulações e jogos em contexto educacional, especificamente a educação em gestão. O nosso objectivo com este trabalho é promover a aprendizagem e a construção do conhecimento através de um dos artefactos socioculturais mais recentes: simulações e jogos online.

Palavras-Chave: *Simulação de Gestão. Online Games. Training. Business. Internet.*

1 INTRODUCTION

This paper explores some of the rationale that a team of lecturers at the Lisbon School of Accounting and Administration (ISCAL) think should underpin simulation and game usage in an educational context, specifically in management education. Our aim with this work is about promoting learning and knowledge building through one of the latest evolved socio-cultural artifact: online simulations and games.

Games and simulations have been used in the field of education for many years, particularly in the areas of business, training staff in financial and economic skills, combat training and war gaming. The health sector commonly uses similar realism techniques to those in games and aircraft pilots, and other vehicle drivers, often use simulations in the early stages of training. Internet-based games are also commonly used in the areas of education, business and policy to provide a safe but realistic experience of the real world.

The implementation in the curriculum of a Management degree of a collaborative, online business simulation game, Marketplace, was based on the rationale presented in this work. Marketplace is a virtual competitive business environment, in which groups of students work as companies analyzing markets, designing their marketing strategy, and developing and marketing products. Although we do not have the intention of describing here the characteristics of the simulation, it is important to mention that the game aims at teaching a range of hands-on managerial skills within a realistic environment.

2 SIMULATION AND GAMES IN PEDAGOGICAL CONTEXTS

The use of games for learning must be considered as part of the wider challenges education is currently facing. The profound influence of digital technologies and globalization in a knowledge society demands a reconceptualisation of how we learn, where we learn and what we learn. In this context the role of education is to develop new individual and social skills that are essentially different from the ones provided through traditional methods. This demands a commitment to adapt to a changing vision for education based rather upon more immersive learning experiences and social interactions (FREITAS, 2008).

Yet formal Education may still be quite immune to this changing reality adhering to practices based mainly on content-oriented approaches that conflict directly with the needs and mood of the digital generation. Even where technology is used in the educational process it is often used as a vehicle for teacher-centred content-driven approaches leaving little space for development of autonomous learning through innovative technology-intensive learning and knowledge building experiences. The knowledge society demands a range of personal and social skills that promote collaboration, creativity, multidisciplinary, adaptivity, intercultural communication and collective problem solving. Among digital technologies, simulations and games can be seen as promising in providing technology-intensive experiences that may promote most of these desired personal traits and provide an innovative and powerful approach that responds to these learner needs.

Technological advancements coupled with the creative flair of game designers are giving games that are highly immersive and interactive. During the last decade highly sophisticated game categories emerged including single, multi-user and massive multiplayer online entertainment games, serious games, simulations and virtual worlds. Their versatility proposes paradigmatic changes in the educational process by opening the opportunities to merge formal with informal learning and removing the boundaries between learning, knowledge building, working and entertainment.

Simulations, serious games and virtual worlds provide immersive, three-dimensional spaces as new learning spaces (FREITAS, 2008) that embed major principles of learning. At least many of the well-designed games address the needs of the younger digital generation (PRENSKY, 2006) that conceptualize the world in a totally different way from previous gen-

erations showing affinity to technology-intensive, collaborative, entertaining and highly interactive multimedia experiences. Technology-based social interaction and networking are two fundamental elements of their needs profile and they satisfy these through participation in various online social networking environments and web-based communities. Also sharing learner-generated content is becoming a way of life for the digital 'natives' and the role of education is to take up these tools and help learners to become more skilful in these new ways of learning and knowledge building where simulation and gaming technologies converge with other digital technologies (KIILI, 2005a, 2005b; FREITAS, 2008).

The power of simulations and games comes from the underlying pedagogy that embeds learning within 'Play'. Playing a game is essentially an experience in self-learning that stands in stark contrast with teacher-driven instructional design approaches where learner adopts a consumer role (PAPERT, 1998). Play is based on imagination, experimentation, exploration and role play accompanied by the need to stay aside creating a real and an imaginary private territory where one manages all activities, takes decisions, organise roles and tasks. Commercially available games serve also as a virtual 'playground' where play is structured according to game rules and available tools where one can realise a play project experiencing the pleasure of building and destroying. But a lot of research evidence is needed to evaluate the possible advantages.

Through their multimedia nature simulations and games adapt to individual preferences and address the natural propensity of the digital generation of thinking in pictures and simulations (GEE, 2007) emphasising visual rather than textual data (FREITAS, 2008). At a more fundamental level they change the underlying epistemology from representation to simulation and enactment (FRASCA, 2003, p. 224). Instead of descriptive accounts of expert knowledge and skill, epistemic games (Shaffer 2006) model expertise through authentic contextualization and embodiment of human behaviour (Gee 2007). Pedagogically these visions look both interesting and challenging.

