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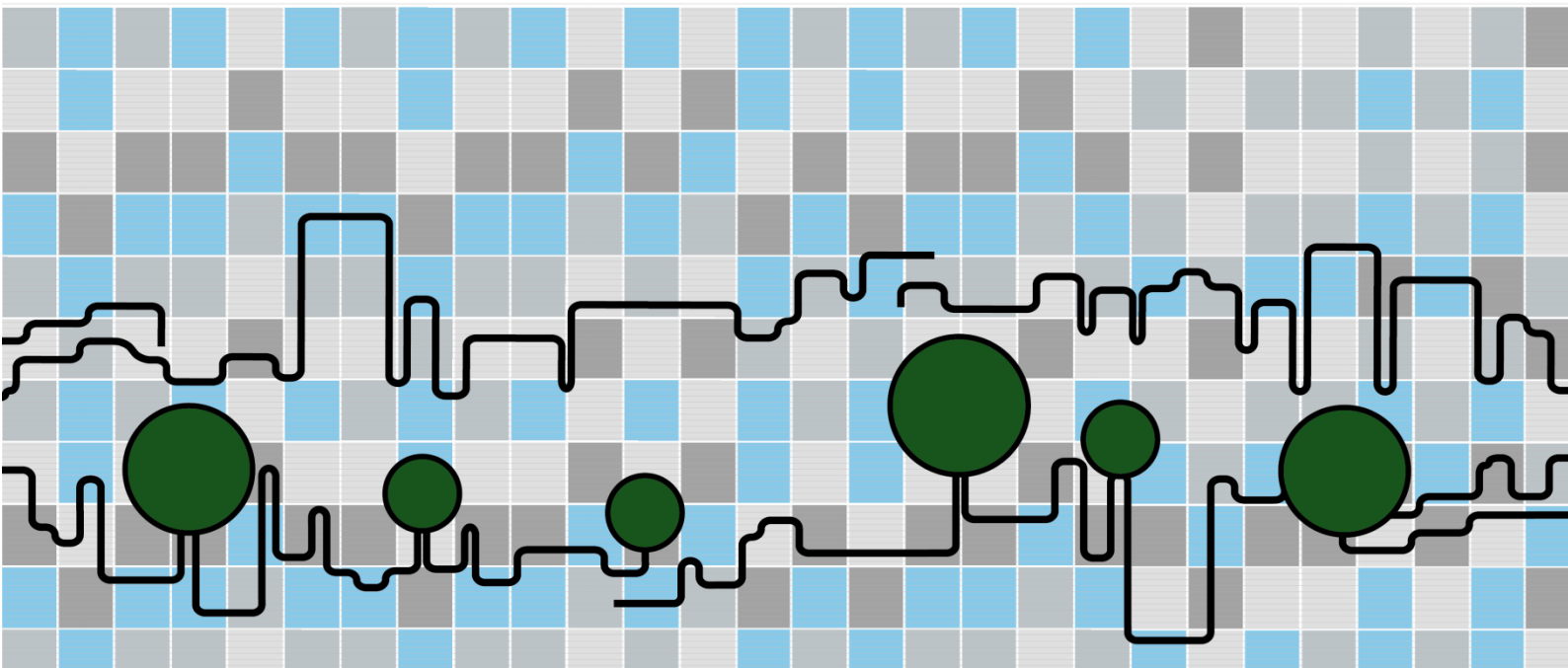
Education and Culture DG

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New Technologies, Education for Sustainable Development and Critical Pedagogy

Vassilios Makrakis & Nelly Kostoulas-Makrakis (Eds.)



