

Available online at www.sciencedirect.com**SciVerse ScienceDirect**

Procedia - Social and Behavioral Sciences 46 (2012) 5502 – 5508

Procedia
Social and Behavioral Sciences

WCES 2012

The serious game: what educational benefits?

Houda Mouaheb ^a, Ahmed Fahli ^b, Mohammed Moussetad ^b Said Eljamali^c^a LIRADE-TIE ORDIPU, Faculté des sciences Ben 'Msik, Casablanca 20700, Maroc^b LMI, Faculté des sciences Ben 'Msik, Casablanca 20700, Maroc^c LIRADE-TIE ORDIPU, Centre pédagogique régional, Casablanca 20330, Maroc

Abstract

This work lies in the educational opportunities of a learning tool: the serious game. The serious game was investigated using an American example: Virtual University. We first highlight the main features of this media, namely that it can be used as: a teaching tool, a means of entertainment, and as a technology of information and communication. It aims for multiple learning objectives, it finds application in many areas and it targets all age groups. Then, we show that learning through the serious game has educational values that are based on learning concepts advocated by constructivist psycho-cognitive theories; it guarantees intrinsic motivation, generates cognitive conflicts and provides situated learning.

Keywords: serious game, constructivist psychocognitive theories, intrinsic motivation, socio-cognitive conflicts, situated learning;

1. Introduction

The game, since it first appeared, has fascinated children and adolescents and they dedicate most of their leisure time to it, if not more! The game has also penetrated the world of education allowing the birth of video games such as the serious game.

Since 2002, we have witnessed an explosion of interest in this type of game. Interest that is reflected in the considerable number of games that have been developed, the multiplication of events on the subject, a tendency to its marketing, and a diversification in the areas of application. But, why is there such an infatuation for this new media?

Beyond the major advantages that developers can put forth for the user of this type of game, our interest lies in the educational opportunities that can be provided by such a learning tool. In this respect, we question the educational benefits of the serious game. In other words, wouldn't the increased interest in such a tool be particularly related to its teaching strengths? And to better inform our thinking we relied on a concrete example: Virtual University; an American game dedicated to training in the management of universities.

In this regard, we assume that the serious game presents teaching values that are based on conceptions of learning advocated by the constructivist psycho-cognitive theories: it would ensure intrinsic motivation in the learner, generate cognitive conflicts in him, and would provide situated learning.

The verification of these assumptions would allow for a possible integration of this type of game in classrooms and at the same time highlight the theoretical references of the act in order to teach students in recreational activities. References would then be the basis for the design of serious games for education or training. Firstly, we present the

main features of the serious game, and after the presentation of our example, Virtual University, we focus on presenting the educational values of such a tool.

2. The main features of the serious game

A survey in the world of serious games has provided a wide range of definitions, from which we selected two basic accuracies that can be used to highlight the main features of this tool. We mention first the definition of Etienne Armand Amato (2007): "the" serious games, "may be defined as utilities video games, productive in other words, whose design aims to bring about a transformation in their recipients in line an improvement of skills (training), the adaptation to the environment (treatment of phobias), understanding of a phenomenon (education) or greater adherence to the message (promotion, advertising, ideological video games, also known as Political games."

According to Julian Alvarez (2007), the serious game is a, "computer application, which aims to combine aspects of both serious as, but not limited to, teaching, learning, communication, or further information with entertainment from the spring game. Such an association has intended to depart from mere entertainment." The definitions cited associated with the consultation of several examples of serious games, have allowed us to highlight the following characteristics of this type of media:

- An object teaching priorities: the serious game is a learning process;
- A means of entertainment in parallel: the serious game is a game
- A technology of information and communication: the serious game is an application of video game technologies;
- It targets multiple learning objectives: to teach, train, educate, heal;
- It applies in almost every field: education, vocational training, health, defense, politics, advertising, business;
- It is intended for all age groups: children, adolescents, adults and older people.

