

eGAMES FOR e-LEARNING

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1. EXECUTIVE SUMMARY

Educational online games have been gradually winning more interest by several education process intervenients.

Several are the factors contributing to this interest. One of them is motivation.

With educational online games using it is possible to add fun in learning, which appeals student to learn difficult and boring contents.

Educational online games using has been largely studied and applied on the last years, however, e-learning environments using continues an opened topic, especially to the way how these games can be used by students.

Learning environments in e/b-learning should be motivating, learning-centricity, personalization, incremental learning, and immediate feedback, among others. E-Games use can explore these pedagogical principles.

Strategies for e-Learning should incorporate methods and techniques that keep students motivated to enable it to achieve their learning successfully. These strategies incorporation using multimedia games is a very important way to obtain positive results in learning process. The leisure activities can help students to be motivated.

Driven by growing interest in online educational games, we have identified the next goals to this work:

- Web Games roles identification in educational context;
- Web Games guidelines and best practices identification in educational context;
- Type Identification of web games developed for LMS;
- Examples of web games developed in a specific LMS;

Finally, we present our conclusions based on literature review and also propose future work.

2. INTRODUCTION

In recent years we have seen a grown enthusiasm in Digital Games Based Learning use (DGBL). Many authors have studied and researched DGBL potential as learning and teaching tools. Eck (2006), refers in his work two factors, which contribute to the interest in DGBL as a learning tool. The first factor is related with “Net Generation” or “Digital Natives” who become disengaged with the traditional instruction. They require multiple streams of information, prefer inductive reasoning, want frequent and quick interactions with content, and have exceptional visual literacy skills - characteristics that are all matched well with DGBL. The second factor is the games popularity increase.

Other factors are for instance motivation. Games are good tools to promote motivation and engagement between game and content.

When games are well developed and used in an appropriate context they provide an excellent environment for learning. Games can clarify the difficult and abstract concepts, provide a fun environment to the student's knowledge practice, and maintain variability that is needed to keep learners attention.

3. eGAMES AND EDUCATION

Valiathan,P., & Anand, P. (2008), argued that games have two necessary elements to the learning process: understanding and motivation. Why? Because using games to teach, helps learners practicing essential formulas, facts and processes, and also tedious topics. Games allow these topics to become more interesting and add a fun element to learning process, which contributes largely to be considered an excellent tool for learning.

Nowadays educational institutions are confronted with problems of motivation in their students. All the new approaches that can contribute for motivation increasing and consequent positive results are well seen by the learning process "actors". And in these new approaches, educational games can play a very important role, when it is known by everyone that youngest generations spend hours on the computer, playing and interacting with other players.

Hirumi (2008) also argued that games are effective tools to learning because: (a)Use action instead of explanation; (b)Create personal motivation and satisfaction; (c)Accommodate multiple learning styles and skills; (d)Reinforce mastery skills and (e)provide interactive and decision making context. Clark, (2006), refers in his paper that we can have the best of both worlds. Games and Learning. The two are not mutually exclusive. He said that with right design and tools, they can be mutually supportive. He has identified ten things that games can offer to learners: Motivation, Learner-Centricity, Personalization, Incremental Learning, Contextualization, Rich Media Mix, Safe Failure, Immediate Feedback, Lots of Practice and Reinforcement and Collaboration Lost.

Prensky (2001), developed a set of key criteria that encourages engagement with game. The set of characteristics are: Rules; goals and objectives; outcomes and feedback; conflict/competition/challenge/opposition; interaction; representation or story. To explain more these characteristics, Prensky developed a scheme to answer the question "Why games are so involved"? We observe in this scheme the give and receive process simplicity.