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PREFACE

Information and communication technologies (ICTs) are developing rapidly, and being infused into every domain of our societies. Education is also being affected by ICTs: the way one can access and construct knowledge is changed, the roles of schools and the roles of the teacher are changing, and new pedagogical and ethical questions are raised. The link between ICTs and sustainable development is being addressed by extensive debate and research which recognize the challenge new technologies bring to the reorientation of education towards learning to live sustainably. ICTs play an important role in advancing sustainable education in three ways: a) by increasing access to educational materials about sustainability (e.g., via distance learning, educational networks and databases); b) by helping to promote new ways of interactive learning addressing sustainable development issues and 3) by opening access to information and knowledge. While ICTs can provide interactive mind/cognitive tools to support learning and develop new understandings and knowledge in areas of teaching and learning for sustainability, ESD themes integrated into the school curricula could provide a worthwhile context for ICTs in education. For example, social, economic and environmental issues can provide meaningful and challenging contexts for developing a wide range of ICT skills.

In general, ICTs can provide opportunities for learners to construct meaningful learning environments which can be applied to ESD such as: 1) engaging and challenging learners; 2) stimulating dialogue and social negotiation through new modes of social interaction; 3) learning by exploring, discovering, doing and reflecting; 4) constructing personal and collective representations of meaning; 5) supporting discourse in dealing with real-life problems; 6) representing dynamic relationships needed for knowledge construction; and 7) developing pupils' understanding of the implications of ICT for working life, society and the environment. There are key sustainable development areas such as cultural diversity and intercultural understanding, health, HIV/AIDS, governance, natural resources, climate change, rural development, sustainable urbanisation, disaster prevention and mitigation, poverty reduction, corporate responsibility and accountability, and the market economy, where there is potential to assess the impact of ICTs.

In the context of an evolving paradigm in pedagogy enabled by ICTs, teachers have to see themselves functioning as facilitators and mentors, as resources and as curriculum developers as well as transformative intellectuals. Each of these roles is associated with specific activities. Teachers as “facilitators and mentors” will guide and facilitate learners’ critical and creative thinking in a collaborative learning environment enabled by new technology. Teachers as “resources” will have to develop learners’ capacities for active citizenship and to contribute to their fellow teachers’ professional development enabled by new technology. As “curriculum developers”, teachers critically assess school knowledge, reorder and enrich curriculum according to the principles of new pedagogy enabled by new technology. Teachers as “transformative intellectuals” are involved in developing a discourse that, as Giroux and other critical pedagogues state, unites the language of critique with the language of possibility that leads to praxis and social transformation.

Teachers functioning as “transformative intellectuals” are giving students an active voice, making the political more pedagogical and the latter more political. In other words, teachers are able and committed to function as change agents of reorienting what they teach and how they teach for promoting a key goal for 21st education that is, learning to transform oneself and society. In these two volumes, there are contributions, which in one or another way tackle the infusion of sustainability issues across all education levels. In a wide number of these contributions, there is evidence that ICTs, can enable education for sustainable development. These contributions can be used as a useful resource to teachers’ professional development from early childhood education to higher education.

For the preparation and production of this volume, we would like to thank, all the contributors, the people who assisted this process, especially Associate Professor Nikos Andreadakis and our two Ph.D. students, Dimitris Gkatzos and Nikos Larios, as well as the European Commission for funding this publication.

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Students' Generation of Meanings on a Global Energy Issue through Digital Game Play

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Abstract

The potential of digital games as learning tools in school-based contexts, and especially within the field of Environmental Education, is not yet fully explored. To address this problem the present study focuses on a qualitative analysis of the dialogues exchanges between students making use of a multiple platform of transmedia storytelling. This multiple digital platform, Collapsus, combines interactivity, fiction and documentary on a scenario using global energy politics as the main issue of a challenge-based game task. The present study examines the ways students through the interactive game of the platform collectively resolve global energy challenges influencing the world's energy production, with the aim to avoid undesirable energy black-outs. The study's findings indicate that the students managed to relate their choices in regard to global energy politics to issues of quality of life involving social, ecological and economical parameters. They also succeeded to collaborate without particular difficulties.