The complexity of the gaming experience led to a wide range of investigations about different aspects of simulations and games. Historically research about games evolved in parallel with the latest game design. With the rise of edutainment in the 80's, based on the behaviouristic drill-and-practice paradigm, research focused on extrinsic and intrinsic motivational aspects of gaming in an attempt to defining elements of game design that might be used to make learning environments more engaging (BOWMAN, 1982; BRACEY, 1992; DRISKELL; DWYER, 1984; MALONE, 1981; MALONE; LEPPER, 1987a, 1987b). From a more cognitivist perspective, with the publication of Csikzentmihalyi and Larson's (1980) discussion of "flow," researchers investigated the power of video games to place users in "flow states", (KIILI, 2005 a, 2005b).

With the release of successful game genres like the line of "Sim" games, real time strategy games and simulations, the emphasis of research shifted to comparative studies about the effectiveness of games and conventional instruction (e.g. RANDEL; MORRIS; WETZEL WHITE-HILL, 1992). The emergence of action and fighting games launched the (research) debate linking violent tendencies and aggression with playing games (ELLIS, 1990; GRIFFITHS, 1999; ANDERSON; BUSHMAN, 2001; BENSLEY; VAN EENWYK, 2001). Throughout the 90's research focused on the use of simulations and drill-and-practice games for learning in the military, schools, and industry (THIAGARAJAN, 1998).

Within this context Gredler (1996) published her seminal work proposing a research paradigm for educational games and simulations claiming that very little empirical study has been done on how these games are used and points to the fact that the existing research has failed to yield a useful research framework. At the same time Kafai and Resnick (1996) published their book about Constructionist approaches in using games for learning. Seymour Papert and Mitchel Resnick continued on this line of research.

With the introduction of powerful gaming consoles in the late 90's and at the turn of the century, the game industry was dominated by Fighting, "Shoot 'em up" and interactive fiction games. As a reaction researchers and game developers focused on writing games that capture the user with rich, interactive narrative and developing deep characters. The Games-to-Teach Project (2002) was launched as a research and development partnership between MIT and Microsoft with the specific objective to develop conceptual prototypes for the next generation of educational media for math, science and engineering education.

Research about games in the last few years focused more on the individual gaming experience specifically on issues of motivation in relation to needs satisfaction, user perception and identity. The emergence of Massive Multiplayer Online Games generated a lot of interest and research about user experience (Yee, 2006), experimentation with identity between real and virtual contexts (GRIFFEN, 2007) and learning in MMOGs (FREITAS, 2006; STEINKUEHLER, 2004, 2006, 2008). Online virtual worlds became research contexts recruiting virtual subjects (Bainbridge, 2007). Since the early 90's a number of investigations have taken a broad review approach (BERSON, 1996; GRIFFITHS, 1996, 1999; EMES, 1997; CESARONE, 1998; DILL; DILL, 1998; MCFARLANE; SPARROWHAWK; HEALD, 2002; KIRRIEMUIR; MCFARLANE, 2002, 2003, 2004; MITCHELL; SAVILL-SMITH, 2004; EGEN FELD-T-NIELSEN, 2006; FREITAS, 2008).

The benefits of using games for learning are manifold. Apart from a number of physiological outcomes, games may enhance process intelligence involving perceptual analysis and quick decision taking. On the cognitive side, gaming can stimulate content related tasks such as creative writing or technology-enhanced design activities. The content of a game may lead to insights into the underlying domain model and stimulate explorations through negotiations, constructions and argumentation (DILLENBOURG; BAKER; BLAYE; O'MALLEY, 1996). Gaming also develops transferable skills like communication, teamwork, leadership and creativity (PRENSKY, 2006; KIRRIEMUIR; MCFARLANE, 2004; FITZGERALD, 2007; FREITAS, 2008).

On the affective side, games develop self-efficacy by giving user a sense of control over the environment (JONES, 2002). They offer experiences that are intrinsically motivating because they are based on personally meaningful goals whose attainment requires activity at a continuous optimal level of difficulty. The continual performance feedback provided by games boosts self-esteem by enhancing a sense of efficacy and empowerment over one's environment. Failure in games does not lead to irreversible long term effects, but stimulate gamer to work harder at developing the requested competence. Games have been also reported to reach under-served learners and learners with no previous interest in some domain. They could unlock a new enthusiasm for subject areas where traditionally few learners have participated (FREITAS, 2006).

From a social perspective, the latest generation of games is promising in their power to evolve into a more collaborative experience addressing diverse user needs. Both contiguous and online multiplayer games are contexts where participants interact at the domain, gaming and community level in the process satisfying each others' needs for competence, relatedness, affiliation and self-actualisation. This may serve as a process for developing interpersonal and life-related skills that can give an enhanced feeling of social competence.

To enhance the educational value of the gaming experience, researchers recommend the provision of pedagogical scaffolding. Leemkuil (2006) proposes the use of the group in a gaming context as a pedagogical tool to enhance cooperation and collaboration through debriefing and group discussions. Using a constructionist framework that promotes learning by designing, learning about systems and learning in communities, this investigation focuses on collaborative gaming involving different levels of individual and collective activities that promote learning and knowledge building through digital technologies along different dimensions. Collaborative gaming generates interactions along the domain determined by the

theme of the game, interactions with the game both as a tool and as a medium and develops interpersonal and inter-group interactions. Thus collaborative gaming involves a complex system of interacting variables. It demands approaches that capture interactions at the experiential and metacognitive levels, along the domain, technology and community dimensions according to the level of competence of participants. The psychosocial processes operating in this context and the major factors influencing interactions in collaborative gaming have to be identified and possibly integrated in a pedagogical model. This will then serve as a tool to manage and evaluate collaborative game-based learning and offer advice for designing games that accommodate more to collaborative contexts.