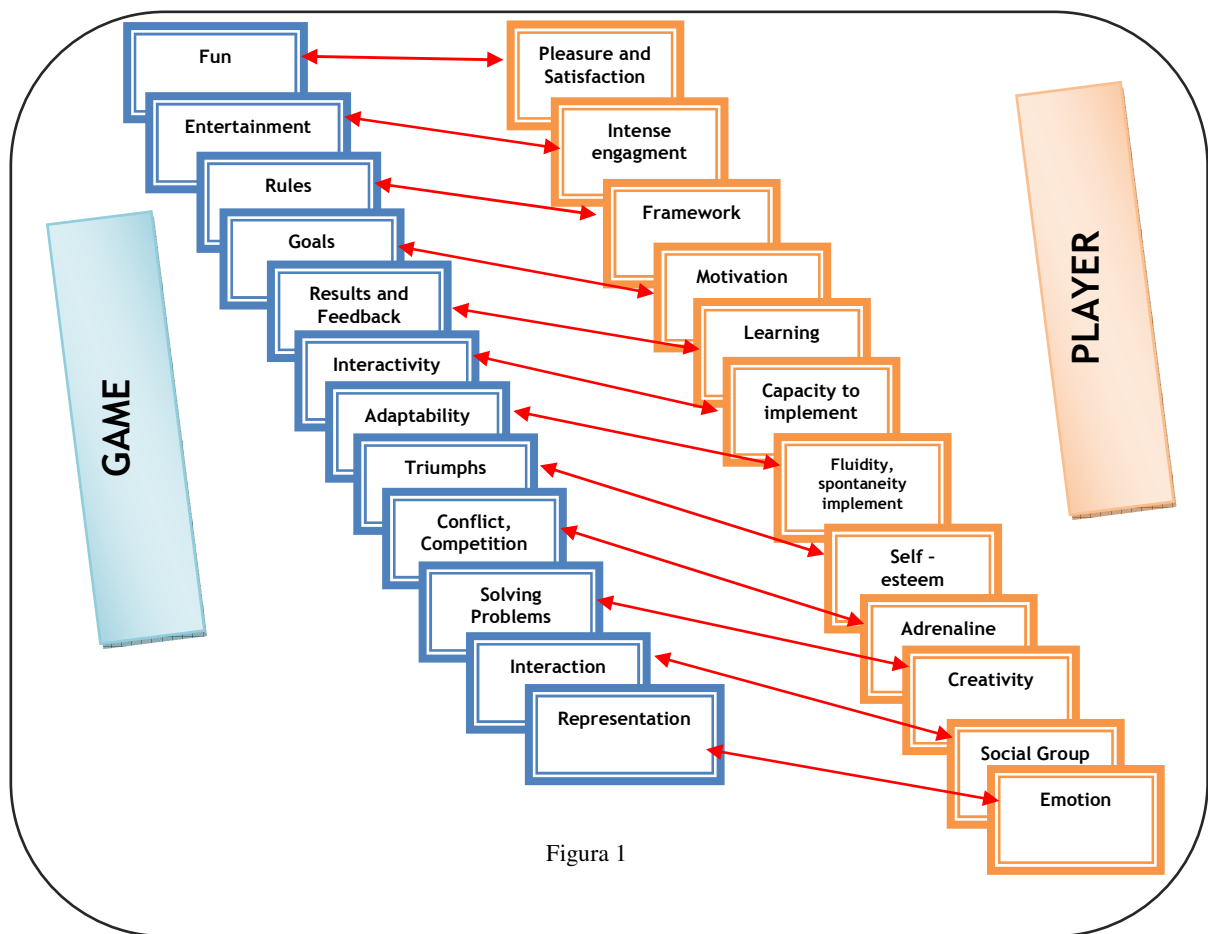


Figura 1

The better is the entertainment provided by game, greater is the player's involvement. It is highlighted the importance of player's motivation. Without motivation a game can never be a success.

It is argued by Jones (1998) that the following characteristics are essential on design to engaging environments: Task that we can complete; Ability to concentrate on task; Task has clear goals; Task provides immediate feedback; Deep but effortless involvement; Exercising a sense of control over our actions concern for self disappears during flow, but sense of self is stronger after flow activity; Sense of duration of time is altered.

If games are understood and perceived as good tools for learning by incorporating elements that generate involvement and motivation and by incorporating appropriate pedagogical principles, can we say that their simple use contributes to reach educational objectives set?

Several authors in literature argue that educational games yes, but it's necessary to research and study more deeply, for games to be considered effectively stable educational tools. For instance, Erc (2006), arguments that most people believe that games are engaging, can be effective, and have a place in learning, but the message will be changed to avoid the risk of creating an impression that all games are good for all learners and all learning outcomes, which is categorically not the case.

The author further argues that is necessary to researchers explain, why DGBL is engaging and effective, and the need to identify practical guidance for how, when, with, whom and under what conditions games can be integrated into learning process to maximize their learning potential. Investigators have focused more on saying that games are effective, instead of explaining it (why

and how they are effective). Some serious games researchers have conducted some works to study how games could be integrated in learning process.