3. Overview of Virtual University

3.1. *What is Virtual University?*

Virtual University is the first fully interactive tool that simulates administration of a university system; with all the aspects of administrative life so as to promote a better understanding of management practices in American Universities. In moving through the campus of Virtual University, the players take notes of the information needed to make decisions, depending on the mission to accomplish in relation to one of the ten scenarios that the game offers.

3.2. *The environment of Virtual University*

The website: www.virtual-u.org is the centerpiece of the game. It is free to download and provides all necessary information such as: its various uses, documentation on how to use the game, how to ask for training, an email forum to interact with members of the development team and other users.

3.3. *Overview of the functioning of Virtual University*

An opening screen offers six options including a virtual one that can start a new game scenario "New Scenario Game." Once booted, a second screen shows a list of ten scenarios. Each is accompanied by a formal explanation of the nature of the specific challenge that the player must accomplish as administrator of the establishment. After choosing a scenario, the player must choose the type of facility to be simulated. Then a welcome letter explains the exact task at hand. Finally, the screen of the virtual campus introduces the player straight into the game.



Figure 1: Display of the virtual campus of Virtual University.

This screen shows six areas that enable the player to monitor the status of important variables and implement decisions based on the strategy pursued to solve the problem scenario that confronts the player. These are: Campus, Faculty, Students, Courses, Performance, Finance and Score. The game gives for each sector, a set of parameters (variables and information) necessary to choose the appropriate strategy and implement the decisions taken. In addition to these sectors, the option MORE REPORTS displays a series of eight reports: admissions and financial aid, sport, development and alumni affairs, facilities management, library and information technology, investment, parking and police station. On this same screen, other options appear such as: the total amount of money that university has, the note of the evaluation of the administrator, the overall score, a calendar, an aid, the report of administrators, and a blackboard that displays sudden incidents and objectives to achieve.

4. The pedagogical virtues of serious games

4.1. Serious game interaction and intrinsic motivation

According to the Larousse dictionary, motivation is, "physiological and psychological processes responsible for the initiation, continuation and termination of behavior." The serious game, being a video game, brings together two aspects to which it owes its motivation: playfulness and technology. Malone and Lepper (1987) have specifically addressed motivation and play in a learning context. They cited four key characteristics found in any environment characterized as intrinsically motivating: challenge, curiosity, control and the imagination / imaginary (fantasy). According to them, it's the game that succeeds in bringing together all of these features that is the most popular. In fact, the challenge and curiosity generated by the uncertainty in the game, the hazard and the unpredictability of the outcome in advance activate and maintain the desire to continue the activity. The feeling of control resulting from freedom makes the player the master of the game and they guide its progress towards the desired goal based on the feedback received. Finally, the imagination / fantasy keeps players away from everyday life where they exist in a fictional context in which they can venture out and suspend any active suspicion. This freedom allows the player to increase experiences and trials and gradually to turn its potentialities into skills and knowledge. While research for the success or performance led him to overcome difficulties that are no more resolved under pressure or obligation.. The game reduces anxiety associated with the learning process and allows the learner to learn easily without even being aware. This freedom associated with fiction changes the status of the error. Errors made by learners are no longer seen as a failure that could impede their progress but as an essential and needed phase of the game.

On the other hand, Csikszentmihalyi (1990) identifies the concept of "flow" also known as "optimal experience" as a specific aspect of gaming activity that is likely to create an ideal of the motivation that would decrease its peak.

It appears that in an educational context the game is likely to make the learning process interesting in itself to obtain the greatest motivation in the learner.

If the idea of learning through playing is nothing new in itself, and the game has for a long time been recognized for its educational values, the advent of technology has given us many new opportunities to learn. The educational objective associated with the design techniques and the technologies of traditional video games make the serious game a new multimedia educational tool that benefits, in addition to the educational virtues of playing, of all the educational benefits of information and communication technologies in education or ICTE, particularly in terms of motivation. In 1996, researchers at Laval University (High School of Education) in Quebec published a report on "the contribution of new information technologies and communication in the learning of elementary students and high school. Of the 14 findings that these researchers found, we selected the following two regarding the role of ICT in learner motivation:

- More interest and attention given to a learning activity;
- The development of the spirit of research that ensures the continuation of the activity of learning.