2.1 Interactions

Games are external concretisations of the larger natural “Play” phenomenon that is an essential component in the developmental process of all higher animal groups. Leemkuil (2006) gives a chronological description of how play was manifested over the ages through different types of games that were used for pleasure, to train certain motor or mental skills and to transfer knowledge. Farné (2005) discusses extensively play from an anthropological perspective manifested as a lifelong gaming endeavour of becoming playful through play.

As a constructivist and constructionist learning process (RABINOWITZ, 1993; PAPERT, 1980, 1993; KAFAI; RESNICK, 1996; ACKERMAN; ARCHINTO, 2001), play is always accompanied by the need to stay aside, creating a private territory (both real and imaginary) which enables escape from all interferences by adults offering gamers the possibility to be by themselves and act accordingly, to organise an activity and to take decisions, to establish roles and tasks within a situation that must be shared to become real.

Play characterises the whole life of human beings many times involving a shift from play activity to a play-like activity. From a pedagogical point of view this means a shift from using play as a device for preparing materials and teaching activities aimed at facilitating and making attractive identified learning outcomes, to a situation when play becomes a category, a style, when certain learning processes are based on research and exploration. Such experiences are triggered by curiosity and cognitive adventure, which makes individuals understand the sense and the value of what they are learning, as a significant experience *per se*.

For Kirriemuir and McFarlane (2002) since playful learning emphasizes experiences such as experimentation, exploration, trial and error, imagination, role-play, and simulation of experience, it might be possible to develop environments for learning based on these activities. This reconceptualisation of students as bearers of expertise, as capable of acting in the role of expert, raises serious questions about how we currently structure learning experiences in schools. It represents the pedagogical shift from learning to knowledge building.

Digital games and simulations offer a promising interactive environment that realises this pedagogy. Squires (2002) considers them as ‘the most fully realized educational technology produced to date’ that accommodate splendidly the epistemology and innovative pedagogy of self-directed learning and working in a knowledge society. Shaffer (2006, p. 126) claims that Dewey’s model of learning through active engagement in meaningful activity depends on the *medium* in which the activity takes place – that is on the tools and materials with which the student is working. ‘Digital games make it possible for more people to learn about the world by participating in a wider range of meaningful activities than is possible with traditional materials alone,’ (SHAFFER, 2006, p. 128) or using other digital technologies.

Playing game genres that have an educational orientation like Real Time Strategy (RTS) games, managerial or simulation games provides an experience that is fundamentally different from didactical approaches; didactical refers here to sequential, teacher-centred and behaviourist model of learning. They are based on an epistemological shift from ‘representing’

to 'simulating' reality (FRASCA, 2003) which demands a corresponding shift in underlying pedagogical models that mediate learning and understanding through direct action involving both 'reflection in action' and 'reflection on action'. Both classroom and technology-intensive instruction are still profoundly didactical in nature, assuming a teacher-student relationship with emphasis on the acquisition of abstract decontextualised knowledge and skills. On the other hand games provide contexts where users employ their natural learning capabilities (SCHANK; CLEARY, 1995).

By merging the fundamental learning ingredients - fun, play, rules, goals, winning, competition and community aspects – simulations and games propose extremely motivating learning and socialising contexts where these natural modes of learning are nurtured, refined and shared with others (FREITAS, 2008). Gee (1996, 2004, 2005, 2007) discusses in great detail how games impact learning and concludes that games are powerful learning machines that integrate elegantly into their very design many theoretical islands, learning principles and findings from cutting-edge research in the Learning Sciences into a coherent (gaming) pedagogy.

Digital games exploit this neurocognitive dimension of our brains maximising the comprehensibility and retrieval of information. Gee (2007) maintains that information retrieval is not in the form of separate and disjointed memory reconstructions but more as simulations and re-enactments. 'For humans, effective thinking is more like running a simulation than it is about forming abstract generalisations cut off from experiential realities,' (2007, p. 25). 'Good video games can externalise good thinking and problem solving' (2007, p. 4). This explains why simulations and games are highly effective and efficient media for transferring World 1 into World 2 experiences. Through their multimodal appeal and their exploratory approach, games establish very elaborated memory residues that can be rapidly accessed and re-constructed enabling gamers to 're-live' the experience in a holistic and vivid way. One must put these positivistic commentaries in the right perspective complementing them with findings from empirical research and corroborating them through pedagogical practice. The distinction between using games for entertainment and their use for educational purposes should always be kept in perspective.

3 INDIVIDUAL EXPERIENCES

Games and simulations can serve as introspective tools to reflect about the personal experience of learning by comparing and contrasting established behavioral and thought patterns with innovative ones. Most important they promote reflection about the influence of individual traits on learning and how these tools address a range of user needs.

