Serious gaming towards learning of future city management

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Abstract: The use of serious games as a learning tool is one of the most promising approaches. Games can deliver not only the knowledge but also strengthen skills, such as communication, collaboration and problem solving. After assessing both advantages and disadvantages of using serous gaming during classes, the authors presented SimCity 2013 as an example for students to be able to build a settlement that can consistently grow into a city by zoning land, including residential, commercial, and industrial development. In term of game planning, operation, and management strategies, players will need to specialize their cities into particular industries, such as manufacturing, education, tourism, all those elements preparing students to be better decision-makers.

Keywords: education, serious gaming, simulation.

Conceptul de serious gaming aplicat în educație pentru managementul orașelor viitorului

Rezumat: Utilizarea jocurilor serioase (serious gaming) ca instrument de învățare este una dintre cele mai promițătoare abordări. Jocurile pot oferi nu numai cunoștințe, ci și consolidează abilități, cum ar fi comunicarea, colaborarea și rezolvarea problemelor. După ce au evaluat atât avantajele cât și dezavantajele folosirii jocurilor serioase în timpul orelor, autorii au prezentat SimCity 2013 ca un exemplu pentru ca studenții să poată construi o așezare care poate crește constant într-un oraș prin zonarea terenurilor, inclusiv dezvoltarea rezidențială, comercială și industrială. În ceea ce privește planificarea jocului, operarea și strategiile de management, jucătorii vor trebui să-și specializeze orașele în anumite industrii, cum ar fi producția, educația, turismul, toate acele elemente pregătind studenții pentru a fi mai buni factori de decizie.

Cuvinte cheie: educație, jocuri serioase, simulare.

1. Introduction

Seeing that some students frequently complain about traditional lecturing classrooms a boring and ineffective way of schooling while many instructors continuously seek the innovative way of teaching to motivate their students, they are still admitted that existing educational lessons and instructional strategies lack incentive and engagement powers (Lee and Hammer, 2011). The use of serious games as a learning tool is one of the most promising approaches. Games can deliver not only the knowledge but also strengthen skills, such as communication, collaboration, and problem solving. To create and utilize such that highly engaging classroom atmosphere with serious games, however, it is complicated, expensive, and time-consuming. This class implementation requires an integration of appropriate pedagogical contents and certain technical infrastructures. Under these situations, another approach that many lecturers are now pursuing is known as gamification.

In recent years, gamification has firmly positioned itself in the commercial sector and has been rapidly adopting by various companies, firms, and enterprises to encourage employee performance, to improve corporate management, and thus far to promote marketing strategies and customer engagement especially. For instance, customers can earn stars, points, tiers, discount coupons, and any other forms of reward for visiting retail shops or shopping through online store via the mobile phone application. This result is driven by its capability to shape and influence consumers' behaviour in a desirable direction. Loyalty programs, such as credit card rewards and frequent-flyer mileage rewards are often provided as clear case studies of successful gamified

mass-market products (Dicheva, Dichev, Agre, and Angelova, 2015). Nonetheless, while the term is gaining ground in the business world, the potential uses of its application in an academic discipline are quiet a relatively emerging trend. Actually, traditional schoolings already have several similarities of game elements. Students must complete and submit the assignment in order to get points, and then these points would transform later to letter grades. Students may also receive rewards for desirable behaviours or punishments for improper actions. With these grading and rewarding systems, if students perform well, they will earn an equivalent grade point average (GPA) and be promoting to the higher level at the end of every academic year. It seems that, given all these points, school is already being at the ultimate gamified experience. However, something about this environment of game-like elements fails to fascinate not all but many students. The typical classroom atmosphere often leads to schooling misconducts and undesirable outcomes, including absence, cheating, withdrawal, incomplete grade, and dropping out. Those students, at any rate, would not describe classroom-based activities in school as playful experiences. Thus, the existing game-like elements do not satisfactorily generate the power of engagement and encouragement.

