

Cognitive and Affective Impacts of Online Game-Based Learning About STIs: Formative Evaluation by Experts

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Introduction

An applied research project funded the Initiative of the New Economy (INE-SSHRC) and the AAP (Industry Canada) which led to the development of generic environment for designing single and multiplayer educational games to equip teachers (K12 to university), professional educators, community development agents and company trainers who wish to create educational games adapted to their learning needs while offering effective conditions for learning. These environments were built, on the one hand, after a literature review of research on essential game attributes (Sauvé et al, 2005 for the Simulations and Advanced Gaming Environments for Learning Project - SAGE) and, on the other hand, using the concept of frame games as developed by Stolovitch and Thiagarajan (1980), and adapted by Sauvé (Sauvé et al., 2002 and Sauvé, 2005).

To be more specific, the objectives of the research are: (1) to review the literature on the impacts of educational games; (2) to analyze the characteristics of existing games to root out the variables that are pertinent to learning; (3) to develop a generic game shell that integrates the essential variables for efficient learning; (4) to develop a game for both promoting health and for prevention and to get this validated by experts; (5) evaluate the impact of a game, conceived by practitioners for prevention and health promotion, in terms of the knowledge acquisition and the attitude change of the clientele being served by the practitioners.

This paper presents certain results of a study of an online digital game, in a Parcheesi format, which was developed to measure the impact of an online game designed to facilitate affective and cognitive learning about the prevention of sexually transmitted infections (STIs) on a secondary school audience. We will present in a precise manner the context of study, define the concept of educational gaming, and describe the methodology and the first results of the evaluation of the game by experts.

Context

The success of the Internet and the diversification of learning technologies have increased interest in games for learning. According to Livingstone (2002) and Ridley (2004), games have overtaken books and other media as forms of entertainment. In 2007, the video game sector represents a 25 billion Euro turnover (FUTURN, 2007). Forest (2006), estimates that the video game market in 2010 will be \$1.3 billion in Canada and \$46.5 billion in the

US. A 2002 American poll found that 92% of 2–17 year-olds had played video games and more than 2/3 of 2-18 year olds had a video game system at home (Kaiser Family Foundation, 2002). In Canada, 63% of 15-69 year olds had a mobile phone in 2004 (Ericsson Canada Inc., 2004). In Quebec, the NetAdos poll (Lamy, 2004) found that 60.7% of Quebecers aged 12 – 17 years old play online and that 26.5% of young adults (18-24 years) do so regularly. A more recent Quebec poll found that 68% of Quebecers use the Internet and 26% own a fixed or portable game console (Centre francophone d'informatisation des organisations [CEFRIO] and Léger Marketing, 2007).

Although the academic literature often discusses the creative potential of new technologies including educational games, in practice, this has yet to be realized. It seems that schools have not explored the educational potential of these new applications. In many countries, including Canada, the educational potential of digital games have not become a reality (Dempsey et al., 2002; J. Piette, personal communication, April 9, 2005; Prensky, 2005a, 2005b, 2006). A European Union inquiry into education and the media (Mediappro 2006) found a major gap between Internet use at home and in the schools; all important learning tools were found outside the schools including those essential for self-directed learning and learning among peers – functions which online educational games can support. Baldaro et al. (2004) and Barab et al. (2005) note that games have not been studied enough to establish their technological performance or the processes that assure their effectiveness and efficiency as learning tools.

According to Brougère (2001) (cited in Fournier, 2004), scientific studies in the domain are not conclusive; the “proof” of the educational value of games is insufficient, but he believes all the same that it is possible to learn while playing. Our systematic analysis of the literature on the impacts of games on learning (Sauvé, Renaud, & Gauvin, 2007a) supports his comments. Methodological weaknesses, problems with the definitions of concepts and operational variables, etc. do not currently permit us to clearly identify the real learning impacts of games.

The Educational Game

An educational game is defined as follows: an artificial situation (fictitious, fanciful) in which one player or more are put in a position of conflict (struggle, confrontation) or at times being set against each other (competition), or, at other times, players working together against other forces (cooperation); the game is governed by rules (game movements, game control and game conclusion) which structure the player's actions with one aim in mind, that of winning (winners vs. losers), being victorious (overcoming chance, beating the computer, one or several players) or defeating an opponent, all while learning (Sauvé, Renaud, Kaufman & Marquis, 2007b).

In order to be sure that the game being experimented on takes into account this definition, a study by Sauvé et al. (2005) of Web sites offering games has shown the following: (1) few games offer the learning content that answers the pedagogical and technological criteria looked for by francophone teachers; (2) the existence of online games that deal with scholastic subjects, in particular mathematics and French; (3) most online games demand long download times and sometimes they are expensive; and (4) few sites offer information on the acquired learning gained through the games themselves. In order to respond to the needs of the teachers concerning online learning through the use of games all while taking into account how young people learn, a generic game shell has been created from the framework of the game *Parcheesi*.