3.1 The digital generation

Young learners living in a technology-permeated knowledge society, in which entertainment and play are an essential ethic, experience life in fundamentally different ways from previous generations (PRENSKY, 2001, 2006). Digital tools, and the range of functionalities they mediate, are considered as indispensable components of their life style each satisfying some specific need. Entertainment, immediate access to information, a sense of connectedness, the sense of relatedness through extensive social networks, sharing information and knowledge are the identity norms of the digital generation.

Prensky (2001) claims that immersion in the hi-tech environment is actually 're-wiring' the brain of young learners and redefines its mode of operation in fundamentally different ways from those of previous generations. These 'Digital Natives' are used to rapid, parallel

information processing based on multi-tasking. They prefer a 'graphics *before* text' strategy when learning, rather than the opposite and prefer networked environments that offer random access. They thrive on instant gratification and frequent rewards and thus prefer games to "serious" work or work situations with strong elements of gaming. In contrast, the older "Digital Immigrants" (teachers and parents) are apprehensive to technology and tend to adopt book-based, sequential and seduced approaches to learning.

Deriving inspiration from Mead (1970) book about culture and generation gap, Selfe, Mareck and Gardiner (2007, p. 28) discuss extensively this cultural conflict elaborating on the concept of 'Intergenerational Disjuncture' comparing the three distinct cultural styles, each distinguished by the ways that the younger generation are prepared for adulthood. The 'post figurative' style, characterising pre-industrial societies in which change is largely imperceptible and the 'future repeats the past', considers education as the passing down of traditional values and knowledge through an adult-teacher. The second style, the 'co-figurative', characterise industrial societies where some form of disruption is experienced by society making the older not any more the experts. Therefore the young look to their contemporaries for guidance in making choices rather than relying on their elders for expertise and role models in a changing world.

The third cultural style is the 'pre-figurative' symptomatic of a fast changing (post-industrial) society that exists without models and without precedent. Change is so fast that neither parents, nor teachers or highly skilled and professional people can teach the young what they need to know about the world. Neither the elders nor the experts can provide models for the future. The authors emphasise the responsibility of adults in addressing the emerging needs of youths in a pre-figurative society claiming that the answers to their dilemmas are not the ones being offered in schools that are still embedded in a post-figurative framework. Papert (1998) has already anticipated the time when standard predetermined curricula will be replaced by learner designed ones. Gee (2007, p.6) points to the inverted roles that has happened between himself and his son Sam confirming the reversed learning trends where the younger first learn for themselves and then teach the adults. Games are an integral part of this digital pre-figurative social setup and thus should be an integral component of the educational process.

3.2 Educational outcomes

Games and simulations promote different forms of learning that form an essential part of the individual experience. This section organises the discussion around three categories of beneficial outcomes of games and simulations, mainly physiological, cognitive and motivational.

3.2.1 Physiological outcomes

Research reveals a range of physiological positive effects from gaming and simulation including increased visual processing and acuity, refined eye-to-hand co-ordination and refined hand movements (EGENFELDT-NIELSEN, 2006). BBC Health News (2008) describes the therapeutic use of the Nintendo Wii gaming console, dubbed Wii-habilitation. Players can test their skills in tennis, boxing, and golf among others, a type of gameplay that is seen as an excellent means for improving strength, endurance and co-ordination in those who have sustained serious injuries. Various social groups are benefiting from this innovative approach including overweight children, stroke patients, war victims and the elderly. Specialised Wii-mediated exercises with victims suffering from brain injuries stimulate undamaged nerve cells to create new pathways for messages to the limbs helping the brain relearn this mechanism.

3.2.2 Cognitive outcomes

Research points to a range of positive cognitive benefits from gaming. McFarlane, Sparrowhawk and Heald (2002) contend that games provide a forum in which learning arises as a result of tasks stimulated by the content of the games, knowledge is developed through the content of the game, and skills are developed as a result of playing the game.

Regarding tasks stimulated by game content, the report mentions the role of games in creative writing where characters or scenarios from games promoted a high degree of engagement with the game and the perceived authenticity of the game's context provided jumping off points for other activities. These factors could also be used to stimulate creative work in other areas such as art and design, technology and in some cases science. In addition teachers could use students' extensive games experience outside school as a starting point for work in school. Though games stimulate a lot of 'off game' creative work (defining characters roles, game environments, accessories, etc.) which are then uploaded and promoted in 'affinity spaces', research in this area is very sparse.

The second learning outcome, that is, knowledge developed through the content of the game, opens a big debate from a research perspective. Squire (2004) points to the fact that very little knowledge is acquired through games and concludes that they are interesting not for their content but for the way new explorations initiate negotiations, constructions, and journeys into knowledge. Brown *et al.* (1997) found that, though the game *Packy and Marlon*, aimed to promote self-care amongst diabetic children, improves a lot their motivation and self-care behaviours, it did not improve their knowledge on diabetes significantly.