We can create games that are fun to play but they fail when it is supposed to attain educational objectives and the respective learning outcomes. Professor Seymour paper calls “Shavian Reversals” (Boring games and drill-and kill learning).

For games that motivate learners, involve them in the game and therefore to carry out an effective learning, should be taken into account the best practices in the design of games, its alignment with the educational objectives and learning outcomes. Some authors identify some of the aspects to be taken into account. Fortugno refers that a game experience needs to have certain basic elements to be meaningful experience for players. These elements include interactivity designed with clarity of input and output; short-term and long-term goals to shape the players experience, a well-designed ramp for beginners to learn the ropes; and a game structure that actually contains the possibly of genuine play, not just quiz-style questions and answers. Why emphasize what seems so obvious? Because many times we have seen educators entering into game development that are content to transfer the style of games onto educational tasks understanding the substance of what makes a game work. And without these fundamentals, the end experience can be dead in the water. What exactly creates that elusive feeling of “play”? No one really knows. And it varies from game to game. But experienced game designers are probably the best-equipped folks to bring it into project.

He continues argues that both developers and educators - forgets this one: making games is really hard. And when you add to this the ambition of creating an innovative game with new kinds of content and gameplay, as well a game that actually tries to teach something meaningful to players, the problem is multiplied by orders of magnitude. Competition and collaboration is just one example of the “gameness” of game. The excitement if games doesn’t magically emerge from fancy graphics, well-written stories, or point-based rewards. Good games integrate a number of complex elements (moments of decision-making, challenging goals, rewarding feedback, etc) to create a fun play experience. The best way to understand all of this is to try these games yourself. One feature in all good games is a marriage of form and content. If you want to make a game about car racing, you want the game’s play to feel like racing - fast and risky with lots of quick thinking and made-or-break decisions. There is no one right way to design play for any given content, but the result should be that the way the players interact with the game, the process of play, parallels what the game is about. The play of a game is not just graphics, audio and text. Play is an Activity, and the content of a game should be expressed in that Activity. The actual repeated actions, decisions and choices, and thinking processes that the game design engenders should themselves embody what the game is about. One important approach is to choose content that is a game-like as possible. Games are dynamic, participatory systems, and process-oriented content is much better suited to games than factual content.

It is accepted that play is a primary socialization and a mechanism for common learning. Several theories are widely studied and applied to games that contribute to how and why the games are effective tools for learning: ERC (2006) identified some of them: anchored instruction, feedback, behaviorism, constructivism, narrative psychology and a host of other cognitive psychology and educational theory and principles.

However, despite being a subject to arouse much interest and defended by many authors as excellent tools for learning, others argue that the majority of educational games has been produced in the absence of any coherent theory of learning or underlying body of research, (Shaffer and et al).

One of the aspects to be considered for CBL is the way that the actors of the learning process can use in learning environments, such as e-Learning and develop the learning activities with them. Then we will focus on some key aspects related to the use of educational games in e-Learning.

4. GUIDELINES AND BEST PRACTICES

Denis. G. & Jouvelot, P., (2005), have identified in their paper a set of best practices for successful education game design. They considered the most important, among the various motivation-based synergies between learning material and video games, the following items:

- Reify values into rules (competence) - Games designers must decide which values (moral, scientific, aesthetic, etc.) a game should express, and embed them in the rules, one rare immutable part - in most cases - of games. The goal is to convey knowledge in interactions rather than static data (as in edutainment);
- Give power (competence) - To players must be provided expressive ways to confront with and test rules, experiencing meaningful feedback to their input;
- Tune usability (competence, autonomy) - Barriers placed to player, preventing the game practice, such as gameplay technical difficulty or the game's genre bias, should be levelled.
- Derail the gameplay (autonomy) - Designers should provide gamers with alternatives and space instead of constraining them in a predefined trajectory that hinders audacity, creativity and exploration - key aspects of fun and learning.
- Communication - Games should take advantage of all existing communication vectors for collaborating, negotiating, plotting, and competing, between others. Game-related issues can be discussed by players during the game, fostering both games strategy and broader socialization, possibly continuing after the game.

Also Kenny & Gunter (2007), discussed in their paper the intrinsic motivation and learning.

