Teachers Learning about Sustainability while co-constructing Digital Games

M. Daskolia, C. Kynigos, and N. Yiannoutsou

Abstract—Teaching and learning about sustainability is a pedagogical endeavor with various innate difficulties and increased demands. Higher education has a dual role to play in addressing this challenge: to identify and explore innovative approaches and tools addressing the complex and value-laden nature of sustainability in more meaningful ways, and to help teachers to integrate these approaches into their practice through appropriate professional development programs. The study reported here was designed and carried out within the context of a Masters course in Environmental Education. Eight teachers were collaboratively engaged in reconstructing a digital game microworld which was deliberately designed by the researchers to be questioned and evoke critical discussion on the idea of 'sustainable city'. The study was based on the design-based research method. The findings indicate that the teachers' involvement in processes of co-constructing the microworld initiated discussion and reflection upon the concepts of sustainability and sustainable lifestyles.

Keywords—Constructionism, digital games, Environmental Education, sustainability, sustainable lifestyles, teacher training.

I. INTRODUCTION

LEARNING about sustainability is acknowledged as an essential strategy for achieving sustainable societies and as a tool to enhance quality in educational practice [1]. Getting involved with sustainability issues at a pedagogical level is considered a sine qua non condition for people to better understand current reality [2], develop their action competence in bringing socio-environmental change [3] and envision a more viable and equitable future [4], [5]. This is why 'sustainability' is currently among the core topics of curricula across most countries, while addressing sustainability issues is a central goal of all education sectors and levels, including higher education and the professional development of teachers.

Nevertheless, teaching and learning about sustainability is not a straightforward educational endeavour but rather one with various innate difficulties and increased demands. This is due to the fact that sustainability as a concept is by nature complex, controversial, context-specific and value-laden, and lends itself to many interpretations. It is worth mentioning that even fifteen years ago the British political scientist Andrew

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Dobson [6] counted more than three hundred available definitions for sustainability and sustainable development. This plurality stems from the contested nature of the concept, which is open to various interpretations not only among cultures but also among different interest groups within societies [7]. There are different visions about what sustainable societies should look like, what changes are required so as to achieve sustainability, what the limits of economic growth are, what kind of development societies want to sustain, etc. Fien and Tilbury [8] argue that implicitly stated within these questions there are "differing definitions and assumptions of sustainability and these, in turn, reflect both the variety of contesting ideologies and an ongoing political debate about the nature of sustainable futures".

According to many scholars the very fact that 'sustainability' can mean different things to different people makes it a "successful" concept [9]-[11]. There is an "appealing vagueness" inherent in the concept [12] which definitely makes it a 'boundary object', that is an object which inhabits several intersecting social worlds, and with a structure initially loosely defined for common use but which can become "strongly structured in individual use" [13]. This is exactly where its pedagogical strength lies in: it calls learners to get engaged with exploring the hidden perspectives, it entails critical reflection on its structural value systems and emphasizes the need to challenge established individual and social practices.

However, teaching and learning processes of this kind cannot be seamlessly integrated in current educational practice, due to the resistance placed by traditional school structures which remain normative and conservative to a high degree, and to the consequent reluctance of teachers to deal with 'difficult' concepts and issues [14]-[18]. To address this problem new pedagogical approaches and tools for teaching and learning about sustainability in more emancipatory and critical ways need to be explored. In addition, particular emphasis has to be given to the potential of teacher education to familiarize teachers with how to integrate such innovative pedagogies into their teaching practice as a stepping stone required for bringing change into classroom [19], [20]. Higher education has an important dual role to play towards this direction, first by identifying and exploring approaches and tools offering possibilities of this kind; and second, by developing the knowledge and competences in teachers through appropriate university-based pre-service and in-service teacher education programs, so that they become able and willing to integrate these approaches and tools into their

teaching practice [21].

The study reported in this paper was designed and carried out within the context of the Postgraduate program in Environmental Education offered by the Department of Pedagogy of the University Athens. The participants were 8 Greek teachers of primary and secondary education who were enrolled in this two-year university-based professional development course with the aim to enrich their knowledge and teaching strategies in more effectively addressing concepts and issues of classroom-based environmental education programs. An educational intervention was designed by members of two research laboratories of the Department of Pedagogy, Environmental Education Lab (http://eel.ppp.uoa.gr) and Educational Technology Lab (http://etl.ppp.uoa.gr) for the postgraduate students/ teachers to participate in. The focus of the intervention was on engaging them in the collaborative design and re-construction of a digital microworld especially designed by educational researchers to be questioned in order to facilitate collective processes of learning about sustainability. A literature review revealed a considerable lack of similar theoretical and empirical endeavors within the context of environmental and sustainability education, compared to other, more traditional school subjects (such as mathematics and science). Studying the learning potential of some new digital tools purposefully designed to be questionable and malleable to evoke exchange of meanings among the students and unravel their critical and creative thinking towards defining 'sustainability', was considered a challenge worthy of further exploration.