Leemkuil (2006, 269) quotes Randel, Morris, Wetzel and White-hill (1992) who examined 68 studies directly or indirectly on the difference between simulations or games and conventional instruction in student performance. Seven out of eight studies involving math found that the use of computer games is superior to traditional classroom instruction for improving math achievement. Subject matter areas where very specific content can be targeted and objectives precisely defined are more likely to show beneficial effects of gaming. Furthermore, they conclude that simulations and games show greater retention over time than conventional classroom instruction, and that in 12 of 14 studies, students reported more interest in simulation and game activities than in more conventional activities.

Leemkuil quotes two other studies having methodological robustness in contrast to Randel *et al.* (1992). Wolfe (1997) who reviewed only studies in which a computer based general management game was used to teach predefined strategic management learning outcomes, reports that in every study the particular gaming application that was used produced significant knowledge-level increases. When the business game approach was pitted against the case study approach, which is the major alternative teaching strategy in strategic management courses, the game approach was superior to cases in producing knowledge gains. In another study Klawe (1998) summarizes the results of the Electronic Games for Education in Math and Science (EGEMS) project aimed at exploring the potential of specially designed electronic games to increase learning and appreciation of mathematics and science. Klawe concluded that it is possible to design computer games that students greatly enjoy playing and that are very effective in helping students understand mathematical concepts. Relatively small changes in design, however, can strongly influence the extent of the effectiveness.

The third learning outcome mentioned by McFarlane, Sparrowhawk and Heald (2002) considers skills arising as a result of playing the game. Playing games gives rise to a range of psychological benefits especially related to process intelligence. Subjects with little or no video gaming experience showed significant improvement on the benchmark tasks after playing just ten hours of a first person-shooter video game. Playing action games develops players' 'visual

selective attention' manifested as the ability to concentrate on the most important things and filter out the rest (PRENSKY, 2006; GREEN; BAVELIER, 2003).

Prensky (2006, p. 35) also claims that research points to a number of thinking skills enhanced by repeated exposure to computer games and other digital media. These include 'representational competence' - reading visual images as representations of three-dimensional space; 'multidimensional visual-spatial skills' - the ability to create mental maps and do mental paper folding; 'inductive discovery' - acting like a scientist by making observations, formulating hypotheses, and figuring out the rules governing the behaviour of a dynamic representation; 'attentional deployment' - the ability to focus on several things at the same time and being able to respond faster to unexpected stimuli. Prensky claims that while individually these individual cognitive skills may not be new, the emerging combination and intensity is a characteristic of the 'Digital Natives'.

On a more pedagogical orientation Kirriemuir and McFarlane (2004) reported that teachers and parents recognize that games and simulation play can support valuable skill development, such as strategic thinking, planning, communication, application of numbers, negotiating skills, group decision-making and data-handling. Jacobs and Dempsey (1993) claim that games improve practical reasoning skills, develop higher levels of continuing motivation, and reduce training time and instructor load. Hogle (1996, p. 11) states that simulations and games may improve several types of cognitive learning strategies like organizational strategies (paying attention, self-evaluating, and self-monitoring), affective strategies (anxiety reduction and self-encouragement), memory strategies (grouping, imagery, and structured review), and compensatory strategies (guessing meaning intelligently). On a cautionary note Leemkuil (2006) concludes that several authors have questioned some claims because of a lack of sufficient empirical support considering that much of the work on the evaluation of games has been anecdotal, descriptive or judgmental.

Research also focused on transferable skills - the short and long term cognitive and affective residues that result from the gaming experience. The comparative aspect of this research compares and contrast gamers with non-gamers. Other investigations focus on the conditions required to develop specific skills. On the basis of the survey done about game use in schools, Kirriemuir and McFarlane (2004) point to the different skills profile developed in gamers. Gamers' expectations of learning activities are changing radically shifting their preference for tasks that are fast, active and exploratory, with information supplied in multiple, parallel forms. They also point to the fact that traditional school-based learning may not be meeting these demands.

The skills profile of gamers is much more discussed and researched beyond the formal educational process. Prensky (2006) claims that computer and video gamers are better than non-gamers at 'situational awareness' manifested as taking prudent risks in business. Game players get good at taking information from many sources, pulling together data from many places into a coherent picture of the world and making good decisions quickly. Not only do game players learn thinking, collaboration and other skills, but they begin to acquire them at a very early age. Saunders (2007) claims that immersive world applications like games have the potential to support communication between learners, to support problem-based learning opportunity and to support exploratory learning experiences.

Beck and Mitchell (2004) elaborate on how gamers are more successful in business than non-gamers. Regarding personal skills video game-players are committed to professional excellence, put a high premium on skill and adding value, have a strong sense of competence, love data, are comfortable taking measured risks, multi-task well, learn on the fly, think globally, see the world through the lens of competition and expect themselves to actually deliver. Their social skills include collaborative problem solving, have both highly developed teamwork skills and the desire to be part of a team, care about their organisation and yet

don't count on fixed organisational structures. According to the authors these transferable professional skills are developed because gamers have amassed thousands of hours rapidly analyzing new situations, interacting with characters they don't really know and solving problems quickly and independently in a world that has also emphasized tangible results and given them constant, critical feedback. Fitzgerald (2007) discusses how gamers also tend to be more loyal to their companies and are likely to want to work with others more than non-gamers. Freitas (2008) highlights communication, teamwork, leadership and creativity as the particular skills supported through gaming.

