

A PROPOSAL OF A GAME FOR EDUCATION AND ENVIRONMENTAL CONSCIOUSNESS

ALBERTO SIRE HORTA

University of Taubaté, Department of Informatics, Taubaté, Brazil
alberto_sire@yahoo.com.br

LUIS FERNANDO DE ALMEIDA

University of Taubaté, Department of Informatics, Taubaté, Brazil
luis.almeida@unitau.br

RITA DE CASSIA RIGOTTI VILELA MONTEIRO

University of Taubaté, Department of Informatics, Taubaté, Brazil
rita_rigotti@yahoo.com.br

DIEGO VILELA MONTEIRO

University of Taubaté, Student at the Department of Informatics, Taubaté, Brazil
dvm1607@gmail.com

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ABSTRACT

This work presents the use of digital games which contain Role Playing Games (RPG) features as the main pedagogical teaching tool in contemporary education, for both child and adult, for academic and corporate purposes equally. It is proposed that through the use of the games playfulness, the students' attention will be grabbed, ergo enhancing teaching by the use of a rule system, which has been created taking as base those from RPGs, therefor making players' learning subtle and flexible. For such purpose, an electronic game prototype, which uses a typical RPG atmosphere, has been developed, such game has playful elements, focusing on the child's ecological awareness development, also aiming environmental education and inferring an "action/reaction" set of social and individual attitudes towards the environment. It is emphasized that, by allocating the children's shared imagination while developing a persistent universe, in which the player must cooperate with one another, or at least with a set of already conceived rules, a virtual universe where learning the desired competences is more likely will be reached. This work highlighted the ability of electronic games in the RPG style as an interesting tool to support teaching. This work presents its importance mostly by demonstrating that education is still evolving and should keep being studied. Tests with a group of kids, whose ages ranged from 8 to 10 years, were made. Such tests measured and compared the results in order to discover whether the game was indeed helpful or not. Comparing the average initial results of the first tests and the ones of the second set, there is improvement. This demonstrates that the use of games for teaching can bring tangible benefits and in short term can help with subjects that are routinely not well assimilated. Even though the tests were applied only to children the literature supports the claim that games are an important tool for learning regardless of age.

Key words: Role-Playing Game, environmental education, teaching methods.

INTRODUCTION

We live in an age where information has become something basic and, consequently, it has moved the educational paradigm of just accumulating knowledge, and now it is more valuable knowing how

to deal with this knowledge. It is necessary to create tools which improve the collaboration capabilities, creativity, socialization, criticism, logical thinking and spontaneity.

The game as an educational tool encourages the student in all these features. It has the power of transforming an activity, that most often becomes dull, into something pleasurable and that arouses students' interest. Thus, we can use educational games with one of the biggest allies of the "Information Age," the computer.

In this sense, Saldanha and Batista [2009] highlight the Role-Playing Game (RPG) and its ability to foster a cooperative, and not competitive, practice among its participants. What this game mode differs from others is that the plot is usually endless [Crawford 1982].

RPG was created by Gary Gygax and Dave Arneson in the U.S. in the 70s with the game Dungeons & Dragons. This kind of game, in order to improve gameplay, focuses on the character's evolution and on the story. Generally, a player is allowed to customize the creation and development of the character, through the skills, including choosing his appearance and initial skills [Feil and Scattergood, 2005].

Therefore, creativity is essential for this kind of game. It is based on a narrator, or a master, responsible in telling a story in which each player represents a character.

This article proposes an RPG, containing playful elements, directed to the development of the ecological consciousness of the child, aiming environmental education and the inference of a set of individual or collective attitudes of "action / reaction" towards the environment.

LITERATURE REVIEW

Moratori [2003] points out that computers are increasingly present in everyday life in our society. Their cultural presence increase every day and with their arrival in schools, it is necessary to reflect on what is expected from this technology as a teaching resource for use in the teaching-learning process.

According to Prensky [2005] one reason why the teaching methods should evolve is that the way the information is processed in the brain has also changed due to the regular use of technology. He explains that some kinds of games are better for some subjects, and within this explanation presents RPG as fit to teach behaviours. Prensky [2005] also presents a study conducted by The Lightspan Partnership in over four hundred school districts, in which participants played educational games on the weekend, the study found that these participants presented, 51% improvement on math problem solving against the control group, language arts, vocabulary, and algorithm all presented higher scores as well.

One of the first Brazilian RPGs directed towards education was developed by Andrade *et al* [1992]; it has been widely used by history teachers. This game describes the Colonial Period in Brazil.