Introduction

Exploring the learning potential of digital games and their use for educational purposes remains a greatly under-explored although fast growing research area (Prensky, 2001; Gee, 2003; Kirriemuir & McFarlane, 2004). Although it is well-documented that playing with digital games contributes to the development of important skills, such as planning, strategic thinking, decision-making, problem solving and communication (Whitebread, 1997), the potential of digital gaming as a learning tool in school-based contexts is not yet fully explored (Kynigos & Daskolia, 2011). Research affirms that there are several examples of current digital games that can facilitate social exchange, conversation and teamwork among players by offering multimodal channels of communication, collaboration and experience among them (Gee, 2003; Williamson & Facer, 2003). Apart from that, digital games can act as systems of socially constructed meanings by which new forms of literacy can be developed (Gee, 2003). As objects which represent particular 'realities' (Gee, 2003), digital games can be employed to assist the generation of new meanings with regard to these realities. Convergence of the various possibilities offered by different expressive media is suggested by Jenkins (2006) as an important feature of current digital culture to be further employed for educational purposes. Such enhanced participation in trans-media game-based activities is thought as allowing the learners' learning interest to boost and as a motivating factor to a more active engagement in collaborative exchange.

There are nevertheless many questions raised by educational researchers pertinent to digital game-based learning's scope and impact not only in informal contexts but school settings as well. One of them has to do with whether digital game-play opportunities can be of any additional value in teaching and learning about concepts and issues of particular subject domains, such is the case of Environmental Education (EE). EE is an educational field where considerations of this kind have been left greatly unaddressed although there is plenty of room for posing and exploring such challenges (Kynigos & Daskolia, 2011). This is not surprising as EE has attributed a minimal interest towards investigating the contribution of digital tools in teaching and learning about environmental concepts and issues (ibid). Even though a growing number of children and young

people have become really passionate about some new technological tools and their associated practices (as in the case of digital game play), and there is enough evidence that they are more actively involved in learning activities incorporating elements related to their everyday digital practice (Hewitt & Forte, 2006), not a strong interest has been expressed till now from the part of EE research in addressing this recently-born reality and in investigating its implications in the context of children's informal playing or as a potential pedagogical tool for supporting EE practice in school settings.

Reservations from the part of EE concerning the pedagogical value of using digital games have also to do with how adequately it can address the idiosyncratic nature of its subject-matter. Environmental and sustainability concepts and issues are by nature complex, controversial, value-laden and dense with conflicting social interests. Teaching and learning about them requires the exploration of the various perspectives inherent in them and the exercise of critical thinking in identifying their roots and solutions in the established individual and social practices (Bardwell, Monroe & Tudor, 1994; Scott & Gough, 2004). However, these are modes of knowledge that build not only on 'objective' scientific data, but also on the values, speculations and emotions which arise through personal and collective reflection and action processes (Unesco, 1978; Huckle, & Sterling, 1996). Moreover, environmental and sustainability issues are complex issues that need to be addressed through collaborative processes of thinking and action (Zeiderman, 1992). In terms of pedagogical design, group learning approaches towards approaching issues of this genre have to take into consideration the students' prior knowledge, the roles they adopt and the information exchange among them (Dillenbourg & Hong, 2008).

We argue that digital game-play learning offers many opportunities worthy to be explored by EE within the context of assisting young people to get engaged with environmental and sustainability concepts and issues in more meaningful and enjoyable ways.

The study context

The study reported in this paper aims to identify ways in which students address a global environmental issue, energy resources allocation policy, while engaged into digital game-based learning through a transmedia storytelling and interactive games platform. Among the main characteristics of these games is the increased engagement of players which turns the whole gaming experience more meaningful and fun for them and creates a learning environment through which players are incited to critically reflect on the issues involved and exchange information in attempting to solve them. By combining several digital media opportunities and functionalities a transmedia platform enables players to immerse into an entire imaginative world instead of focusing solely on particular characters or a given story plot. This storytelling experience becomes therefore more exciting and motivating for players to learn more and explore the game in greater depth, since they become part of the story and they need to understand several parameters of the issue in order to win. Moreover, by engaging different types collaboration among learners is an essential prerequisite for them to understand the story and respond to the game's demands (Jenkins, 2007).