Research about the transfer of specific skills is quite controversial. Referring to a number of studies that connect problem-solving with video games, Egenfeldt-Nielsen (2006) argues that research about the development of problem-solving skills has received much attention over the years. He concludes that problem-solving might improve between video games, are predictive of better performance in a video game (KO, 1999) but it is hard to transfer the improvement to contexts other than video games. On the same vein Kirriemuir and McFarlane (2004) cautions about the perception that the exploratory approach, built in strategy or adventure games giving users a high degree of control, translates into the development of logical thinking and problem-solving skills. They argue that to date much of this research relies on inference from the structure of computer games and psychological theory rather than direct and sustained empirical evidence. It is still doubtful whether gamers are in fact able to move from intuitive problem solving in the game to an understanding of effective processes for identifying problems and generating hypotheses and solutions in other contexts.

Other research has identified that use of computer for gaming may play a significant role in developing effective use of computer-mediated information resources especially programming, problem-solving skills and enhanced self-directed problem-solving. Mackereth (1998) suggests that familiarity with, and interest in, video games can influence children's confidence when using computers for more professional applications and that children unfamiliar with video games may not develop the skills necessary to relate with electronic media, such as dealing with dynamic visual change, parallel processing of multiple streams of information and the ability to experiment in free-form, ill-defined problem domains. Children's early interactions with computer games encourage them to develop a playful approach to computers (DOWNES, 1998) which develops the expectation that 'trial and error works', and that linear progressive models for using computers (such as those characterized by worksheets or computer manuals) are often the least effective way of engaging with computer-based technologies (Facer *et al.* 2003). Massanari (1998) also records teachers' concern that gaming in schools may make it harder to engage children with the computer as a tool in more conventional learning tasks.

3.2.3 Motivational outcomes

Research focuses on two aspects of motivation in relation to games and simulations. One direction considers extrinsic motivation focusing on the influence of games' appeal on adoption and use by different social groups. The other research perspective focuses on the intrinsic motivational benefits of games comparing the gaming condition with other media or instructional contexts and also explores motivational benefits resulting from the gaming experience *per se*.

On the comparative side, Oyen and Bebko (1996, p.187) studied the development of memory enhancing by embedding a memory task in a computer game context and comparing it to a more formal "lesson" context. The researchers found that the game contexts stimulated much greater observed rehearsal and that rehearsers recalled more items than non-rehearsers

in both contexts. But recall in the games was less than for the lessons. The authors assume that the game condition, while more enjoyable and interesting for children, was also more difficult. The added complexity and the distracting features inherent in the games may have combined to make the task more difficult, resulting in the decreased recall performance of the non-rehearsers.

Lieberman (2001) found that students playing a video game for 30 minutes expressed more enjoyment and learned the same as those watching an educational video for 30 minutes. While TV conveys all information at once, the video game delivered a limited amount of information in 30 minutes compelling players to repeat game several times. The researcher concluded that though the game is less efficient on a time basis at imparting information, this compensates by enhancing motivation facilitating replay that leads to complete knowledge acquisition.

Colley (2003) confirms that boys obtain greater experience with computers at home than girls quoting Comber et al. (1997) and Shashaani (1994) and asserts that much of this experience is acquired with computer games, which boys play to a far greater extent than girls. These trends are confirmed by the Eurydice report (2005) providing evidence that across Europe the attitudes of boys vis-à-vis the use of ICT differs from that of girl (boys are more attracted to ICT and use it more freely) because of their longer exposure to ICT and games.

Regarding the intrinsic motivational benefits resulting from the gaming experience, there is a widespread agreement amongst researchers about the motivation pull of games (RYAN et al., 2006) and its link to learning. Leemkuil (2006) claims that the fast growth of the use of digital games has led to renewed attention to the role of game play in education and to scientific research that could be used to design games. People play games because they are intrinsically satisfying (MALONE; LEPPER, 1987a, 1987b) by providing optimal level of challenge, provoke sensual and intellectual curiosity, develop competencies and provide 'fun'. Gamers are challenged when they have to work towards personally meaningful goals whose attainment requires activity at a continuously optimal level of difficulty. In games tasks are hard but doable (GEE, 2007). They provide continual performance feedback in different ways which boosts self-esteem by enhancing a sense of efficacy and power over one's environment. This in turn enhances the sense of control over the tool and the gaming task (JONES, 2002).

Games and simulations empower users to produce a desired amount of a desired effect, give them insight into cause-and-effect relationships both within the game and more important between the virtual and real worlds. Games also enhance user's sense of control by providing choice – which tasks to do and how. This results in a cascading effect. An increase in performance promotes one's sense of competence which in turn boosts self esteem and *autonomy* which is considered as a sense of volition or willingness when doing a task (DECI; RYAN, 1980, 2000). Ryan et al. (2006, p. 350), claim that "perceived competence is among the most important satisfactions provided by games, as they represent arenas in which a person can feel accomplishment and control."