They argue that it is necessary to choose appropriate theoretical bases to apply in design games. They have identified the following items:

- Motivation and relevance
- Hierarchical Knowledge acquisition
- Immersing content with the game's fantasy context
- Providing support for practice and relearning

It seems clear that it is necessary to provide educational games with a balance between pedagogical, educational and fun principles (accepted as part of a game). Thus it is essential to take into account the pedagogical requirements and associated with these ones the design guidelines.

Moreno-Ger, et al., (2008), have identified some educational game design pedagogical requirements for online education. The pedagogical requirements are: Integration with online education, adaptation and assessment. Associated to these requirements they have identified a set of design guidelines: choosing an appropriate genre, adding assessment and adaptation to design, and integration with an online environment.

In integration with online education pedagogical requirements they refer a gap between the game and the course when the first is used in traditional classroom environment. They argue that using games in online education can increase educational value videogames by integrating them into the emerging e-learning standards and platforms. They have identified pedagogical requirements adaptation as a very important role to the educational experience quality. With this requirements it's possible to define different learning styles, different levels of initial knowledge and different expectations and objectives. Therefore if a game is delivered by a learning management system it's possible to track and guide the learning experience and it's also possible to activate mechanisms that allow some adaptation every time a game runs. Collaboration, feedback and assessment, are very important elements in online educational games. It's possible to define a model to monitor

student's activities such as logs and relevant events, allowing generating and gathering of useful information to student's activity grade. Authors refer that process can be either automated.

As mentioned previously the educational value videogames could be increased by integrating them into e-Learning environments. Educational games integration or linking in these environments is not a simple task to perform. Several factors contribute to this complex task, namely: games nature, it's alignment with learning activities, learning outcomes obtainment, among others.

Games use and simulation in these environments are still open issues to be studied.

Then we present some reflections on educational games use in these environments.

5. LMS AND eGAMES

Nowadays, Learning Management Systems (LMS) have an exponential acceptance in educational institutions and in business. Phenomena such as globalization and the mainly need from higher educational institutions to globalize their offer training, have contributed to this acceptance and introduction of new learning methodologies.

If using games and simulations in education is widely accepted by many and its benefits identified, the way these tools can be used in e-Learning environments is yet undefined. Aspects such as content management, track learner progress through various online activities are fully investigated in our days, but their application into e-Learning serious games environments is also undefined.

Serious game has only recently emerged as a result of a popularity and engaging qualities combination from computer games and affordable broadband communications development. (Wortley, 2007)

Serious game or game based learning use technology and methodologies to capture and engage users on a specified task, allowing them to obtain new knowledge and develop certain skills.

Serious Games different categories can be available on LMS, such as:

- Edutainment quiz games;
- Single player task-based simulations with decision trees;
- Single player role playing simulations in persistent virtual scenarios;
- Multi-Player task based simulations (non-persistent);
- Multi-Player role playing simulations in persistent virtual worlds.

Serious games incorporate data capture and behaviour tracking and it is expected them to test user's ability to remember facts, perform tasks within a requisite timescale and make "correct" decisions, that can generally use that captured data to feed LMS. (Worthey, 2007).

To games integration, SCORM Model (Sharable Content Object Reference Model) resolved partially this question. SCORM is a standard and specifications collection designed to allow interoperability, accessibility and reusability of content. SCORM goals are: defining a set of mechanisms to package, launching, and navigating through learning material that can be used by any SCORM compliant LMS.

However, integration using SCORM is yet undefined because most modern serious games do not follow the linear based learning patterns around these standards in which they are based (Worthey, 2007).

Worthey, (2007) argues that serious games offer a wider spectrum of learning outcomes both at individual and group levels, than the previous e-learning approaches, being these outcomes evaluation more difficult to integrate into LMS. The concept of content development and SCORM compliance is difficult to reconcile with serious games which engage multiple users in creative and freeform interaction. Non-linear design and interactivity, wide spectrum of learning outcomes (more difficult to integrate into LMS) and SCORM compliance difficult to reconcile with multiple users in creative and free form interaction, are the compliance issues in development approach of serious games.

We can integrate games or simulation using SCORM, or even using flash, but this integration is limited to several levels, for instance collaborative impossibility on games between the parties, a factor relevant in gameplay. Other problems associated to games availability in the context of learning are: development high costs, customization difficulty, working with subject matter experts with limited knowledge of gaming pedagogy, and last the user expectations.