4.2. *Serious game interaction and socio-cognitive conflict*

As mentioned by Johsua S. and Dupin J.J. (1993), the interaction of the learner with the environment and the creation of a cognitive conflict are central to Piaget's constructivism. Without denying the basic principles of constructivism, other theorists, such as Vygotsky, tried to go beyond Piaget's individualistic reductionism by offering the concept of socio-cognitive conflict as the basis for development and learning: social constructivism. In particular, we specify that it is in part, a socio-constructivist perspective that learning activities offered by the serious game are registered; an idea that we largely developed in previous work (Mouaheb et al., 2010).

The serious game, like any video game, involves active participation by the player. Also, reiterated by the necessity to distinguish between "mechanic interactivity" and "mental interactivity", as it was made clear by Jacquinot (1997).

In Virtual University, the player can move around the campus and manipulate several parameters, such as increasing spending on information technology to improve educational quality. This maneuver is mechanic of course, but it presupposes that the player reacts mentally from the problem situation that is presented. It must first consider in relation to different strategies to improve educational quality and to choose the most appropriate. In addition, Virtual University reflects the reality in true grandeur. This wide context permits the simulation of reality in all its complexity and therefore consideration is needed of all the parameters that interact both at the level of each activity or specific competence covered by the game that between all activities or specific skills in relation to the general competence that the game seeks to develop in the learner.

The simulation of these interactions and their dynamics in a global context provides the player with an intense mental and intentional interactivity so he can monitor as in reality the consequences of his actions following the decisions taken. This interaction provides a fertile ground for the generation of real cognitive conflicts ensuring a personal and solid build of knowledge.

Returning to our example, the player has the ability to track the consequences of his decisions. If the budget does not allow the increase to be made, the player will have to think of other strategies. Thus, the player will discover for himself the strategy, among others, to adopt.

It should also be noted that Virtual University can be played individually or with others. It is recommended initially to involve more students in the game. Thus, the confrontation of their cognitive schema will offer more opportunities to set up processes for adaptation knowledge and initial structures that will help to improve the equilibration process. The individual game will, thereafter, improve the performance of each player.

Virtual University therefore meets the basis of learning and development according to social constructivist thought.

4.3. *Serious games and situated learning*

In this section we propose to evaluate the situated character of learning via Virtual University, based on the nine principles of situated learning proposed by Herrington and Oliver (2000, p23-48); recommended for the design and implementation of situated learning environments:

- Learning in authentic context:

Training in the management of a university as a learning approach that is "situated", consists first of placing the learner in an authentic context, a U.S. institution of higher education. In Virtual University, the observation of this principle appears in different aspects of the game, both topical and related to the notion of time as compared to the parameters contained in the game and ensure its operation. This is part of all the information needed to choose the appropriate strategy as well as manipulate variables for the implementation of decisions taken. First of all, Virtual University simulates the management of four types of actual existing American universities, each with its specifics (private, public, number of departments, number of teachers etc). The player can choose the type of institution to manage according to his needs. On the other hand, the game has not neglected any place that actually exists in the university campus. Police and parking are also included in the virtual campus. In addition, a calendar permits the tracking of the player's activities during the academic year by offering the opportunity to implement strategies in the short and long term. Note also that the parameters of the game have been compiled from hundreds of U.S. universities. However, unlike the real campus, access within a given space is not allowed, only a sound effect reflects the location (croaking of frogs in the Biology Department, sirens for police etc). But from a management perspective, a university's president designs different places, especially through accounts and reports, which present all the information necessary for the implementation of strategies.