This accomplished sense of competence can then be used to compete. Games are motivating because they allow competition within a safe environment. Through various possibilities gamers experience satisfaction by comparing their performance with that of others. Failure in games does not lead to irreversible long term effects, but stimulate gamer to work harder at developing the requested competence. The task is hard but doable through increased effort and exercise. Gee (2007) considers this 'Performance before Competence' as an essential learning principle. When the requested level of competence is achieved, games recognise this through a number of built in feedback features.

From a social perspective, games and simulations are becoming more motivating because they are evolving into a more collaborative experience where gamers feel satisfaction by helping others achieve their goals. In both contiguous and online multiplayer games

participants interact at the domain, gaming and community level in the process satisfying each others' need for competence, relatedness, affiliation and self-actualisation. Through this experience interpersonal and life-related skills are developed giving an enhanced feeling of social competence.

The fun factor is the strongest motivational element in games. Bartle (2004) emphasise that people play games because they are seeking 'fun'. This fun or pleasure principle arises because games offer pedagogically holistic experiences by integrating cognitive, affective and intuitive aspects of learning in line with Damasio (1994) emotional tagging theory. Gee (2007, p.10) points out that pleasure is inseparable from deep learning and hard work.

At the affective level, games increase fun by stimulating curiosity and fantasy. Sensory curiosity results from abrupt changes occurring in the gaming environment involving music, evolving scenes, commentaries or humor. Cognitive curiosity is stimulated by task-related interactions that cause cognitive disequilibrium as a result of optimal level of discrepancy between current level of knowledge or skills and a more advanced one, a situation that creates the most favourable enticing conditions for learning.

In addition to cognitive stimulation, games are attractive due to their emotional activation resulting from immersion which is associated with *presence*, (LOMBARD; DITTON, 1997; RIGBY, 2004) or 'the sense that one is within the game world, as opposed to experiencing oneself as a person outside the game, manipulating controls or characters' (Ryan et al. 2006). A gamer enters a state where one ceases to be aware of the physical self, focuses intensely on task leading to a distorted sense of time and effortless action. Games create this immersive experience through stunning photo-realistic graphics, surround sound effects and animated characters that are part of a spectacular game environment. The experience in the game is made 'more real and authentic, both by creating a compelling story line and graphic environment, and by making controls as "intuitive" or user-friendly as possible' (RYAN et al., 2006, p. 350). They define 'intuitive' as the degree to which game controls make sense, are easily mastered, and do not interfere with one's sense of being in the game.

Good games are enjoyable because they are based on a model specifically designed to promote insight into the domain simulating authentically all problem situations. Enjoyment comes from playing roles demanding expertise in the game environment thus behaving like a professional. In *Flight Simulators* one behaves like a professional pilot, in managerial games gamer 'plays god', in *Food Force* one has to carry out specialised missions typical of a humanitarian aid expert, while in *Full Spectrum Warrior* or in *Oblivion* gamer has to act the role of a professional soldier. Besides extending the area of effectiveness within some domain of expertise, games serve also as tools for promoting insight and empowerment over the social environment by promoting social metacognition (JOST; KRUGLANSKI; NELSON, 1998).

4 CRITICAL PERSPECTIVES, CONSTRAINS AND NEGATIVE EFFECTS

Though research highlights a number of examples of good practice and points to a range of benefits in using games and simulations for learning, it also explores the constraints and challenges that practitioners may have to face both at an institutional and at an individual level. Besides constraints from schools, one may have to deal with issues related to the negative impact of games and simulations.

Various reports, research reviews and investigations focus on factors that influence use of games and simulations in schools. For McFarlane, Sparrowhawk and Heald (2002) student motivation is enhanced mainly when students use games familiar from their home environment and when they have a degree of autonomy in playing the game. Sandford et al. (2006) focuses on the role of teachers in influencing use of games, the particular context in which a teacher works – their experience, their teaching style, their familiarity with the

curriculum followed and the wider culture of the institution and the effective use of existing teaching skills rather than the development of any new, game-related skills.

Three categories of constraints are identified that affect the use of games in schools preventing them from becoming a mainstream activity. Regarding *Constraints in Educational Settings* Sandford *et al.* (2006) points to concerns over curriculum and assessment that determined the selection of student age to use games in lessons, the fixed length of lessons constrains both the planning and implementation of game-based learning in schools, and the range of gaming ability amongst students which had an impact on teachers' lesson plans. McFarlane, Sparrowhawk and Heald (2002) consider the limited valuation of gaming skills by school and the mismatch between games content and curriculum content. Kirriemuir and McFarlane (2004) also point to the mismatch between game and curriculum content. They also consider the long time needed for both the student and teacher to orient themselves within the game. There is also the difficulty in persuading scholar community members and school stakeholders as to the potential/actual educational benefits of computer games and simulations. On a more global level cultural acceptance of games as media through which learning can take place involves the contestation of the wider public perceptions of games. Consequently many adopt a 'wait and see' position that should be challenged by initiatives adopting the use of games guided by research and examples of good practice.,

Other researchers point to the scepticism from both students and teachers. Egenfeldt-Nielsen (2006) quotes a number of studies (EGENFELDT-NIELSEN, 2004; GROS, 2003; HOSTETTER, 2003; KIRRIEMUIR; MCFARLANE, 2002; PRENSKY, 2004; SQUIRE, 2004) indicating that students may be reluctant to engage with video games based on scepticism which stands in stark contrast to the usual idea of all students embracing video games. The challenge is to find game designs that can make learning and playing work together, or, at least, not one against the other (EGENFELDT-NIELSEN, 2005; GRUNDY, 1991; HEALY, 1999; MAGNUSSEN; MISFELDT, 2004).