Educational games in e-Learning environments must take into account all guidelines and best identified and studied practices. However additional elements must be studied and applied, taking into account the specific environment utilization of e-Learning, so that learner expectation won't get frustrated, and game turns into an effective and motivating educational tool, with well-defined educational objectives and satisfying all the learning process stakeholders.

Then we describe part of the research produced by Vasilis Daloukas, which aim was to develop a games module for the Moodle platform.

6. LMS AND eGAMES: Examples in a specific LMS

Following the research associated with games use in e-Learning environments, we describe the module games produced to Moodle platform by Vasilis Daloukas, consisting on the following games: Hangman, Crossword, Cryptex, Millionaire, Sudoku, The hidden Picture, Snake and Ladders.

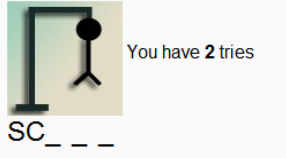
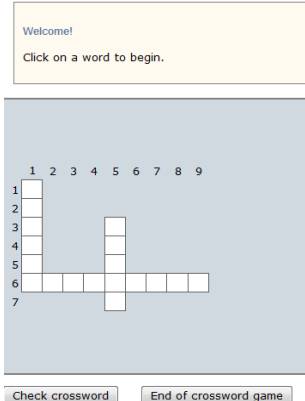



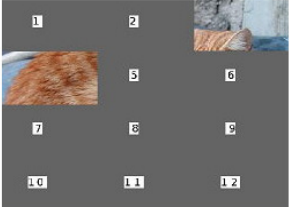
Game module idea is very simple. The game module allows creating dynamic and interactive online games while reduces the duplicate online resources needs. To do this games don't require you to create new questions and answers but instead it ties in with existing data that you have entered into Moodle Quizzes and Glossaries. As shown in the table below:

Game	Glossary		Questions		True / False
		Short answer	Multi choice		
Hangman	X	X			
Crossword	X	X			
Cryptex	X	X			
Millionaire				X	
Sudoku	X	X		X	X
The hidden picture	X	X		X	X
Snakes and Ladders	X	X			
Book with questions	X	X		X	X

Figura 2

Source: http://docs.moodle.org/en/Game_module#Hangman

One brief description about these games:

	<ul style="list-style-type: none"> • Hangman - This game takes words from either a Glossary or quiz short answer questions and generates a hangman puzzle.
	<ul style="list-style-type: none"> • CrossWord - This game takes words from either a Glossary or quiz short answer questions and generates a random crossword puzzle. Teacher can set the maximum number of columns/rows or words that contains. Student can press the button “Check crossword” to check if the answers are correct. Every crossword is dynamic so it is different to every student.
	<ul style="list-style-type: none"> • Cryptex - This game is like a crossword but the answers are hidden inside a random cryptex.
	<ul style="list-style-type: none"> • Millionaire - This game takes words from multiple choice quiz questions and creates a “Who wants to be a Millionaire” style game complete with the three lifelines. Can they make a million dollars?
	<ul style="list-style-type: none"> • Sudoku - This game shows a sudoku puzzle to the students with not enough numbers to allow it to be solved. For each question the student correctly answers an additional number is slotted into the puzzle to make it easier to solve.
	<ul style="list-style-type: none"> • Hidden Picture - this game randomly grabs an image from a glossary and hides it behind panels. As each question is answered correctly a portion of the image is revealed. How fast can they guess the image?

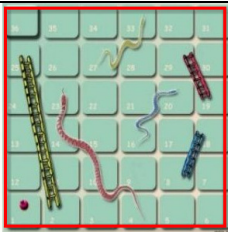
	<ul style="list-style-type: none"> • Snakers and Ladders - The students have to traverse a traditional “Snakes and Ladders” board by answering questions taken from either a Glossary or quiz short answer questions. As they get n answer right the dice is rolled and a random number displayed.
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Tabela 1

Source: Adapted from: http://docs.moodle.org/en/Game_module

Vasilis Module, as well as the work done by Torrente, (2009), aims to put into practice various approaches in order to deliver educational games using e-Learning platforms.

7. CONCLUSIONS AND FUTURE WORK

Based on literature we may conclude that education games and simulations allow a greater involvement and motivation when used by students. Motivation, personalization, incremental learning, rules, objectives, representations or history, competition / challenge / opposition, are pedagogical principles to be integrated in learning and when associated to games, allowing a potential student’s engagement. It is true that educational games are not themselves a success. It is important to consider pedagogical principles widely studied and evaluated, and they have been described throughout this work such as the good practices application in its design. This work identified some of these good practices, namely, communication, give power, usability tune, derail the gameplay, and reify values into rules.