We designed and implemented a study with a small group of 11-grade students based on a learning scenario which foresaw that students would interact and collaborate through 'Collapsus', a multiple platform of transmedia storytelling and interactive games dealing with issues of global energy politics (Fig. 1). This platform involves users in a series of challenges related to issues of this kind and brings them in a position to have to decide on their future while also witnessing the consequences of their choices. The different media used – the interactive game and the film/animation and documentary components – are not isolated but combined to each other, so that the players enter into an expanded imaginative world, they become part of the story and lean on each other to meet the challenges posed to them.



Figure 1: The Collapsus storytelling and interactive games platform.

By looking into the near future, Collapsus shows how the imminent energy transition from fossil fuels to alternative energy sources affects a group of ten young people who appear to be caught up in an energy conspiracy and failing energy supplies. The story entangles the interventions of international power systems that try to cope with issues of political dissension, uprisings and a population terrified from increasingly frequent black-outs. Collapsus places users in the centre of the events and provides the opportunity to decide upon their own future and observe the consequences of their choices. Consequently, the users are asked to make decisions and seek for solutions both on a national and a global scale that will help the actors of the story get out of the energy crisis with minimal costs. They have to select types of energy by taking into consideration their advantages and disadvantages as well as their trade-offs. This process strongly contributes to the development of dialogical interactions between the users as they have to collaborate in order to address and solve these challenges.

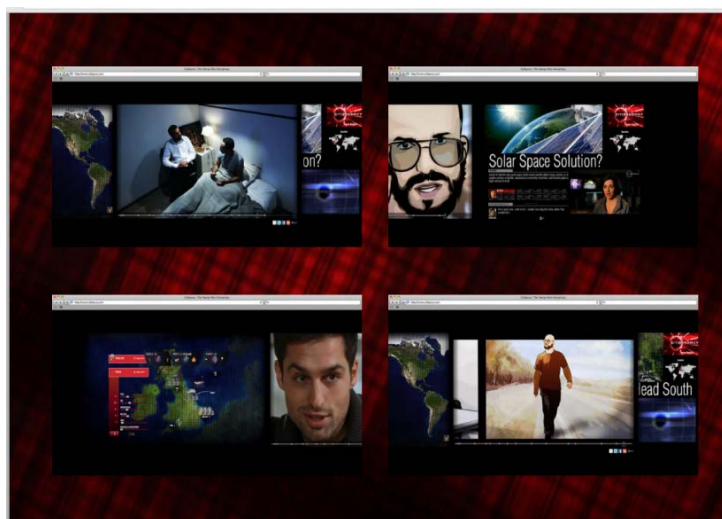


Figure 2: Multiple representations in the Collapsus platform.

This is because the challenges that the users of the platform are confronted with cannot be solved by each of them individually. Instead, they necessitate face-to-face communication in small groups so that the right decisions are taken in common. The users have the mission to face these global energy challenges on a collective level. While they are pondering on the types of energy to select they receive visual feedback and so they every time they proceed with the solution they have decided to follow. Collapsus attempts to merge real documentary footage with mini-games and movie fragments while incorporating the users' perspectives while the story unfolds. Apart from interacting and deliberating on the decisions the users have to make to avoid undesirable energy blackouts, they have the opportunity to broaden their perspective by listening to the experts' point of views and of course by observing the consequences of their decisions projected into alternative courses of action and how they influence the deployment of the whole story.

Methodological frame and implementation of the study

The reported study departs from the assumption that by engaging students with a digital game which puts them in a position to have a series of energy policy challenges to confront, the students' generation of meanings concerning global energy politics is facilitated. The research questions that guided the study are:

- In what ways does a multiple platform of transmedia storytelling and interactive game, when intertwined in appropriately designed learning activities, lead to the generation of meanings concerning global energy politics among students?
- In what ways do the students ascribe meanings to related environmental concepts while attempting to identify solutions to the challenges set by the game?
- To what extent do the various media provided by the platform support students in better understanding global energy politics issues?