- Authentic activities:

Tasks to be carried out in the Virtual University are summarized in the implementation of decisions taken to meet the challenge specific to each of the ten scenarios of the game. The same scenarios were developed, of course, so to place the player in problem situations that they will encounter in reality. But the authenticity of these activities is measured primarily by the complexity of the university due to the interaction between different sectors of the institution. Precisely, Virtual University reflects the changing face of the different parameters of the university against each other, thus, playing a scenario does not occur independently of each other. Finally, note that Virtual University brings out messages that correspond to events that occur suddenly during the game to simulate unexpected events that all directors must manage for their business.

- Access to the skills of experts and a process modeling:

In the context of a face-to face training players have direct access to the performance of expert trainers in the management of universities and to their mental processes and practices implemented in the game. As part of an autonomous or remote training this principle is observed through:

- A strategic guide that the website is available to any user.
- A multimedia tutorial, also available on the website.
- An integrated help option in the game.

- Multiple roles and perspectives:

A university president is required to manage a complex organization and must therefore play several roles. In Virtual University the play of a scenario is not exclusive but is recommended for beginners. The player should target multiple goals for performance. This offers him a multitude of perspectives in different areas of knowledge since the game covers all aspects of university management.

- Collaborative construction of knowledge:

This principle is fully respected in a face-to face training during which an exchange takes place on the performance of different players using the game individually or in teams, providing a collaborative construction of knowledge. In the context of distance education, the game does not provide an integrated forum for exchange between different learners. Still, they can exchange games and chat after saving them (option allowed by the game) by sending them by email.

- Reflexive demarche:

In addition to the exchanges and discussions that students may have with the instructor or each other, and which represent a fertile ground to reflect on the learning undertaken and the difficulties encountered, the game itself ensures this reflexive approach through various options of the game:

-Graphs show the evolution of important parameters of the university management by allowing the player to monitor applications.

-An envelope icon allows you to view during each fiscal year progress compared to the scenario chosen and the total points accumulated.

-At the end of each academic year, the player receives a letter of evaluation that shows in detail the opinion of the committee evaluation specifying the best performances and aspects of the university that management is to improve the following year.

The score-available at any time presents the overall score and an overview of various performance indicators for each fiscal year.

- Tacit knowledge explicit:

Playing Virtual University by operating variables to implement the decisions taken is in itself an explanation of tacit knowledge.

- Support in the form of coaching, scaffolding and fading of the trainer and peers:

In either the present context of training or from a distance, the teacher or tutor as well as the expert management of the university in terms of facilitator training, must accompany the players or guide them during the learning process. Depending on the needs of learners, this framework can take the form of coaching, scaffolding or fading. Not to mention the considerable contribution of peers in this process of mutual exchange concerning the performance of each other.

- Integration of assessment of learning in learning activities:

In Virtual University, the assessment of learning is very much integrated with learning activities and takes different forms. The graphics, the envelope in the virtual campus, the score and the letter of evaluation of year-end are all elements of assessment that the player receives throughout its business. The detailed nature of the score and the letter at the end of year reports on the evaluation criteria.

5. Conclusion

Given the diversity of its applications, it appears that the concept of "Serious Game" is a vast field that is not limited to training and may in particular be used for other educational purposes. However, the characteristic features of this concept were identified as an object teaching:

- A means of entertainment;
- An information technology and communication;
- It targets multiple learning objectives;
- It applies in almost any field;
- It is for all ages.

With the help of the literature and the inclusion of some key concepts of constructivist psycho-cognitive theories namely: intrinsic motivation, socio-cognitive conflict and situated learning, we treated the example of the serious game called "Virtual University".

This treatment allowed us to identify the following key points: From its playfulness combined with video game technologies, this tool is able to motivate learners intrinsically; the simulation game also recreates learning situations extremely close to that of reality, especially considering the complexity, dynamism and all of the interrelations and interactions that exist within the university system. This is a major educational advantage by encouraging:

- An intense interaction that generates real cognitive or socio-cognitive conflicts, providing a solid construction of knowledge;
- An autonomy in the learning process following a strong metacognitive activity;
- An eventual transfer of acquired skills.