Literature didn’t find answers to how games are effective (why and whom they are effective), However, it is assumed that a game has a high potential to motivate and allows an easier acquiring skills learning. And finally, we have identified that serious games use in e-Learning environments is not a simple task.

There are aspects to be studied in order to facilitate these games delivery by e-Learning platform, for example, the Moodle platform, among others. This particular aspect, future work aims to respond. We intend to examine ways to integrate or connect the CBLMS, in particularly, using Moodle platform. How to integrate games into an e-learning platform, such as Moodle? How to have learning activities setting aligned with the course? How to obtain the learning outcomes? These and other questions will be answered through a research and practical work implementation.

The future work to be performed is composed by the following stages: (1) proposal model to allow games use in e-Learning environments, specifically to Moodle platform, (2) e-game development to programming skills acquisition having higher education students with ages between 18 and 25 years as the sample group and finally (3) the assessment work.

8. REFERENCES

Clark, D. (2006). Games and e-Learning. Retrieved April 22, 2009, from: <http://www.caspianlearning.co.uk> .

Dennis, G. & Jouvelot, P. (2005). Papers and abstracts. Retrieved May, 3, 2009, from: <http://portal.acm.org/citation.cfm?id=1178581> (Motivation-Driven Educational Game Design: Applying Best Practices to Music Education).

- Eck, R.V. (2006). (Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless.... Retrieved May 2, 2009, from: <http://net.educause.edu/ir/library/pdf/ERM0620.pdf> .
- Fortugno, N. & Zimmerman, E. Learning to Play to Learn - Lessons in Educational Games. Retrieved April, 22, 2009, from: <http://www.ericzimmerman.com/texts/learningtoplay.htm>.
- Gee, P., Hayes, E. (2009). Public Pedagogy Through Video Games. Retrieved, April 27, 2009, from: <http://www.gamebasedlearning.org.uk/content/view/59/>.
- Hirumi, A. & Kebritchi, M. (2008). Examining the Pedagogical Foundations of Modern Educational Computer Games. [doi:10.1016/j.compedu.2008.05.004](https://doi.org/10.1016/j.compedu.2008.05.004).
- Jones. M. G. (1998). Creating Engagement in Computer-Based Learning Environments. Retrieved March 15, 2009 from: <http://it.coe.uga.edu/itforum/paper30/paper30.html>.
- Kenny, R. & Gunter, G. (2007). Papers and abstracts. Retrieved May, 3, 2009, from: <http://www.waset.org/ijss/v2/v2-1-2.pdf> (Endogenous Fantasy - Intrinsic Motivation and Learning).
- Moreno-Ger, P. Burgos, D. Martinez-Ortiz, I., Sierra, J.L., Fernández-Manjón, B., (2008). Educational game design for online education, Computers in Human Behavior, [doi:10.1016/j.chb.2008.03.012](https://doi.org/10.1016/j.chb.2008.03.012).
- Oblinger, D. (2004). The Next Generation of Educational Engagement. Retrieved, April 25, 2009, from: <http://www.jime.open.ac.uk/2004/8/oblinger-2004-8.pdf> .
- Prensky, M. (2001). Digital Game Based Learning. New York: McGraw-Hill.
- Shaffer, D., Squire, K., Halverson, R., Gee, J. (2004). Video Games and the Future of Learning. Retrieved April 23, 2009, from: <http://www.academiccolab.org/resources/gappspaper1.pdf> .
- Wortley, D. (2007). Serious Games and e-Learning. Retrieved May 5, 2009, from: <http://www.digitallearning.in/articles-details.asp?articleid=1186&typ=TRENDS> .
- Valiathan, P. & Anand, P. (2008). Designing Games for e-Learning: A Framework - 2008 - ASTD. Retrieved February 22, 2009, from: http://www.astd.org/LC/2008/1008_purnima.htm .
- Torrente, J. Moreno-Ger, P., Ortiz, I., Manjon, B. (2009). Integration and Deployment of Educational Games in e-Learning Environments: The Learning Object Model Meets Educational Gaming. Retrieved May 7, 2009, from: <http://www.e-ucm.es/publications/articles.html> .