In terms of the research methodology used in the study we followed a design-based approach (Cobb, Confrey, diSessa, Lehrer, Schauble, 2003; Design-Based Research Collective, 2003). This is a qualitative methodological frame which is mainly contextualized in educational settings and its focus is on generalizing from findings to guide the design process. It is grounded on theory and relevant research results while reflection is an integral part of the whole process.

The study took place among students of the 11th grade class (2nd class of Lyceum) of a school located in Athens. We purposefully decided to employ a small number of participants in order to pursue an in-depth analysis. Participants to the study were four students divided in two pairs. Their selection was based on their previous experience with playing digital games, although not with Collapsus in particular.

The students enacted a scenario which was designed by the researchers to engage them in a series of activities before, during and after having played the game. To allow the students to get familiarized with the platform, the researchers left enough time for them to try all its functionalities. Once familiarized the two pairs of students were asked to address the challenges set by the game and to attempt to solve them through face-to-face discussion, sharing their ideas and explaining their moves in the game. The students were also provided with several opportunities to reflect upon their decisions and the degree they affected the global energy production in different countries.



Figure 3: Film/Animation in the Collapsus platform.

Hypercam was used the software for collecting data in this study through recording the moves of students while playing the game. Data collection was also based on participatory observation, short interviews and the narrative reports prepared by the students regarding the new understandings they gained and the collaboration problems they faced.

Findings of the study

A preliminary analysis of the study’s findings revealed that the students managed to associate choices with regard to global energy politics with issues of quality of life involving social, ecological and economical parameters in a relevant and concise way. Almost all four of them developed their ability to use various environmental concepts proposed by the different media and apply them in a relevant way when making decisions about how to proceed in the game. For instance, even though they gave the impression at the beginning that they could not realize how to use power plants in the game, they consequently employed strategies that progressively led them to integrate them with the minimal environmental cost for the countries involved. The initial disagreement between the two groups concerning appropriate decisions to take was replaced by arriving at successfully supporting their views with arguments.



Figure 4: The documentary part of Collapsus platform.

More particularly, students communicated sufficiently with each other in order to identify the issue at stake and meet the challenges involved. An indication to this is the fact that the information presented in the game regarding environmental concepts, such as different types of energy, led the students to interact more intensely with each other. What is more important to highlight concerning this point is that students communicated with the aim to share their ideas and personal views regarding the environmental perspectives to be taken into account when thinking about the alternative solutions to the challenges as well as how to relate the environmental concepts projected by the film/animation to social and economical factors. Students also exchanged information and views during the film-animation and the documentary parts on the issue of the global energy policy, as they were divided between those who were strongly supporting to focus on the environmental dimension and those being in favor of the economic perspective of seeing the whole issue.

The findings of the study also revealed different levels of the student abilities when using environmental concepts in a contextualized problem-solving situation. What is indicated is that an appropriate pedagogical use of a digital game platform such as Collapsus facilitated the creation of learning opportunities leading to reflection on environmental issues and concepts. The students were provided with some novel learning opportunities to understand current socio-environmental issues. We argue that by using a digital learning platform with these characteristics a learning situation was orchestrated where students had several opportunities to generate meanings on some current socio-environmental issues, to face the complications of bringing forth sustainability and to realize the need to apply collective thinking and action to accomplish it.

As related to collaborative learning, our findings indicate that most dialogical interactions among students included information exchange, justification of their choice, investigation of alternatives, reply to question posed, evaluation, after-statement, and agreement. As evidenced by the short interview, the students considered their interaction and communication as necessary for constructing the knowledge they needed to meet the challenges. Verbal conflicts were accompanied by arguments as a result of the information gathered by playing the game, that is the feedback messages, the consequences of previous choices and prior knowledge. As the interactive game and the film progressed, students started to realize that they had to focus on the overall situation instead of separate dimensions. In other words, the key for them to understand and meet these challenges was to achieve a balance between the three fundamental aspects of sustainability, meaning “economy”, “society” and “environment”.