2. Research Scope and Objectives

Decision-making is a fundamental part of human life. Decisions can be made quickly and easily when the objectives are clear, the information necessary to evaluate alternatives is available, and the outcomes of decisions can be accurately predicted. However, as the complexity of the decision increases, the decision-making process becomes more difficult because of the number of factors that have to be taken into consideration for the analysis.

In other words, the decision is directly related to the value assigned to its consequences or results, especially when it involves large-scale complex systems and can create major impacts on the population or a nation.

There are insufficient resources to evaluate all risks, especially for decisions involving complex interconnected and interdependent systems. Also, even if enough resources were available, there will always be unforeseen or unknown risks constantly emerging as a result of the operation and evolution of the systems and their environment.

The main goal of the present research is to introduce the idea of serious gaming concept as a teaching application in graduate level and the use of simulation computer game "SimCity 2013" as a teaching tool in a way that effectively enhances students' learning experience on risks and vulnerability concepts.

2.1. Applicability of Gaming in Education

Games have been created with the purpose of entertainment for a long time. They have always attracted people because they provide fun and excitement. For this reason, game developers have tried very hard to invent and introduce the new ways of enjoyment.

Thankfulness to the rapid advancement and extensive expansion in computer hardware and visualization technologies, each and every time, the graphical detail and definition of games have become more realistic and accurate to the player. With the ability to mimic or simulate reality, some game designers started to adopt a purpose of playfulness to develop another kind of games, a more serious one. Those applications can be used for research, education, and training as if they are seen fit or compatible with the study and finding objectives. When discussing the use of games or concept of gaming in education, there are at least four categories of existing idea emerging in the literature:

- Serious Gaming;
- Simulations;
- Game-Based Learning;
- Gamification.

Digital games always have outstanding motivational potentiality; they manipulate a set of design elements to encourage players to interact with them willingly without any rewards, but just for the satisfaction of playing and the opportunity to win. So much so that playing video games or computer games undoubtedly consume the attention of players. By watching students or participators play the video games or computer games, indeed it becomes apparent that they prefer this way of learning approach rather than traditional ones (Griffiths, 2002). However, it is unquestionably relevant to assess the extent that the technologies of serious games had a positive impact on education. Since serious games have the capability to acquire concentration and to stimulate motivation of players in learning experiences and outcomes, consequently, it has led to an emergence of gaming terminologies in education, including edutainment, serious gaming, and gamification respectively. In fact, serious gaming can be viewed as a redefined version of the first fundamental gaming concept in education "edutainment", which was considerably popular during the 1990s. At that time, edutainment - educating through entertainment – became well-known due to the booming growth of personal computer market (Michael and Chen, 2006). The term was usually used to describe any types of education that are concurrently knowledgeable and enjoyable. The primary target group was young children in elementary school and junior high school with the focuses on reading, mathematic, and science.

Unfortunately, due to a growing interest on the Internet and the poor quality of the games themselves, edutainment has finally failed to mark itself as the first milestone in the history of gaming in the academic world (Michael and Chen, 2006; van Eck, 2006). Yet, the development of digital games for non-entertainment purposes was begun and evolved longer before a flourishing era of edutainment. As edutainment failed to prove its applicability and practicality, the concept of serious gaming was subsequently re-examined during the late 1990s (Susi, Johannesson and Backlund, 2007). In 2002, with a released campaign of the video game, America's Army, by U.S. Army and founded institution of the Serious game Initiative by Woodrow Wilson Center for International Scholar in Washington, D.C., a journey of serious gaming got started.