II. THE STUDY CONTEXT

A. Focus and assumptions of the study

The focus of our research endeavour is to study an educational intervention addressing the concepts of 'sustainability', 'sustainable urban living' and 'sustainable lifestyles'. The whole intervention was designed and implemented within a constructionist learning framework. Constructionism builds on the idea that students learn more effectively in situations where they are collaboratively involved in constructing and deconstructing digital artefacts (microworlds) that are personally meaningful to them [22], [23]. An engagement of this kind can evoke the learners' exploration and meaning-making processes with regard to the concepts and models embedded in the microworlds [24], [25]. Microworlds can be thus conceived as 'boundary objects' [13], that is, artefacts which can operate as tools of communication and convey meaning among members of a community. They can play the role of public entities in the context of debate, experimentation and expression of ideas [26].

In the present study we used the technological and pedagogical construct of 'half-baked microworlds', that is, pieces of software the main characteristic of which is that they are provocative by design, in the sense that they call for changes, and they offer the respective functionalities for learners to change them [27]. Their learning value lies not in the process of simple interaction with the microworlds but in that they are open to be challenged and modified because 'the assumptions' on which they are based contradict the learners' conceptions of how things work. They can be thought as digital objects which have been explicitly designed and mediated to learners as malleable fallible artefacts to change them and improve them. What really matters is not so much the actual result of the learners' effort but their engagement with this kind of joint reverse-engineering procedure aiming at individual and collective understandings related to the subject-matter itself.

Fig. 1 The SusCity game construction environment

B. The SusCity microworld

It was within this framework that we designed the SusCity game microworld. This is a game template (a digital authoring system) which can be used by teachers and students to create their own Sustainable City games (see Fig. 1). Users are able to create their city background by loading, drawing or editing city backgrounds. They can place objects on the terrain (as points on a map), such as residential areas, parks, squares, streets, bus stops, theatres, cinemas, schools, universities, super-markets, malls, churches, gyms, etc. Each place object (site of the city) has a specific value with respect to a set of 'properties' or 'affordances' shared by all places (such as sociability, energy saving, natural resources protection, money saving, health promotion, cost, entertainment, sense of security, aesthetic appraisal, life-long learning, etc). In order to form their 'sustainable city' system the users have to decide on the properties and the respective values of all place objects. They should also describe the effects in the resources of the system when they visit or make use of each site. This means that they determine: a) a set of default values for the system's properties which will function as starting point for the players (e.g. a person should have by default some money – the system's property – which will increase with a visit to work and decrease with a visit to the café), and b) a set of threshold values which will indicate when the system's sustainability is violated by the player (e.g., the minimum value of 'energy' for a player to remain in the game) that will lead to loosing the game.

The added value of the SusCity microworld is that it allows

students to construct a game on the idea of 'living sustainably in the city' by intervening on the mechanism that underlies the game. Usually, in digital games, this mechanism is black-box for the users (e.g., in SimCity game). In the SusCity case we open to user manipulation, construction and deconstruction the part of the mechanism that contains the model of sustainability upon which the game is built and we keep away the syntax and the information that might be noise for the students. Integrating a sustainability model in a digital game – as opposed to just discussing a theoretical model – allows for evaluation of the model during game play, which is a motivating activity oriented towards the way the model works.

Within the context of the present study we used the SusCity template to design PerfectVille, a half-baked game which was constructed to be given to the postgraduate students / teachers to play with before they get engaged into their own game construction. PerfectVille consists of the main sites of an imaginary city. Each site has a specific value with respect to a set of properties – sustainability indicators (such as energy, hygiene, money, health, etc) (see Fig. 2). To win the game, the students need to: a) decide which places to visit, after reviewing the attributes of each place by clicking on it, and b) take into account the changes in their resources if they decide to visit a place. Thus, if the players choose to go for example to the restaurant, to the cinema, or to the Concert Hall, and never go to work, they will soon run out of money and the game will end for them. Students are expected to play the game for a specific time of approximately 20 minutes. During that time they have to try to stay in the game as long as possible (that is, to be careful not to run out of resources), to keep the highest score in crucial resources (e.g. hygiene, health, fun, etc), and to visit as many different places as possible (to avoid 'strategies' where students repeat the same route over and over in order to remain in the game). The game keeps a record of the players' route in the imaginary city (the places they decide to visit) and of their resource values.

Fig. 2 The PerfectVille game play environment – Review of the site properties

PerfectVille is designed as a 'half-baked' game microworld. This means that its pedagogical mission is not only for the students to play with it, become more acquainted with the mechanism of the game so that they construct their own later.