As far as the digital platform is concerned the students did not face any particular difficulty regarding the human-computer interface. Instead they characterized the whole experience as interesting, entertaining and motivating, and as providing much useful information about politics concerning global energy resource allocation. They also argued that it offered them a unique opportunity to learn about global energy politics, a complex issue about which they would never think to search information. Concerning the path they followed, the students had first a short navigation, they then defined the energy challenge, they analyzed the available data, and considered the alternative options they had in relation to different types of energy. After that, the students decided about the changes they would have to make in order to meet the challenge, they analyzed the feedback messages they got and finally reviewed the decisions taken. As far as the multiple representations of the platform, the students used the film and the animation parts of the platform to render the whole procedure more creative and thus interesting to them and the other students to get information regarding international relations and conflicts around the central issue of energy politics. On the other hand, in several occasions the students skipped the mini-games included in the film, since they did not offer specific information about environmental concepts.

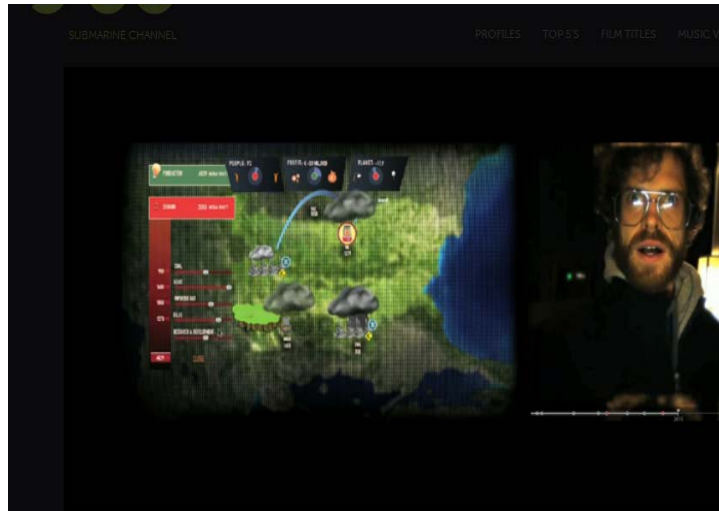


Figure 5: The interactive game in Collapsus.

Further analysis suggests that the interactive part of the digital game was that tool in the platform that challenged learners most to communicate and collaborate and hence to develop new understandings about global energy politics. Students focused mostly on the interactive game, since it was the tool through which they could ascribe meanings to the related environmental concepts and actually apply them in their attempt to meet the challenges. Another important implication is that even though the interactive game was the tool that initiated most of the interactions, the feedback messages created an appropriate context for acquiring more information about the energy concepts presented in the game and their impact on environment, economy and society. Furthermore, the results show that the documentary possibility was least exploited by the students, even though they got some information from that too.

Some concluding remarks

We argue that the use of Collapsus, a transmedia storytelling and interactive games platform, contributed to a great extent to the effective interactions and exchanges of information and views between the members of the two groups of students. This was a crucial factor for the students to address and attempt to resolve the energy challenges posed by the game and subsequently for developing and improving their knowledge of environmental concepts and global energy politics issues. The students managed thus to ascribe meanings to related environmental concepts while they attempted to identify solutions to the challenges set by the game. We actually ascertain that the meanings the students ascribed to the environmental concepts employed were determined by the interaction between the students and that between the students and the platform.

This small-scale study contributes to the knowledge regarding how to design and use pedagogically innovative ways of incorporating new technologies (and digital game play in particular) in learning about environmental concepts and issues. Our findings provide some first insights that transmedia storytelling can actually help creating meaningful learning situations in classrooms concerning environmental issues by facilitating students' strategic thinking, decision-making, problem solving, communication as well as the application of environmental concepts in specific real-world issues. With the aid of this technology-based learning environment the students showed an enhanced competence in discussing about global energy politics and in drawing conclusions about it. One implication for future studies in this field could be to use a technology-based learning environment of game-construction instead of just game-playing in order to examine how students ascribe specific meanings to environmental concepts and how they apply them in real conditions.