In general term, serious gaming usually refers to the uses of video games and computer games for informing, educating, and training at all genders and ages. The concept itself inherits the same primary goals as edutainment but extend far beyond teaching facts and rote memorization (Michael and Chen, 2006). By way of example, Corti (2006) simplifies the term of serious gaming that "Serious gaming is all about leveraging the power of computer games to captivate and engage end-users for a specific purpose, such as to develop new knowledge and skills." Today's "serious games" is serious business; as stated by Ben Sawyer, co-founder of the Serious Games Initiative (Susi, Johannesson, and Backlund, 2007). In 2006, digital gaming sector was estimated with a value of $10 billion per year industry and the market of serious games only was roughly worth $20 million, however, it is expected to grow continuously over the next decade (van Eck, 2006). During the last decade, serious gaming has been applying to a broad spectrum of applications areas and research domains, including military, government, education, corporate, and healthcare, and also earning a widespread recognition of distinctive features and intrinsic capability from both public and private organizations. Nowadays, a concept of serious gaming is becoming even more and more popular in the global education and training market. As of November 2018, a Google-search on "serious games" and "serious gaming" renders about 670 million and 159w million hits in the results. Consequently, the term itself is already established, but there is still no universal accepted definition. Many sources or references either describe the concept vaguely or do not define it clearly. They just clarify serious gaming as an intention of using digital games to achieve something greater than an entertainment purpose. Moreover, it also interestingly appears that there are not many commercial digital games in the market that carry such those educational value. Hence, when discussing the serious gaming, the key question is, "What the fundamental concept itself means actually?"

Speaking about the term of serious gaming in academic society, the Department of Technology, Policy, and Management, TU Delft, a leading institution in serious gaming, provides the definition that "Serious gaming involves the use of concepts and technologies derived from (computer) entertainment games for non-entertainment purposes such as for research, policy and decision-making, training and learning. Serious gaming often combines analogue techniques (pen

and paper) and social interaction with state of-the-art game and simulation technology (immersive 3D virtual game worlds)". Furthermore, many research and experimentations also suggest that some critical or unique skills may be developed or strengthened by playing serious games (Griffiths, 2002; Squire and Jenkins, 2003; Michael and Chen, 2006; van Eck, 2006; Susi, Johannesson, and Backlund, 2007). For instance, the abilities of spatial planning and visualization, such as creative and critical thinking, data allocation and management, and three-dimensional objects rotation and manipulation gradually can be evolved along with gaming experiences (Subrahmanyam and Greenfield, 1994). Given that, serious games may seem to be more effective and advantageous for young people, like children and teenagers, who started out with relatively beginner skills. As a result, researchers, educators, and corporates are now using video games and computer games as an application or a tool for studying individuals, teaching students, and training personnel and staff. Many of these reasons have provided evidence and insights as to why they may be useful for educational purposes (Mitchell and Savill-Smith, 2004). For example:

- Serious games can be used as measurement tools or applications for research. As investigation and study tools, their potentials are diversity;

- Serious games attract participation across different demographic boundaries, including age, gender, ethnicity, and educational level;

- Serious games can aid students in establishing objective, ensuring goal rehearsal, providing feedback and support, and maintaining records of behavioral change;

- Serious games are productive instrument since they help researchers to measure performance on a set of various tasks and can be easily applied, standardized, and perceived;

- Serious games can be utilized to examine individual characteristics, like self-esteem, self-dignity, and self-respect;

- Serious games can be playful, fanciful, and purposeful to participators in the same time. As a consequence, it seems simpler to receive and maintain the attention of participants for longer periods of time (Donchin et al., 1995). Also, due to the fact that they are amusement and excitement, they may also promote a learning experience in innovative ways;

- Serious games can create an element of interactive thinking, which may stimulate learning;

- Serious games allow players to encounter novelty, curiosity, and difficulty, these aspects may motivate learning as well;

- Serious games interact with players through state-of-the-art technology. This implicit interaction may help participants to overcome the fear of advanced technology or complex devices (Technophobia), notably computers (Griffiths, 2002);

- Serious games can be a computer-based simulation. This innovation enable participants and players to engage extraordinary events or unusual activities in the form of complex computer models and to interact with each other without real consequences.

In the same time, using serious games as applications or tools in educational context also have some disadvantages. For instance:

- Serious games may cause young participants, especially children and teenagers, to become excessive excitement. Under this condition, those players can produce unpleasant emotion or inappropriate behavior, such as competitiveness or aggressiveness;

- Serious game technologies have unceasingly developed from time to time. As a result, they are frequently being upgraded, which in turn, it is even harder for researchers or educator to test and evaluate the impacts across studies in an academic environment;

- Serious game exercises may enhance a few certain skills and experiences on some participants, which can lead to the inconsistent or incompatible evaluation results.