The concept of the generic game shell has been developed by Sauvé (Sauvé et al., 2002 and Sauvé, 2005) from the concept of the frame game elaborated by Stolovitch and Thiagarajan (1980). By frame game, we mean that it is a means of teaching which comprises a structure that generates learning activities supporting the use of diverse strategies, implying a conflict and a set of rules for the movement of players and criteria that ends the game by declaring a winner. This structure can easily be adapted to many different objectives and pedagogical content.

Since it is difficult to find a game that deals with health education, we have solicited two health specialists in order for them to create an educational game with the help of a computer generic game shell: *Parcheesi*. Their choice of content is concerned with Sexually Transmitted Infections (STIs) to reach out to their clientele: young people from 14 to 17 years of age. Since there is a lack of time to answer all questions during a medical consultation, they wished to make available a motivating means to obtain the pertinent information about Sexually Transmitted Infections. They have developed, with the research team, 73 learning activities which are grouped into four aspects of STI: (1) prevention: information on the correct ways to break the cycle of STIs transmission (types of condoms, identification of risky behaviours, etc.); (2) prevalence: the state of the situation on the importance of the number of

people infected or carriers of an STIs, and information on the infectious vectors themselves (their nature, their visible or invisible effects); (3) transmission of STI: information on how the different types of STIs can be transmitted. This category allows the players to question the widespread myths and beliefs already well anchored in the population at large and (4) treatment: information on the ways to heal (or coping with) sexually transmitted infections. This section also includes information on ways to prevent transmission to other people when you are infected; for example, abstaining from certain types of more risky behaviours during the treatment period and also information on what to do when you think you have been exposed to an infection. To these questions, the research team has added about 11 role playing activities which permit young people to express and reflect on STIs which will modify their attitudes and behaviours on a daily basis (Sauvé, Delage & Cantin, 2006).

Before experimenting on the game STI: Stopping Transmission on the target audience for our research project in order to measure the impact in regards to the change in knowledge, attitudes and behaviours, we validated, with the help of experts, the suitability of the content and the learning context for the targeted audience and if needed, we applied the necessary corrections before the experimentation.

The Methodology

Learner Verification and Revision (L.V.R.) is a formative evaluation process that helps to improve a system (the game) while it is still in the realization phase (Perron and Bordeleau, 1994). The approach consists in validating the game STI: Stopping Transmission with the help of experts from the domain in question (content and pedagogical) in order to measure: (1) the accuracy of the content conveyed by the game, (2) the concordance between the content and the targeted audience, (3) the visual aspect of the game and (4) the complexity and the degree of difficulty of the learning activities of the game for the clientele. Let us now examine the approach the experts used which is divided into three phases:

- The preparation for the evaluation demands the following: (1) establish the objectives and criteria of the evaluation, (2) choosing one or more evaluation instruments, (3) creating the evaluation instrument(s), (4) contacting specialists and experts in the domain (content and pedagogical) and (5) to place the experimentation material at their disposition.
- The verification consists of the following: (1) to navigate, read, visualize and manipulate the different parts of the game in function of the proposed procedures and (2) to distribute the measuring instrument to the experts.
- The decision consists of the following: (1) to compile, deal with and analyze the responses of the experts, (2) to prescribe, if necessary, any revisions and (3) to revise the game, if necessary, with the information collected from the experts.

To carry out the evaluation of the process of the game, ten experts were consulted. These experts were chosen for their expertise in the following areas: the targeted audience, the thematic of STIs and ergonomics.

The Results Obtained

On the level of the content, the experts consider the title is explicit as it pertains to the content and the information put forth in the learning activities on STIs are exact from the scientific point of view. The experts have however found that certain key elements of sexual education are absent from the game, such as, the notion of pleasure. They also state that the content of the game is a pertinent tool to verify the knowledge and acquisition of knowledge of post-secondary students. They also state that the content is more or less far off from the preoccupations, beliefs and representations of secondary students.

As it pertains to the target audience, the experts conclude that the game “STI: Stopping Transmission” aims for ambitious goals and a target audience that is too large: from secondary 3 to the first two years of university. In their view, the content of the game is rather appropriate for students in post-secondary studies and particularly those who study in sexology or medicine.

As it pertains to the visual aspect of the game, few comments were made. They found the structure of the game to be interesting and motivational and they judge that the game board (color and image) reaches out more to a post-

secondary audience and will be considered less appealing to adolescents. In addition, they have noted that the learning activities do not offer enough dynamic and multimedia content. They believe that all of the activities should offer this type of content in order to reach out to adolescents.