In this sense, Moura and Schaffel [2011] present a game in RPG style used as a tool in teaching biology, developed with the RPG Maker tool. Pereira [2009] proposes a game, also in the RPG style as a tool in history classes. In his work, he emphasizes the necessity of creating a new concept of game different from the other commercial games, something simplified at the most to facilitate their use by children.

For teaching Geometry, Moraes et al [2008] propose GeoEspaçoPEC, an educational game that has as main objective to encourage the learning of spatial geometry in a playful way. In this game the

player explores a three dimensional environment and through clues and challenges allows students to use their knowledge in a playful and entertaining way.

THE GAME

For Huizinga [2010], the game is closely related to the human being. It is through them that culture arises and not the opposite. The author merely describes the three main features of the game, without describing a concrete definition in either biological, aesthetic or logical terms: the game is a voluntary activity; the game is not real life, on the contrary, it is an escape from everyday life; the game differs from "ordinary life" for the place and time it occupies - it is "played to the end" within certain limits of time and space.

To summarize the key features of the game, it can be said that it is a free activity, consciously considered as "non-serious" out of "real life", while absorbs the players in a full and intense way.

Analyzing with psycho-cognitive focus, other characteristics of the game can be described [Passerino, 2003]:

- Ability to absorb the participant in an intense and full way (climate of enthusiasm, exaltation and tension feelings followed by a state of joy and strain).
- Atmosphere of spontaneity and creativity.
- Limitation of time: the game has initial state, middle and end; i.e., it has a dynamic character.
- Possibility of repetition.
- Limitation of space: the placeholder whatever form it takes is like a temporary and fantastic world.
- Existence of rules.
- Stimulation of imagination and self-affirmation and autonomy.

Games and the Education

Learning is more effective when the students acquire a new content and concatenate it to their own knowledge, establishing somehow a relationship between the two contents, the previous and the new. Without this relationship being formed, learning becomes mechanical, since this incorporation and assignment of significance are produced on a smaller scale. Therefore, this new content is stored in an arbitrary and isolated way.

The games consist of an exercise of individual actions already learned, generating a feeling of pleasure for the playful action itself and for the domain over the actions. Therefore, the games have a dual function: to consolidate the schemes already formed and give pleasure and/or emotional balance to the child [Piaget 1986]. Tarouco *et al* [2004] argues that games are important tools that should be used in education, especially children, since games have several ways of teaching all at once.

The game is an important tool in the educational environment, because it offers a dynamic of full development in cognitive, linguistic, social, moral and motor areas, contributing to increased creativity, autonomy, criticism and cooperation.

According to Van Eck[2006] the learning taking place in a meaningful context is one reason why games are effective, and they might differ from other learning medias for not being boring which is the reason given by Papert[1998].

The educational process is of great importance for the acquisition of systematic knowledge for the socialization and formation of critical thinking and reflective beings. Thus, it is necessary to prioritize the playing, creations, games and discoveries, for the development and construction of the child's freedom and expression. It is through games and plays that "the child builds the real, related to their desires and fantasies [Bock *et al* 1999].

The games are sorted in various ways. However, Piaget created a classification based on the developmental stages of the child [Piaget, 1962]: sensorimotor (up to 2 years), preoperative (3 to 6 years) and concrete operations (7 to 11 years).

Any use of educational tools brings a number of advantages and disadvantages. Concerning the use of games as means of learning can be cited:

- fixation of concepts already learned in a motivating way for the learner;
- introduction and development of concepts that are difficult to understand;
- development of strategies for solving problems (Challenge Games);
- learn how to make decisions and know how to evaluate them;
- significance for seemingly incomprehensible concepts;
- provides connection among different disciplines (interdisciplinarity);
- the game requires active student participation in the construction of their own knowledge;
- the game encourages socialization among students and the teamwork sense;
- the use of games is a motivating factor for students;
- among other things, the game encourages the development of creativity, critical sense , participation, "healthy" competition, observation, various forms of language use and the rescue of the pleasure in learning;
- activities with games can be used to enhance or restore skills that students need. they are useful in working with students of different levels;
- activities with games enable the teacher to identify, diagnose some of students' learning mistakes, attitudes and difficulties.

ALIUS EDUCARE PROJECT

Alius Educare project aims to bring to the electronic game, which was developed, a virtual world, with features of RPG, with its own concepts and ideas for the child player's awareness and education, regarding environmental issues.

Tarouco *et al* (2004) highlighted that education through games may prove to be pleasant and efficient, allowing you to create more suitable environments for learning and greater fixation of the teachings.