To rephrase it, it is not an absolute principle that all serious games are always good for all learning experiences and outcomes (van Eck, 2006). Notwithstanding the drawbacks, it would obviously clear that employing serious gaming in an academic context would influence positive educational purposes in any case.

Inevitably, it is imperative that researchers and educators must examine and evaluate the use benefits and positive potentials of serious games while remaining aware of possible unintended negative effects. Given all these points, most people would probably support the use of serious gaming if they are confident that those digital games were appropriately selected to help them learn about difficult topics or complicated problems.

3. Urban Planning Simulation Computer Game "SimCity 2013"

SimCity 2013 is an opened-ended and simulation computer game for city building and urban planning, which originally designed and formally introduced by American video game designer named "Will Wright," a co-founder of the game development company "Maxis." In fact, the game was firstly published in 1989 as SimCity, renamed later as SimCity Classic, and then was conti-nually spawned its first original version to several different editions later, including SimCity 2000 (1994), SimCity 3000 (1999), SimCity 4 (2003), and SimCity Society (2007). Eventually, regar-ding a massive and ongoing success of all five previous editions during the past two decades, a whole new redesign of SimCity 2013 edition was officially introduced and released once again in early of March 2013.

This latest version is a successor that supposes to continue a story of legendary simulation game from its predecessors and to succeed the next level of achievement of all-time best city building and urban planning simulated computer game.

In 2013 version, players will have the ability to construct a settlement that can consistently grow into a city by zoning land, including residential, commercial, and industrial development, as well as essential service facilities, as shown in Figure 1, 2, and 3. Cities in a region will be interconnected and interdependent to each other via predefined regional networks, such as highways, railways, and waterways. The major infrastructures, like economic, energy, transportation, and pollution systems will visibly flow between cities (Electronic Arts, 2013). Moreover, cities will also trade resources or share public services with their neighbours, like garbage collection or healthcare service. Cities can pool their collective wealth and resources to build a greater and larger system network and to provide benefits for the entire region, such as a massive solar power plant or an international airport as same as a concept "the larger in the size of region, the higher in the number of cities and great works that can be built" (Electronic Arts, 2013).

Figure 1. Simulated City Using SimCity 2013 – Residential Zone

In term of game planning, operation, and management strategies, players will need to specialize their cities into particular industries, such as manufacturing, education, tourism and gambling, and others. Each of them will require distinctive urban planning, simulate behavior, and economic strategies. Players will have either option to heavily specialize a single industry in each city or to assign multiple specializations in any given city for diversification (Electronic Arts, 2013). The game will also feature a simulated global price and economy. For instance, prices of key resources, including coal, ore, and crude oil will fluctuate depending on the game global supply and demand. In other words, if players all over the world are predominantly selling specific resource on the global market (in the game) during the same period, this will drive the price for that

resource down. Conversely, a resource that experiences very little exposure in the world market will be considering as a scarce resource, which driving the price up.

Figure 2. Simulated City Using SimCity 2013 – Commercial Zone

Consequently, except the fact that SimCity has been surprising commercial success based on an advancement of complex simulation, it is still remarkable and peculiar because of what it does not have. To be more specific, SimCity is missing a couple of common elements that are considered most counter-productive by motivational theorists. First, there is no competitive element; it is impossible to play SimCity either against another person or the computer. Second, there is no external imposition of goal structure. It is impossible to win at SimCity, unless by fulfilling self-chosen and self-defined goals. Regarding SimCity's designer, Will Wright claimed that as a matter of fact that SimCity's lack of goals, it makes SimCity not a game, but just a toy (Bos, 2001). Hence, SimCity may serve as a setting for self-defined games: build the grandest possible megacity; maximize how much your people love you; and build a city that relies solely on mass transit. Whatever goal players have chosen, they have turned it into a game. Providing that self-defined goals are potentially superior from a motivational theorist's point of view, since they avoid or, in some case, replace the intrinsic motivation of killing pitfall with extrinsic motivation of self-defined goals, which most likely as same as inspiring players to develop their habits of goal setting and goal monitoring. An example of in a classroom setting, teachers may probably need to create goals for students using the simulation, or at least constrain students' possible self-chosen goals, but in any case, these goals would not have to be set against the external imposition of goals by the game.