References

- Bardwell, L.S., Monroe, M.C., & Tudor, M.T. (eds). (1994). *Environmental problem solving: Theory, practice and possibilities in environmental education*. Troy, Ohio: North American Association for Environmental Education (NAAEE).
- Cobb, B., Confrey, J., diSessa, A., Lehrer, R., Schauble, L. (2003). Design Experiments in Educational Research, *Educational Researcher*, Vol. 32, No. 1, pp. 9–13.
- Design-Based Research Collective (2003). Design-Based Research: An Emerging Paradigm for Educational Inquiry, *Educational Researcher*, Vol. 3, No. 1, pp. 5–8
- Dillenbourg, P., & Hong, F. (2008). The mechanics of CSCL macro scripts, *International Journal of Computer Supported Collaborative Learning (ijCSCL)*, Vol. 3, No. 1, pp. 5–23
- Gee, J. P. (2003). *What Video Games Have to Teach us about Learning and Literacy*. New York: Palgrave Macmillan.
- Hewitt, A. & Forte, A. (2006). Crossing Boundaries: Identity Management and Student/Faculty Relationships on the Facebook. *Conference paper presented at the CSCW, Canada* (November 2006). Retrieved September 7th, 2011 from <http://wwwstatic.cc.gatech.edu/~afort/HewittForteCSCWPoster2006.pdf>
- Huckle, J. & Sterling, S. (Eds.) (1996). *Education for Sustainability*. London: Earthscan
- Jenkins, H. (2006). *Convergence Culture. Where Old and New Media Collide*. New York: New York University Press.
- Jenkins, H. (2007). Transmedia Storytelling 101. Confessions of an Aca-Fan. Retrieved November 7th, 2007 from http://www.henryjenkins.org/2007/03/transmedia_storytelling_101.html
- Kirriemuir, J. & McFarlane, A. (2004). *Literature Review in Games and Learning. Report 8*. Futurelab Series. Futurelab. Retrieved September 7th 2011 from <http://hal.archives-ouvertes.fr/docs/00/19/04/53/PDF/kirriemuir-j-2004-r8.pdf>
- Kynigos, C., Daskolia, M. (2011). Collaborative design and construction of digital games to learn about sustainable lifestyles, in Gómez Chova, L., Candel Torres, I. & López Martínez, A. (Eds.), *Proceedings of the 5th International Technology, Education and Development Conference (INTED 2011)*, Valencia, Spain: International Association of Technology, Education and Development, IATED (pp. 1583-1592).
- Prensky, M. (2001). *Digital Game-Based Learning*. New York: McGraw-Hill.
- Scott, W. & Gough, S. (Eds) (2004). *Sustainable Development and Learning. Framing the Issues*. London: Routledge Falmer.
- UNESCO (1978). *Intergovernmental Conference on Environmental Education* (Tbilissi, USSR, 14-26 October 1977). Final Report. Paris: UNESCO.
- Whitebread, D. (1997). Developing children's problem-solving: the educational uses of adventure games. In A. McFarlane (Ed.), *Information Technology and Authentic Learning*. London: Routledge.
- Williamson, B. & Facer, K. (2003). *More than 'Just a Game': the Implications for Schools of Childrens' Computer Games Communities*. Unpublished draft paper. Futurelab. Retrieved September 7th, 2011 from www.futurelab.org.uk/research/draft_articles.htm
- Zeiderman, H., Zelderman, H., Comber, G. & Malstrellis, N. (1992). The touchstones project of learning to think cooperatively, in Davidson, N. & Warsham, J. (Eds.), *Enhancing thinking through cooperative learning*. New York: Teachers College Press.