It follows that "Virtual University" is a tool that can serve in management training at American universities. However, this result would gain in relevance by a systematic assessment of the game from potential users for a pragmatic validation. But the problem arising from the use of "Virtual University" in Morocco is its incompatibility with the functioning of the Moroccan university system. We plan to design a serious game adapted to a Moroccan context, based on this example.

References

- Alvarez, J. (2007). Du Jeu vidéo au Serious Game : approches culturelle, pragmatique et formelle. *Thèse spécialité science de la communication et de l'information*. Toulouse : Université de Toulouse II (Le Mirail), Université de Toulouse III (Paul Sabatier), 445, 6.
- Amato, E., A. (2007). Vers une instrumentalisation communicationnelle des jeux vidéo : quelles formes de séduction idéologique ou publicitaire ? Colloque international EUTIC 2007 : "Enjeux et usages des TIC", 7-10 novembre 2007.
http://www.omnsh.org/article.php?id_article=134
- Csikszentmihalyi, M. (1990). Flow: the psychology of optimal experience. Harper & Row. New York, USA. Traduit et adapté de l'anglais par Lucas.M in Revue québécoise de psychologie, vol. 18, n° 2, 1997.
[\[http://www.rqpsy.qc.ca/ARTICLE/V18/18_2_169.pdf\]](http://www.rqpsy.qc.ca/ARTICLE/V18/18_2_169.pdf) . Consulté en décembre 2007
- Doise, W, Mugny, G, & Perret-Clermont, A.N. (1976). Une approche psychosociologique du développement cognitif . *Archives de Psychologie*, 171, 135-144. Version électronique (pdf). [\[http://www2.unine.ch/webdav/site/psy/shared/documents/publications/1976Uneapprochepsychosociologiquedudeveloppementcognitif.PDF\]](http://www2.unine.ch/webdav/site/psy/shared/documents/publications/1976Uneapprochepsychosociologiquedudeveloppementcognitif.PDF)
- Grégoire, R., Bracewell, R, & Laferrière, T. (1996). L'apport des nouvelles technologies de l'information et de la communication à l'apprentissage des élèves du primaire et du secondaire . *Revue documentaire*. Ottawa. Rescol/schoolnet
[\[http://www.tact.fse.ulaval.ca/fr/html/apport/apport96.html\]](http://www.tact.fse.ulaval.ca/fr/html/apport/apport96.html)
- Herrington, J, Oliver, R. (2000). An instructional design framework for authentic learning environments, *Educational Technology Research and Development*, vol. 48, no 3, p. 23-48.
[\[http://edserver2.uow.edu.au/~janh/Assessment/Authentic%20Assessment_files/ETR%26D.pdf\]](http://edserver2.uow.edu.au/~janh/Assessment/Authentic%20Assessment_files/ETR%26D.pdf)
- Jacquinet, G. (1997). Nouveaux écrans du savoir ou nouveaux écrans aux savoirs ?, *Apprendre avec le multimédia, où en est-on ?* . CEMEA.
- Joshua, S, Dupin, J.J. (1993). Introduction à la didactique des sciences et des mathématiques. Paris, PUF.
- Malone, T. W., Lepper, M.R.. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R.E. Snow and M.J. Farr (Eds.), *Aptitude, Learning and Instruction III: Conative and Affective Process Analyses*. Hillsdale, N.J.: Erlbaum, 1987. Cité par Schaller. D in *What Makes a Learning Game?* [\[http://www.eduweb.com/schaller-games.pdf\]](http://www.eduweb.com/schaller-games.pdf)
- Mouaheb, H, Fahli, A, Moussetad, M, & Eljamali, S. (2010). Le serious game et les théories psychocognitives constructivistes. *Colloque international Didactique et TICE IV*. Liban.
- Vigotsky, L. (1934). *Pensée et Langage*. Traduction de Françoise Sève (1997). La Dispute.