Figure 3. Simulated City Using SimCity 2013 – Industrial Zone

Last but not least, SimCity 2013 also has a unique style of learning experience by increasing its challenge level. In early stages of SimCity, players can ignore some minor rules, policies, or constraints, and their city will still be growing. Progressively, players must learn to manage tax rates, property values, crime, pollution, mass transit, waste removal, and other factors, as their city gets larger. None of these conditions are required to be dealt within a given period, but all of them must be taken into account for the continuous growth of a city. This is a brilliant and natural this primary characteristic of a learning experience, "organic scaffolding", can be compared to arcade-

style games that usually artificial and inflate a level of difficulty and to complex learning environments that regularly present a tool in its full complexity from the outset.

4. Design and Development of Simulation City by Using SimCity 2013

Fundamental goal of playing SimCity is to build a city. It may sound like a simple task, but in fact, it is quite challenging. When starting a new city, there are neither best strategy nor specific technique that can be used as a routinely based approach. The game provides a lot of freedom in what the player can build, so that many people tend to construct essential infrastructures and service facilities without the pre-design of city layout. In this study, to use the application of simulation urban planning game for the non-entertainment purpose, especially at higher education level, the systematic urban planning is definitely inevitable.

In SimCity 2013, the player will be assumed the role and duties as a city mayor. The central aspect of this character is all about construction and zoning, which comprise a wide range of responsibilities, including laying down the roads, manipulating the land areas, providing the essential facilities, maximizing the service capacities, and otherwise balancing between demand and supply of resources. Most of the time, the player will work with the main menu bar across the lower end of the interface. This menu bar contains fourteen buttons with fourteen different options. Each of them is distinguished by the symbols, such as lightning bolt, plumbing, trash can, firefighter helmet, and police badge, as depicted in Figure 4.
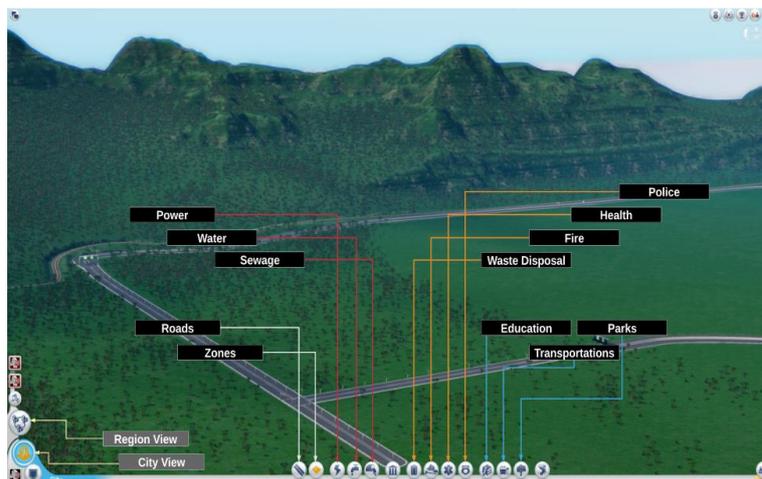

Figure 4. SimCity 2013: In-Game Main Menu Bar

4. Conclusions

The use of a concept of serious gaming in commercial and industrial sectors has been widely accepted and agreed to be a promising strategy in training employee skills as well as promoting customers experiences and satisfaction. Even though this technique was proven to provide a considerable level of success in marketing practices and business management, adopting this technique in the academic field, notably higher education, to teach certain knowledge or to encourage learning experience could be difficult to some extent. By all means, choosing games that can benefit learning experiences and outcomes is quite complicated. The challenges and problems found when adopting games into the educational system are also varied.