Following this line of reasoning, it is expected that the child player seeing itself affected by the problem, that are relevant to the environment, to take them seriously, because after engaging with the story, the plot will make the player empathize with the life and world exposed and, therefore, binding them with its problems. The protagonists were set on top of attractive archetypes and of easy identification for the target audience of the project, trying to transmit through a colloquial communication, messages imbued with moral and teachings.

Development Approach

Three distinct approaches were used, the explicit teaching, dramatic element of the "master" and the story itself.

Regarding the explicit element, the player, through a quest needs to raise the awareness of the residents of a village about the environmental consequences of their actions. Another approach was developed in small quiz events, in which the user must answer any question correctly aiming the gain of a reward, which will not be available otherwise than through the correct answer of the question. Some will not be eligible for more than one attempt.

This type of approach is set to explicit teach, since the user does not have the power to decide not to learn what is taught, consisting of a linear process without the possibility of stopping.

The dramatic element of the "master," as proclaimed by RPG, occurs through the interaction with other characters from the main group. This interaction enables every key event of the game; on every player's attempt to lose focus, one of the non-player characters (NPC) assumes the role of master and resumes the main story.

The approach took into consideration the motivation which drives the plot, the conflict triggered by the plot, and the story itself, it places the players in the pro-environment prerogative to fight against the LIX organization in order to prevent it from further harming the ecosystem. This story flow keeps always intense focus on the unfolding story and on the attitudes towards the environment.

Plot of the game

The world is experiencing a period of post-apocalyptic calm generated by the Great War (World War III), all this has had as result: many technologies in the world had been lost as well as a big part of the knowledge. A few, a very small amount of people, called "Arcane", understand how the technological artefacts that remained from humanity work, having this knowledge desired by all, they insist on keeping it safe. Soon after the war, a company emerges and goes through the years as the only one creating technology and supplying electricity, their extraction methods are obscure and, usually, attributed to magic.

The plot focuses on the young Luna, a 15-year-old teenager, whose life is about to take a turn. On a normal school day, during a boring geopolitics class, the main character is caught in a situation somewhat embarrassing when an unknown person begins to discuss with her teacher about her destination.

The quarrel intensifies and becomes even more bizarre when Luis Fernando, her teacher, becomes enraged and attacks her and Max, another partaker in the discussion. Cornered, there is no alternative but to join Max and defend from the imminent threat, this all happens in only a few moments. Without understanding what has happened and extremely confused, Luna starts to fall ill

and faints. Upon waking, she finds herself in a place she has never seen before, the refuge of a group of people who call themselves "Magyar".

Startled, Luna is tranquilized by Max, who begins explaining to her, what the true intentions of the evil teacher were and why they were only beginning at that moment. Through this conversation, she begins to understand why her father never really liked the LIX Company, and what its true intentions were. Max explains about the operation of the order of the Magyars, and the reason why they could cast spells during battle, like the ones she had seen during the previous confrontation.

The discussion extends and a milestone in the story happens, Luna discovers that her father was part of the order, and it has led to his disappearance. This fact is of extreme importance; on account of her father's past Max can get the young character's trust and get her to be part of the Magyars in the battle against environmental desolation committed by the mega company LIX.

Then, she is taken to meet the most powerful 'Creator' and current head of the order, Julius, who promptly explains his interest in Luna, for she has been born during the exact moment of the planetary equinox of our solar system, it is believed, because of an ancient legend, that the person who is born on this conditions will be able to catalyse the plumbing Earth's energy. Thereby, the LIX company also showed intention to raise her as an integrant, since their extraction methods make use of the life force of living beings.

As consequence of the indiscriminate use of this method, some beings were goaded into frenzy and the world became infested by monsters (mutated beings).

With that, the game begins and the main character is forced to perform some tasks, which must be executed in order, such as educate a small village on the responsibilities of their actions on nature and why they should preserve the ecosystem. After finishing their little quests, tasks encouraged by the game, Luna integrates Magyar group and pursues answers in a small central of the LIX Company and its manager Damian.

Thenceforth, the story unfolds all the RPG elements, allowing the player to choose their paths, challenges and battles, directing it to the final encounter with the truth. In these ways, the characters must gain experience, build their attributes, assemble their equipment and add friends.