The complexity and the level of difficulty of the learning activities of the game for secondary students and young adults, profane in matters of STIs, needs to be adapted in terms of language and the media treatment of the learning activities. The experts suggest reworking the majority of the activities: with a total of 84 activities, only 15 were not commented on concerning their formulation as shown by one example in the following table:

Table 1. Example of a modification to a question

<p>Recommendations : Question : They suggested that we explain beforehand that there are different types of condoms. They suggested looking over the formulation of the question which has an opposition between “contribute” and “decrease”. Feedback : They suggest that we include with the feedback linked to a good answer an explanation of the same type offered by the feedback for a bad answer.</p>	
Before expertise	After expertise
<p>Polyurethane condoms contribute more to a decrease in sensations as compared to latex condoms.</p> <ul style="list-style-type: none"> • True • <u>False</u> 	<p>In the commerce industry, two types of condoms are proposed: made of latex (the more common) and made of polyurethane (sold mostly in pharmacies). Polyurethane condoms have the effect of reducing sensations as compared to latex condoms.</p> <ul style="list-style-type: none"> • True • <u>False</u>
<p>Feedback for a Good Answer: Well done! This is the correct answer.</p>	<p>Feedback for a Good Answer: Well done! This is the correct answer. Condoms made of synthetic membranes have a greater ability to transmit body warmth and sensations as compared to latex condoms. However, they are more expensive.</p>
<p>Feedback for a bad answer: The correct answer is “False”. Condoms made of synthetic membranes have a greater ability to transmit body warmth and sensations as compared to latex condoms. However, they are more expensive.</p>	<p>Feedback for a bad answer: The correct answer is “False”. Condoms made of synthetic membranes have a greater ability to transmit body warmth and sensations as compared to latex condoms. However, they are more expensive.</p>

They have also pointed out that certain learning activities put forward by the game are not placed in the correct category. The vocabulary is not always uniform. The links between the questions and the illustrations of 5 activities are not well adapted and can lead to confusion. The videos that are proposed were adapted for post-secondary students and they will have to be adapted for secondary students. All the corrections that were suggested by the experts concerning the learning activities were taken into account and a new version of the game has been elaborated.

Conclusion

Wishing to measure the impact of an educational game on cognitive and affective learning in a health educational context in secondary school, we chose a game, for young people from 14 to 17 years of age, which was developed by doctors with the help of the generic game shell of Parcheesi. Given the methodological weaknesses of research, we wanted to make sure that the learning content is appropriate for our target population. In order to do this, we have conducted a formative evaluation by experts according to the LVR method. This evaluation has permitted us to see that the game “STI: Stopping Transmission”, created by doctors, is more aimed at a university audience within a framework of verifying acquired knowledge. By making some modifications, the experts agree that the game will have positive impacts on the knowledge, attitudes and behaviours of students in secondary school. Many recommendations and suggestions have been made for this and have been taken into account.

This formative evaluation leads us to conclude of the necessity for pedagogical expertise in function of the target audience in order to be sure that the game responds well to the learning context in which it will be experimented. Even if the content is exact and scientific, it is of primary importance that the game is adapted to the language and the preoccupations of the target audience in order for the game to influence change in attitudes and behaviours. Imagine that the game was experimented on without this expertise! What conclusions would we have come to on the level of its real impact on affective and cognitive learning.

The game STI: Stopping Transmission will be tested in the winter of 2008. During the experiment, different variables will be measured with the help of a questionnaire and a monitoring system integrated into the game environment: structuring and integration of knowledge and also attitude and behaviour modification towards STIs.

