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THE EDUCATIONAL POTENTIAL OF COMMERCIAL COMPUTER GAMES

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Abstract*: Advances in information and communication technologies have generated a radical shift in the experiences and interests of the twenty-first century learners. The new digital technologies embedded in people's daily life along with the massive adoption of computer games has created a diversity of new needs and preferences that has extended to reach the educational environment. The integration of computer games into the educational process has emerged as a necessity, as well as a challenging opportunity for many teachers. While researches reveal the multiple benefits that the use of computer games bring to education in terms of skills development, increased motivation and collaborative capacity, evaluation, or decision-making, game development and implementation is not an easy endeavour. Moreover, many teachers are not fully aware of the pedagogical uses and benefits of computer games. Under this premises, the authors advance commercial computer games as a valid, cost-efficient alternative for teachers that wish to experiment the potential of using games in education, and present the results of a case study that investigates potential uses of commercial computer games in education. The purpose of this paper is to inform educators on factors that could contribute to the adoption of computer games within educational environments. The paper analyses how commercial computer games can genuinely add value to education, and explores the main strength and weaknesses of employing commercial computer games for educational purposes. The results have indicated that commercial computer games represent an alternative solution for game-based learning and it can be employed successfully within specific learning processes.*

Keywords: *commercial computer games, education, 21st century skills*

I. INTRODUCTION

People's lives are intricately interwoven with the use of digital technology. This intense digital exposure changed their thought patterns and information processing [1]. Within this scenario of rapidly increasing usage of digital technologies, games play a significant role. In the last decades, games have evolved from simple forms to complex 3-dimendional avatars playable on the Internet (e.g. World of Warcraft) [2]. Nowadays, digital games can be accessed on different platforms and devices from computers, game consoles to mobile devices. Such abundance has generated new opportunities and challenges for education, in terms of design, development and implementation.

Under these premises, this paper details upon an analysis that focuses on the educational capacity of commercial digital games, with the purpose of identifying key 21st century skills that can be improved by employing games as a mean for knowledge transfer in educational environments.

1.1. Skills, Games and the Future of Learning

The competitiveness of businesses is completely dependent of a well-educated workforce. Are students graduating from school really ready to work? This is a very simple but significant question. Research studies have shown that the most common answer is 'not really' and they have confirm a 21st century skills gap that is costing business a great deal of money [3, 4, 5]. How can this skill gap be reduced while considering time and cost constraints?

The research proposed herein focuses on the 21st century skill that students graduating from secondary schools, technical colleges, and universities lack [6] and advance commercial digital games as an alternative, feasible solution to address this gap. Why did the authors approach this particular area of study? Because the best and the brightest – lawyers, doctors, mechanical engineers, educators, investment bankers, journalists, etc. – have stated that soft skills are the hardest thing they have ever had to learn [4].

21st century skills or soft skills can be defined as those skills – over and above the technical knowledge and expertise in the chosen field – required for an individual to relate to and survive and succeed in his or her environment [7]. It is also important to consider that in the Knowledge Age work requires a new mix of skills that involve higher levels of knowledge and applied skills like expert thinking and expert communicating. The core skills that students should develop during their studies in order to hold a better chance to be successful in their future careers depend on challenging economic situations, advanced in technology, virtual teams and international projects, more students opting for postgraduate education, etc. [8].

The soft skills that have been considered for this research fall under the following categories:

- Personal skills, such as critical thinking and problem solving; creativity, decision-making, planning and organization, adaptation to change, handling responsibility, applying technology;
- Interpersonal skills, such as oral and written communications, team skills (collaboration, coordination, cooperation, negotiation), leadership and hybrid management skills, professionalism and work ethics.

The research has focused on how commercial digital games can contribute to the improvement of the 21st century skills. The analysis has included two commercial digital games that have been tested in order to identify what personal and interpersonal skills can be improved while employing commercial games in education.

1.2. Game-based education: Opportunities and Challenges

The K-12 and higher education systems are still trapped in a "learning by knowing" approach, in a twenty-first century world that requires the judgement and skills of "learning by doing" [2]. It is in this learning-to-do area that games can have their say. Computer games have introduced technology and examples of media around learning to do that can scale. Games create environments where players can repeatedly practice skills, instead of just hearing about them.

Linear content cannot develop into 21st century skills such as leadership, nor capture the intellectual property needed for dynamic planning and execution. Games make education and entertainment environments 'practiceable' through the addition of pedagogical elements that are shaped into tasks and levels [9]. Teachers are no strangers to using games (e.g. broad games, card games, and role-playing games) in the classrooms; still the primary reason for using them has always been for learning and not for entertaining.