Development Tools

To develop this prototype the following tools were used:

- RPG Maker XP: used as the game engine, performing all the sprites processing, conditions, decisions, gameplay, etc.
- Ruby Game Scripting System (RGSS): it was used because it has all the elements necessary for the rapid creation of interactive electronic games and, especially, because it is supported by the tool RPG Maker XP.
- Photoshop CS 5: used for creating graphic resources.
- Character Maker 1999: used for the design of tiles, or bricks from the game.
- Sony Sound Forge Pro 7: used to create the sound design of the prototype.

- Sony Acid Pro 7: used for creating loops, small audio files, which allow its repetition without failures.

Development of the game

Using the steps described by Clua and Bittencourt [2005] and taking into account the precepts of games focused on fun and gameplay presented by Fullerton [2008], after the end of the design and documentation part, which would establish the plot, the development of the game was initiated.

Thus, the development can be divided into two distinct parts: scripting, and the creation of resources - database resources that would be used in the game, graphics and sound.

Gameplay

The gameplay structure is guided in the RPG genre - "Role Playing Games", for video games in the most classical style. The game creates an environment immersing the player into its plot, causing him or her to assume the command of the character Luna through various questions and challenges, living the story through the eyes of this character. Figure 1 shows the sprite of the character Luna.



Figure 1: Sprite of the character Luna.

Following a linear plot, the protagonist must face the challenges and move through the plot as it appears, since one is unable do it otherwise.

Commands are sent using exclusively the keyboard, which also commands the character during battles, which are divided in turns. In the battles in a classic electronic RPG style game the player must define the characters actions from a list, containing from physical attack and defence to combinations of spells and items, predicting the attitudes of the opponents and combining attacks to create new powers and infringing further damage. Figure 2 illustrates a double battle.



Figure 2: Example of a double battle.

The puzzles and logical challenges of the game take place through dialogues in which the player can choose one answer from some options, or by means of certain attitudes that the character must perform on the map to trigger the unfolding of the story.

In the macro view of the game, when the character is free to go to any map, one can access the menus by pressing "ESC" what will allow the utilization of the items, perform magic support, change the equipment of the heroes or even check their status and save one's progress. Figure 3 illustrates an example of a map in the game.



Figure 3: Map of the beach type.

As the game unfolds, the characters mature, gain experience and knowledge that should be used to enrich the plot and build the attributes and peculiarities of each player and their respective class. At any time, the player can view their current status, as illustrated by Figure 4.



Figure 4: Status of the player.

TESTS AND RESULTS

The tests presented here consist of questionnaires with basic questions measuring the level of learning of the explicit teaching approaches contained in the first part of the plot of the prototype "Alius Educare".

The questionnaire consisted of ten multiple choice questions, 5 in order to obtain information of social nature related to the ecological awareness and 5 in order to obtain results of the level of attention spent on the teaching methodology, using the method given by Tarouco [2004].

The first group of questions contained questions like "Have you ever planted a tree? Yes/No" or "What do you do with old toys which you don't play anymore? Give it/Throw it away/Nothing"; the second group of questions was knowledge oriented containing questions such "How long does it take for glass to decompose? Over 4000 years/around 100 years/ around 10 years" and "Which of the items bellow is non-recyclable? Glass/Batteries/Paper"

These tests were done in an elementary school of Lagoinha, São Paulo, with three groups of students aged 8 to 10 years who agreed to participate, totalling 25 students.

The questionnaires were applied before any instruction or contact with the game, and after these episodes. The questionnaires applied before the teaching experience served to observe in which level of social-ecological learning the students were, the results did not show any significant numbers.

Without telling the students about their results, the game was used for about an hour and a half, causing the students to pass the initiation of the main character, in which the quiz must be answered after good ecological practices had been disseminate to a local village to be accepted into the Order of the Magyars.

After analysing the final results, described in Table 1, it can be seen that there was an improvement of 64% in the use of the questionnaire as a whole. However, when analysing separately each set of questions it can be noted that there was an even greater improvement in the second set of questions, which concern the last five.

Table 1. Results of the test.

Question	1o Test		2o Test		Improvement
	Hits	%	Hits	%	%
1	11	44	14	56	27
2	7	28	14	56	100
3	8	32	7	28	-13
4	10	40	15	60	50
5	9	36	12	48	33
6	15	60	22	88	47
7	13	52	18	72	38
8	5	20	20	80	300
9	9	36	16	64	78
10	11	44	23	92	109
Total	98	39.2	Total	64.4	64

Comparing the average initial results of the questions of the second set, which was 42.4%, with the ones obtained after the interaction with the game with the same set of questions, which was 79.2%, there is an improvement of 86.79% in use.