References

- Baldaro, B., Tuozi, G., Codispoti, M. & Montebanacci, O. (2004). Aggressive and non-violent videogames: Short-term psychological and cardiovascular effects on habitual players. *Stress and Health*, 20, 203-208.
- Barab, S., Thomas, M., Dodge, T., Carteaux, R. & Tuzun, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Educational Technology Research and Development*, 53 (1), 86-107.
- Barnett, D. J., Everly, G. S. Jr., Parker, C. L. & Links, J. M. (2005). Applying educational gaming to public health workforce emergency preparedness. *American Journal of Preventive Medicine*, 28 (4), 490-495.
- Centre francophone d'informatisation des organisations (CEFRIO) & Léger Marketing (2007). NETendances CEFRIO - Léger Marketing. Retrieved October 6, 2007 from http://www.infometre.cefrio.qc.ca/loupe/omnibus/internet_0707.asp.
- Dempsey, J. V., Haynes, L. L., Lucassen, B. A. & Casey, M. S. (2002). Forty simple computer games and what they could mean to educators. *Simulation & Gaming*, 33 (2), 157-68.
- Forest, C. (2006, June 22). Canadian entertainment and media market maturing at a steady pace. Toronto: Price Waterhouse Coopers. Retrieved October 30, 2006 from <http://www.pwc.com/extweb/ncpressrelease.nsf/docid/0EE0753076513A1C852571940070FCCC>.
- Fournier, M. (2004). À quoi sert le jeu ? [What's the use of games?]. *Sciences humaines*, 152, 19-45.
- FUTURN (2007, March 29). L'iDate passe au crible l'Industrie française du jeu vidéo ! [iDate examines the French Video Game Industry]. Retrieved October 6, 2007 from <http://www.futurn.net/article.php?sid=258>
- Lamy, C. (2004). NetAdos 2004 - Sondage réalisé auprès des ados québécois & de leurs parents [Poll of Québécois adolescents and their parents]. Québec: CEFRIO. Retrieved October 6, 2007 from http://www.cefrio.qc.ca/rapports/NetAdos_2004_rapport.pdf.
- Livingstone, S. (2002). *Young people and new media: Childhood and the changing media environment*. London: Sage Publications Inc.
- Mediapro (2006). *The appropriation of New Media by Youth (Final Report)*. Louvain-La-Neuve, Belgium: Mediapro.
- Perron, L. & Bordeleau, P. (1994) *Modèle de développement d'ensembles didactiques d'intégration pédagogique de l'ordinateur*, In P. Bordeleau, (Ed.), *Des outils pour apprendre avec l'ordinateur* (pp. 513-553), Montréal.
- Prensky, M. (2005a, March 7). *Adopt and adapt. 21st-century schools need 21st-century technology*. Edutopia. Retrieved October 7, 2006 from <http://www.edutopia.org/adopt-and-adapt>.
- Prensky, M. (2005b, September - October) *Engage me or enrage me: What today's learners demand*. EDUCAUSE Review, 60-64.
- Prensky, M. (2006). *Don't bother me, Mom - I'm learning!* St-Paul, Minnesota: Paragon House.
- Ridley, K. (2004, October 18). *ACNielsen reports continued growth for video gaming industry*. ACNielsen. Retrieved December 15, 2004 from http://www.acnielsen.ca/News/VideoGaming_ThirdQtr2004Results.htm.
- Sauvé, L., Renaud, L. & Gauvin, M. (2007a). Une analyse des écrits sur les impacts du jeu sur l'apprentissage [An analysis of the literature on the impact of games on learning]. *Revue des Sciences de l'éducation*, 33 (1), 89-108.
- Sauvé, L., Renaud, L., Kaufman, D. & Marquis J.-S. (2007b). Games and Simulations: the differences. *Educational Technology & Society Journal*, July, 10 (3), 247-256.
- Sauvé, L., Kaufman, D. & Renaud, L. (2007c). A Systematic Review of the Impact of Games and Simulations on Learning. *ED-MEDIA 2007- World Conference on Educational Multimedia, Hypermedia & Telecommunications*, Vancouver, Canada, June 25-29, Full Paper, 10 p.
- Sauvé, L., Renaud, L., Kaszap, M., IsaBelle, C., Gauvin, M. & Simard, G. (2005). *Analyse de 40 jeux éducatifs* (online or on CD-ROM). Québec : SAGE et SAVIE, juin, 87 pages.
- Sauvé, L., Delage, M. & Cantin, F. (2006). A generic environment for online game creation for health prevention: design and implementation. *E-Learn 2006-World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* to be held. Honolulu, Hawaii, USA, October 13-17, 886-891 (cédérom).
- Sauvé, L., Renaud, L., Kaufman, D., Samson, D., Bluteau-Doré, V., Dumais, C., Bujold, P., Kaszap, M. & IsaBelle, C. (2005). *Revue systématique des écrits (1998-2004) sur les fondements conceptuels du jeu, de la simulation et du jeu de simulation*, Québec : SAGE et SAVIE, janvier.
- Sauvé, L. (2005). *Open and Distance Educational Gaming: using generic frame games to accelerate game design*. In A. Lionarakis (ed), Applications of Pedagogy and Technology, *3rd International Conference on Open and Distance Learning, ICODL 2005*, November 11 -13, Patra, Greece, 393-398.
- Sauvé, L., Power, M., IsaBelle, C., Samson, D. & St-Pierre, C. (2002). *Rapport final - Jeux-cadres sur l'inforoute : Multiplicateurs de jeux pédagogiques francophones : Un projet de partenariat*, Québec, June.
- Stolovitch, H.D. & Thiagarajan, S. (1980) *Frame Games*, Englewood Cliffs: New Jersey.