Even if the academic community has opened up to games, game development and the implementation remain a significant problem. Whether developers build their own game engine or license and modify an existing engine, that investment in time and resources remains a constant challenge. Content creation is a consistent budget item. Interoperability is implemented only partially and it does not reach its true potential. Quite often the targeted platform no longer represents a suitable choice. The development of serious games implies new challenges in terms of pedagogical approaches, game mechanics, assessment and metrics generating an even longer development cycle.

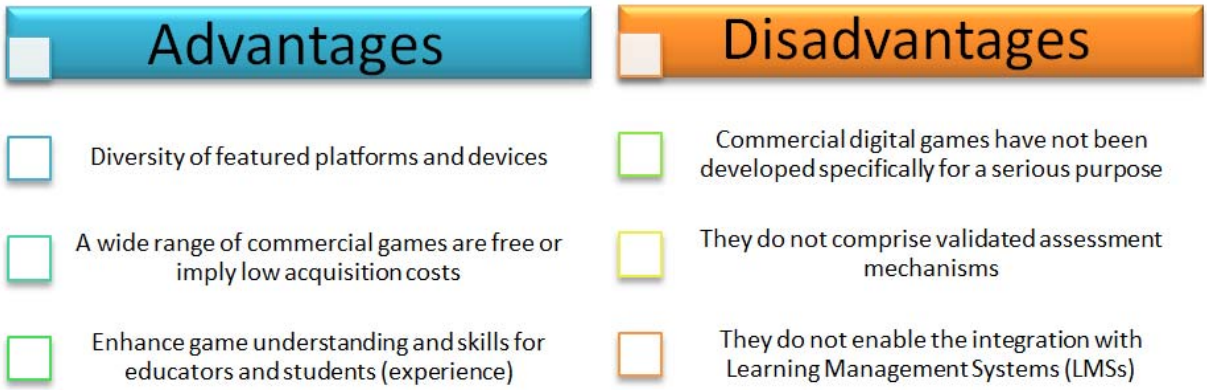

Figure 1. Key advantages and disadvantages of using commercial games in education.

II. COMMERCIAL GAMES AND EDUCATION

There are a series of goals that can be achieved through games [2]: experimenting and experiencing of functions; practicing and automating; learning and practicing rules; dealing with drives; experiencing and exerting power, and cognitive learning. The authors advocate that these goals can be achieved exclusively through serious games, but also by employing commercial games.

2.1. Why commercial games

One reason for choosing commercial games as a starting point for educative gaming instead of serious games is that playing is a voluntary activity [10]. Even though a game contains educative material, it should still be fun enough to be played voluntarily and this intrinsic motivation is a powerful tool in learning. We should also take into account the fact that playing involves the formation of social groups: even sitting alone behind a computer screen does not appear very social, with the emergence of online gaming, play most certainly promotes the formation of social groups.

As researches pointed out that pupils playing computer games frequently may profit from cognitive stimulation in areas of visual-iconic and spatial representation skills [1], educators have begun to delve more into digital games and the complex learning dynamics that take place during game play. At this point, other significant challenges have emerged: the high development cost of games.

Students these days have spent more time playing computer games than reading books and the result has been to acutely sharpen their visual sensitivity, and they have become more apt to do multiple tasks at the same time, like listening to music whilst doing homework [11]. This is especially useful in case of educative computer games. As attention becomes more automatic at a task, scarce attentional resources are freed up that allow the player to perform multiple tasks at the same time, or multitasking [1].

Interactivity creates practice with the subject and an active need to listen, think and speak concerning the topic. Instead of reading a text or listening to a lecture, this engagement is far more effective because it is a two-way line of communication. It replicates the interactivity of a class which allows for discussion and the active prompt of participation by fellow students and a tutor. Although in certain ways an educative computer game would be limited compared to having an actual teacher at hand, it is far more convenient for many situations [12].

Emotional involvement creates a bridge between the topic and the student for a longer-lasting impression. When characters in a book are presented in a boring manner and a reader creates no connection to either character or story, the book is likely discarded and the characters not remembered. It seems that the more one feels one is actually ‘in’ a culture, the more one learns from it – especially non-consciously [11, 13]. Emotional involvement creates a stronger memory of imparted knowledge. It is the active involvement stimulated by computer games which make them effective tools for education [12, 14].

Computer games are fun, engaging and motivating and offer an effective tool to create cognitive stimulation for an effective learning experience. Fun is a very strong motivational factor and the primary method of luring a student into playing an educative game. Part of the effectiveness as a learning tool are the hours freely spent on the activity, not necessarily that the hours are spent more effectively than traditional learning methods, yet games capture students attention and make practicing happen [11, 15].