This suggests that the use of games for teaching can bring tangible benefits and in short term can help with subjects that are routinely not well assimilated, as numbers and concepts. Especially since the students only had the game as a learning source for improving the questions.

CONCLUSION

This work highlighted the ability of electronic games in the RPG style as an interesting tool to support teaching. With the completion of final tests, it was found that the use of the game in question, in the context of learning, provided some positive aspects. The main one was the best assimilation of the concepts seen in class by the students in a motivating and more closely form, which was presented in the form of an electronic game. It leads to an important active participation, which leads them to construct their own knowledge.

However, a game should not simply focus on the awareness of a particular subject solely. A more important factor would be to promote concrete actions in a process that updates all the effectiveness of learning. In this sense, an important improvement to be developed in the proposed game is to create stage changes and the progression within the game through concrete day-to-day actions of environmentalism by the character, which may be taken into account within the game, and consequently, allowing its continuity.

Therefore, these actions would be mandatory so that a player could continue playing and evolve within the game. The challenge, in this sense, is how to incorporate these actions so they can be accounted within the game.

Another important step of the project is keeping up with the children making sure the knowledge is not lost over time, is this way learning if games are sustainable for a long time or if they should only be used for short periods.

REFERENCES

- Anderson, Janice L.; Barnett, Mike. Learning physics with digital game simulations in middle school science. *Journal of Science Education and Technology*, 2013, 22. Jg., Nr. 6, S. 914-926.
- Andrade, F.; Klimick, C.; Ricón, L. E. 1992. O desafio dos bandeirantes - aventuras na terra de santa cruz. São Paulo: GSA- Entretenimento Editorial.
- Bavelier, Daphne, et al. Brain plasticity through the life span: learning to learn and action video games. *Neuroscience*, 2012, 35. Jg.
- Benjamin, Walter. A Criança, o Brinquedo e a Educação. São Paulo: Summus Editorial, 1984.
- Bittencourt, J. R.; Giraffa, L. M., 2003. Modelando ambientes de aprendizagem virtuais utilizando Role-Playing Games. In: XIV Simpósio Brasileiro de Informática na Educação. Rio de Janeiro: SBC.
- Bock, A. M. B.; Furtado, O.; Teixeira, M. L. T., 1999. Psicologias, uma introdução ao estudo de psicologia, Editora Saraiva, São Paulo.
- Breves, Comunicações; DE CASOS, Relatos. Creación e utilización de objetos educativos digitales para la enseñanza de enfermería. *Rev Latino-am Enfermagem*, 2007, 15. Jg., Nr. 4.
- Clua, Esteban W.G.; Bittencourt, João R. In: XXV Congresso da Sociedade Brasileira de Computação. São Leopoldo/RS: SBC, 2005.
- Crawford, C., 1982. The art of game design. Disponível:
<http://www.vancouver.wsu.edu/fac/peabody/gamebook/ACGD.pdf>. Acesso em: 19 de agosto de 2008.
- Da Rocha Gaspar, Débora. Videojuegos, educación y aprendizaje.
- Eguia-Gomez, Jose Luis; Contreras-Espinosa, Ruth S.; Solano-Albajes, Luis. Os games digitais como um recurso cognitivo para o ensino da historia da Catalunha: um estudo de caso.
- Feil, J. and Scattergood, M., 2005. Beginning GameLevel Design. Thomson Course Technology, Boston Massachusetts.
- Fullerton, T., 2008. Game design workshop - a playcentric approach to creating innovative games. Elsevier, v. 2.
- Gee, James Paul. *What video games have to teach us about learning and literacy*. Macmillan, 2014.
- Hejdenberg, Anders. The psychology behind games. *Gamasutra—Website*, April, 2005, 26. Jg.
- Huizinga, J., 2010. Homo Ludens: O jogo como elemento da cultura. Editora Perspectiva, São Paulo, São Paulo.
- Huyen, Nguyen Thi Thanh; NGA, Khuat Thi Thu. Learning vocabulary through games. *Asian EFL Journal*, 2003, 5. Jg., Nr. 4, S. 90-105.
- Lee, Jeremy, et al. More than just fun and games: Assessing the value of educational video games in the classroom. In: *CHI'04 extended abstracts on Human factors in computing systems*. ACM, 2004. S. 1375-1378.

Mayo, Merrilea J. Games for science and engineering education. *Communications of the ACM*, 2007, 50. Jg., Nr. 7, S. 30-35.