Kirriemuir and McFarlane (2004) identifies three constraints met by teachers. One is the lack of time available for teachers to familiarize themselves with the game or simulation and methods of producing the best results from its use. The second concerns the amount of irrelevant content or functionality in a game which could not be removed or ignored, thus wasting valuable lesson time. The other constraint is the considerable effort needed to keep the students 'on track' within the game many times considered as an extra burden in relation to high stakes assessments.

Several reports and researchers identify a number of game-related constraints associated with either the surface or deep structure of games. Regarding surface structure McFarlane, Sparrowhawk and Heald (2002) claim that the more complex a game is the higher is the preparation time, while Gros (2003) argue that it is more difficult to adapt games to the class timings once they were created for many exploration hours. Games which were not created with an educational purpose may have a complex menu system that can confuse and deviate from a particular objective in the game.

A number of constraints arise from poor game design. For Magnussen and Misfelt (2004) the games' interface can distract the students from achieving the defined educational goal. Games can have software problems, not very clear interfaces, provide limited feedback or even integrate illogical rules (BECTA, 2001). For Gros (2003) games with loud sounds and very noisy music compel students to use headphones which stop dialogue and group discussion. Constraints of a more technical nature include difficulty in buying a license for each student Kirriemuir and McFarlane (2004), copy-protection features and lack or limited technical support (SANDFORD *et al.*, 2006). Kirriemuir and McFarlane (2004) refer to compatibility between school hardware and other software to allow transfer of data between applications and the fact that the equipments at school are usually not satisfying for the

needed requirements to play the most demanding games.

Other constraints are related to the deep structure of games, that is, how they mediate interaction with the domain and between different users. Becta (2001) refers to the difficulty in choosing games with the adequate level of interest and challenge to the user and that is relevant for the subject (KIRRIEMUIR; MCFARLANE, 2004). For Gros (2003) games transform themselves and become less entertaining when played with an educational purpose. Becta (2001) refers to the problem of motivational habituation having positive effect on gaming but decreases interest in the school. It also complains about the content and style of several games that are created mainly for boys and about the inclusion of violent characters that demand or satisfy the need for aggression or obsessive control and that may promote the transfer of attitudes and beliefs to reality. This report also complains about the fact that games created to be played by a single player may provide superficial cooperation.

5 CONCLUSION

As a conclusion, in line with Ryan *et al.* (2006) the best approach to adopt is to promote a pedagogy based on the use of games but controlling for potential negative effects. Regarding educational games and simulations, the benefits of such pedagogy clearly outweigh any negative outcomes. The decision to use simulations and games as the technology and medium for a Management course at the Lisbon School of Accounting and Administration (ISCAL) was determined by a number of compelling positive factors. These include the rich personal experiences that simulations offer to users, the engaging nature of the medium, the accommodation by games to instructional and constructionist pedagogical approaches, the need to promote games and simulations as an innovative learning approach, the need to reconceptualise domain learning from different perspective especially by simulating expertise, the resonance of games with the psychological and social make-up of young people and the need to challenge established perceptions. But the most compelling two aspects arise from the conviction that there is dire need to sensitize people about the potential of this area and hence the need to engage in research that addresses these needs and proposes examples of good practice.

In the case of ISCAL, the emphasis in the simulation method of teaching is placed on the business process, execution of strategy and solutions, management of tactics, and team work. This emphasis provides a more meaningful learning experience for business students as opposed to lecture/textbook methods that place emphasis only on the language and the tools of business. Though the case study method of teaching provides a textual replication of business environment by placing the emphasis on the situation analysis, problem diagnosis, problem solving, and strategic thinking, it does not allow for interactive learning on the participant's part.

It is our strong belief that the method of gaming and simulation has distinct advantages over other interactive methods of teaching and learning, such as the use of case studies. As Saunders (1997, p. 105) suggests:

Unlike cases, simulations and games are seldom restricted by the narrative structure of prose, a point seldom noted. Most cases develop their story lines chronologically, a method which while helpful, distorts the reality of how employees actually discover problems at work and solve them. Simulations and games demonstrate a more complex business environment and show learners the effects of the decisions they make.

The implementation in the curriculum of a management degree of a collaborative, online business simulation game was based on the rationale presented in this work. The simulation is a virtual competitive business environment, in which groups of students work as companies analyzing markets, designing their marketing strategies, and developing and marketing products. The simulation aims to teach a range of hands-on managerial skills within a realistic environment.

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