Bereitschaft (2015) asserted that when using SimCity for an educational purpose, particularly at the university level, the limitations and inaccuracies of the game limit its utility in understanding the complexity of urban planning processes. While professional urban planners and theorists who familiar with the required knowledge or experiences would be able to understand the underlying principle by themselves, most players without the proper training will be contextualized biases woven by the game mechanism. This reference seems to be valid and consistent to the finding from routine observations on students' modelling progress. During the actual

experimentation periods, many students tend to start the modelling process without laying out the road pattern or conditioning the zones even the completed basic instructions were presented in the classroom. That is to say, in order to optimize the percentage of success in utilizing SimCity 2013 under the concept of serious gaming, clear instructions and comprehensive demonstration must be provided to the students. Besides the limitation of the pedagogical tool embedded in the game itself, the mind-set condition of participants could be a concern as well. Frequently, when a serious game is included in the coursework as a learning tool, players (students) will try to master the game context and mechanism for experiencing the learning contents. However, non-gamers, people who have less or no digital gaming experience, will spend more time and effort to figure out how to play the game rather than exert to understand the intended learning material. Heeter et al. (2011) suggested that this situation even makes it harder for them to benefit from serious games. Feeling lost or incompetent while attempting to play the game could cause negative impacts that create performance deficiencies, which in turn resulting in negative consequences for learning.

REFERENCES

1. Bos, A. (2001). *Adult Education in the Community Colleges*. In D. H. Poonwassie and A. Poonwassie (Eds.), Fundamentals of adult education: issues and practices for lifelong learning (1st ed., pp. 171-188). Thompson Educational Publishing.

2. Corti, L. (2006). *Editorial to special issue on defining context for qualitative data*. Methodological Innovations Online, 1(2) available online at: https://journals.sagepub.com/ doi/abs/10.4256/mio.2006.0007.

3. Dicheva, D., Dichev, C., Agre, G., and Angelova, G. (2015). *Gamification in Education A Systemic Mapping Study*. Educational Technology and Society, 18, 75-88.

4. Donchin, Y., Gopher, D., Olin, M., Badihi, Y., Biesky, M., Sprung, C. L., Pizov, R., Cotev, S. (1995). *A look into the nature and causes of human errors in the intensive care unit*. Crit Care Med. 23(2):294-300.

5. ElectronicArts (2013). *Annual reports, available online* at: http://www.annualreports.com/ HostedData/AnnualReportArchive/e/NASDAQ_ERTS_2013.PDF.

6. Griffiths, M. D. (2002). *The educational benefits of videogames*, Education and Health 20, pp. 47-51.

7. Heeter, C., Lee, Y., Magerko, B., Medler, B. (2011). *Impacts of Forced Serious Game Play on Vulnerable Subgroups*. International Journal of Gaming and Computer-Mediated Simulations (IJGCMS), 3(3), 34-53.

8. Lee, J., Hammer, J. (2011). *Gamification in Education: What, How, Why Bother?* Academic Exchange Quarterly 15(2):1-5.

9. Michael, D. R., Chen, S. L. (2006). *Serious games: games that educate, train, and inform* (Boston: Thomson Course Technology).

10. Mitchell, A., Savill-Smith, C. (2004). *The use of computer and video games for learning. A review of the literature. Learning and skills development agency*, available online at: https://dera.ioe.ac.uk/5270/7/041529_Redacted.pdf.

11. Squire, K., Jenkins, H. (2003). Harnessing the power of games in education. Insight, 3, 5-33.

12. Subrahmanyam, K., Greenfield, P. M. (1994). *Effect of video game practice on spatial skills in girls and boys*. Journal of Applied Developmental Psychology 15(1), pp. 13–32.

13. Susi, T., Johannesson, M., Backlund, P. (2007). *Serious Games – An Overview Technical Report HS-IKI-TR-07-001*, University of Skövde, Sweden.

14. Van Eck, R. (2006). *Digital game-based learning: It's not just the digital natives who are restless*. EDUCAUSE Review 41(2), pp. 16-30, available online at: https://er.educause.edu/ articles/2006/1/digital-gamebased-learning-its-not-just-the-digital-natives-who-are-restless.

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