Michael, S. [Vsauce]. (2013, March 23). *Why Do We Play Games* [video file]. retrieved from <https://www.youtube.com/watch?v=e5jDspIC4hY>.

Monteiro, J, L. Jogo, Interatividade e Tecnologia: uma análise pedagógica. 2007. Trabalho de conclusão (Licenciatura em Pedagogia) - Universidade Federal de São Carlos, São Paulo

Morais, A. M; Medeiros, D. P. S.; Machado, L. S.; Moraes, R. M.; Rego, R. G., 2008. RPG para Ensino de Geometria Espacial e o Jogo GeoEspaçoPEC. 8o Encontro Regional de Matemática Aplicada e Computacional, VIII ERMAC, Universidade Federal do Rio Grande do Norte, Natal.

Moratori, P. C., 2003. Por que utilizar jogos educativos no processo de ensino aprendizagem? Trabalho de conclusão (Mestrado em Informática aplicada à Educação), Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Moura, M, R.; Schaffel, V, O, S., 2011. Utilização do role playing game eletrônico como ferramenta metodológica de aprendizagem em biologia. V Colóquio Internacional "Educação e Contemporaneidade", São Cristóvão, Sergipe.

Nelson, Brian C. Exploring the use of individualized, reflective guidance in an educational multi-user virtual environment. *Journal of Science Education and Technology*, 2007, 16. Jg., Nr. 1, S. 83-97.

Papert, Seymour. Does easy do it? Children, games, and learning. *Game Developer*, 1998, 5. Jg., Nr. 6, S. 88.

Passerino, L. M., 1998. Avaliação de jogos educativos computadorizados. Taller Internacional de Software Educativo 98 – TISE' 98. Anais. Santiago, Chile.

Pereira, J, S., 2009. O uso do RPG como ferramenta pedagógica nas aulas de história. VIII SEPECH, Seminários de Pesquisa em Ciências Humanas, Universidade Estadual de Londrina, Londrina, Paraná.

Piaget, J., 1962. *Play, Dreams and imitation in childhood*. New York: Norton.

Piaget, J., 1986. *A Linguagem e o pensamento da criança*. Trad. Manuel Campos. São Paulo, Martins Fontes, 1986.

Premsky, Marc. Computer games and learning: Digital game-based learning. *Handbook of computer game studies*, 2005, 18. Jg., S. 97-122.

Prietl, Anja. *Spielen (d) lernen*. 2009. Doktorarbeit. uniwiien.

Saldanha, A. L. e Batista, J. R. M., 2009. A concepção do role-playing game (RPG) em jogadores sistemáticos. *Psicologia Ciência e Profissão*, n. 29, v. 4, p. 700-717.

Schimanke, Florian, et al. Multi Category Content Selection in Spaced Repetition Based Mobile Learning Games. In: *Multimedia (ISM), 2013 IEEE International Symposium on*. IEEE, 2013. S. 468-473.

Squire, Kurt, et al. Electromagnetism supercharged!: Learning physics with digital simulation games. In: *Proceedings of the 6th international conference on Learning sciences*. International Society of the Learning Sciences, 2004. S. 513-520.

Squire, Kurt. Video games in education. *Int. J. Intell. Games & Simulation*, 2003, 2. Jg., Nr. 1, S. 49-62.

Squire, Kurt; Barab, Sasha. Replaying history: engaging urban underserved students in learning world history through computer simulation games. In: *Proceedings of the 6th international conference on Learning sciences*. International Society of the Learning Sciences, 2004. S. 505-512.

Sudwest, Medien pädagogischer Forschungsverbund. KIM-Studie 2003 Kinder und Medien Computer und Internet. *Basisuntersuchung zum Medienumgang*, 2009.

Tarouco, L. M. R., Roland, L. C., Fabre, M. C. J. M., Konrath, M. L. P., 2004. Jogos educacionais, *RENOTE - Novas Tecnologias na Educação*, v. 2, n. 1. 2004.

Teramoto, E, H, I.; Almeida, T, F.; Corrêa, Y, D. 2008. Toth: Jogo eletrônico para aprendizagem da matemática. Trabalho de conclusão (Engenharia da computação) - Escola Politécnica da Universidade de São Paulo, São Paulo.

Van Eck, Richard. Digital game-based learning: It's not just the digital natives who are restless. *EDUCAUSE review*, 2006, 41. Jg., Nr. 2, S. 16.

Whitton, Nicola. Game engagement theory and adult learning. *Simulation & Gaming*, 2010.

Whitton, Nicola. Using theories of gaming engagement to examine adult engagement with learning. 2008.