Prensky summarises the effectiveness of computer games as a medium for education the following way:

- They are a form of fun that gives *enjoyment and pleasure*.
- They are a form of play that gives *intense and passionate involvement*.
- They have rules that give *structure*.
- They have goals that give *motivation*.
- They are interactive that gives *doing*.
- They adaptive that gives *flow*.
- They have outcomes and feedback that give *learning*.
- They have win states that give *ego gratification*.
- They have conflict/ competition/ challenge/ opposition that give *adrenaline*.
- They have problem solving that stimulates creativity.
- They have interaction that supports the formation of *social groups*.
- They have characters and story that give *emotion*.

2.2. Commercial digital games and 21st century skills

Games place the player in a microworld, a system where through cycles of action and feedback, players learn not only about facts, but also about rules, the relationships between these rules, and the emergent properties of this system. This systemic thinking is valuable because it help players solve problems holistically, rather than focusing on single-cause solutions. Video game players learn that if they change one variable, it affects the entire system. Systemic thinking is not embedded extensively in today's education mainly because it is not captured well by standardized tests, but this type of thinking is crucial everywhere outside school, from engineering to politics or social contexts.

Under these premises, this research explores the potential of commercial digital games to develop and improve 21st century skills, respectively personal and interpersonal skills, as a key variable for labor market success. For each game that has been analyzed, the research has focused on the following main elements: category, gameplay, potential for education, and main skill categories.

A. Oregon Trail

Developer: GameLoft
Platform: all platforms (PC, Mobile, iPhone, iPad, UMPS, PSP, N-gage, PalyStation3, Nintendo WiiWare, Nintendo DS, xBox Live Arcade)
Type of access: free
Webpage:
http://www.oregontrail.com/

Category: Simulation & Strategy
Gameplay: The Oregon Trail is an adventure game that covers the period of the Westward Expansion in the Unites States history. It enables players to create their own customized borderline village by adding buildings, livestock, and crops. As players work their way through episodic missions and explore the vast virtual space of the gameworld, they cycle between immersion and detachment.
Potential for education: What is the serious nature of this game? By playing the Oregon Trail, a gamer has the opportunity to meet the most important figures in history and discover fascinating true historical facts. The gamer has to learn how to take the right decisions: how to create his/ her village, how to manage livestock, how to deal will random events – such as hurricanes -, how to protect the villagers, how to manage the village's supplies. At the end of the journey, points are awarded to the players based on several criteria: the

	profession chosen, number of survivors and their health state, possessions, available cash, etc. *Main skills categories*: critical thinking and problem solving; creativity; decision-making; planning and organization; adaptation to change; handling responsibility; applying technology; team skills (collaboration, coordination, cooperation, negotiation); leadership and hybrid management skills.

B. Brain Challenge, Brain Challenge Vol. 2: Stress Management, Brain Challenge 3: Think Again!

 **Developer**: GameLoft **Platform**: all platforms (PC, Mobile, iPhone, iPad, UMPS, PSP, N-gage, PalyStation3, Nintendo WiiWare, Nintendo DS, xBox Live Arcade) **Type of access**: paid **Webpage**: http://www.gameloft.com/minisites/brain-challenge/us/us.php	*Category*: Puzzle & Brain Training *Gameplay*: These games challenge the players' thinking skills in the fields of mathematics and logic. Brain Challenge is puzzle-based and it comprises five different categories: Logic, Math, Visual, Focus and Memory. There are three levels of difficulty that are accessible based on the player's progression. The game includes several modes (Test, Free Training/ Training Room, Creative, Stress, Kid mode, Personal coach and Brain charts) that add to its variety and the (re)playability, making it a good investment. Brain Challenge vol. 2 and Brain Challenge 3: Think Again! adds innovative categories such as Stress Training, Focus and Visual Training. These games include fun facts and also a series of questions from different domains that are asked at the beginning of the game (e.g. Do you sleep with your mobile next to your bed? The radiation might damage your brain). *Potential for education*: improves the gamer's logical skills; boosts gamers' creativity; and includes metrics (achievements). *Main skills categories*: critical thinking and problem solving; creativity; decision-making.

The games that have been subject to this analysis have the potential to enhance players' personal and interpersonal skills. They are free or low-cost solutions that can be integrated as alternative methods for teaching and learning.

III. CONCLUSIONS

21st century skills require 21st century schools that support increased innovation and curriculum flexibility, learning that is personally customized and connected to students' wider life projects, evidence-informed rather than data-driven improvement. The visual-iconic input delivered by computer games appears preferable to traditional educational methods when it comes to imparting knowledge to digital natives. Similar to how e-readers are starting to replace books, educative computer games may replace or otherwise supplement schoolbooks, in order to create better accessibility to the knowledge contained within.

The authors analyze the potential of commercial digital games in education in relation to 21st century skills that can be enhanced through games. This research aims to fundament the adoption of game as a sustainable alternative for teaching and learning, built upon the needs of the next generation of learners and also on game development constraints. Future work aims to address metrics and assessment in commercial digital games.

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