It is meant also to engage the students in a process of questioning the 'axioms' upon which the game is built and give them food for thought to engage in discussions about the sustainability parameters of their own practices in an urban context. Within this framework we designed a scenario entitled "From PerfectVille to MySusCity" which involves collaborative play and design of digital games on the idea of the sustainable city. The scenario is centred around the constructionist learning idea of revealing, reflecting and negotiating on concepts related to sustainable urban living both through playing, challenging and modifying an existing game (PerfectVille) and through constructing a new game (MySusCity).

III. METHODOLOGY

Our study was based on the Design-Based Research method. Some key characteristics of this methodological format are that: it is grounded on theory and the relevant research results; it includes intervention in a specific setting/situation; reflection is an integral part of the methodological process; conclusions are used as the basis for designing a new intervention; and the theory resulting is situated, contextualized and continually growing [29], [30]. Among the criteria for choosing this method was our intention to design and study a pedagogical intervention with view to generalize from particular settings and cases to inform the design process. The tool – the half-baked game microworld – had not been used before, and thus the reflection and refinement process on the design was crucial for the validity of the collected data and the analysis performed. Finally, the theory in this study is both an input (upon which design is based) and an output of the research (the data analysis aims at enriching theory).

A. Participants in the study and successive stages of the pedagogical intervention

The participants in the study were 8 postgraduate students of a two-year Master course in Environmental Education which is offered by the Department of Pedagogy of the University of Athens. Two of them are males and six females. Six of the participants are full-time teachers in primary (three females and one male) and in secondary education (one male and one female), while the other two are part-time secondary teachers. The rationale for their selection had two dimensions. The first was to get feedback about the research idea and the technology behind it in order to make the necessary adjustments for classroom use. The second was to get the postgraduate students involved in the discussion and development of the whole idea in order to become prepared to carry out the activity with their own pupils during a subsequent phase of the study.

The educational activity and the study took place within the context of the students' 'Practicum in Teaching and Researching in Environmental Education' from December the 20th (2010) till March the 18th (2011). Four face-to-face assembly meetings were coupled with online communication among students and between researchers and the students.

During the first face-to-face meeting with the researchers (and tutors in the Postgraduate course) the participating teachers were introduced to the rationale of the scenario and were asked to play with PerfectVille in pairs and record their performance. After the end of the first face-to-face meeting they participated in an online discussion in which they challenged: a) the basic axioms upon which PerfectVille is constructed, and b) the characteristics of PerfectVille as a game. Next, the students got involved in a discussion –with the moderation of the researchers/ tutors– on the winner's profile, the winning mechanism of the game and the model of life projected through the game. Discussion was held both in face-to-face meetings with the researchers/ tutors and in the e-class forum. Our aim was to raise various sustainability issues in relation to and as opposed to the model of life reflected in PerfectVille, such as how 'sustainability' is defined within the context of everyday life, what 'sustainable lifestyles' stand for, what are the criteria for leading a sustainable life in an urban context, etc.

Fig. 3 Pictures of the games created by the two groups

During the third face-to-face meeting the two researchers introduced the SusCity microworld to the students and demonstrated how they could use the tool to re-construct PerfectVille and create their own sustainable-city game. The participants formed two groups: one consisted of primary school teachers and the other of secondary school teachers. The goal of each group was to create a game for the pupils of the key stage they were teaching. The games constructed (see Fig. 3) have data in Greek, they need the E-Slate platform to run and can be downloaded from the following url: http://etl.ppp.uoa.gr/_content/download/eslate_kits_en.htm, under the titles "Envicity" and "SusCity – primary".

Each group was invited to design a new game microworld with a different city background, new sites, new attributes and varied values for each site. Decisions on each of these characteristics was based on discussions among the members of each group. No special technical skills were required for the teachers to design and construct their new games. The participants' collaboration was based on synchronous (skype) and asynchronous (the e-class discussion forum) communication tools. In the final face-to-face meeting with the researchers the students presented their own games and played, discussed and evaluated each others' games.

B. Research questions

The main research question of the study is to investigate in what ways collaborative design and construction of half-baked digital games can support learning about sustainability-related concepts and issues. Some more specific research questions are:

1) Does the SusCity microworld lend itself to initiate and support discussion upon the underlying assumptions of the game relating to different models of urban living?

2) By challenging the underlying assumptions of PerfectVille do the students get engaged in meaning-making processes on the issue of 'sustainable urban living'?

3) In what ways do the students attribute meaning to the concepts of 'sustainability' and 'sustainable lifestyles' while they are playing, discussing, reflecting and re-constructing PerfectVille?

4) What structural changes in PerfectVille do the students suggest when they discuss about it and while they are constructing their own game?

5) What are the points of differentiation between PerfectVille and the new games created by the two groups?

C. Categories of data collected and data analysis

The data collected included: the participants' self observation reports, the researchers' observation reports, semi-structured interviews with the students, a discussion-based group interview with all participants, messages exchanged in the e-class forum and the new SusCity games created by the two groups.

Thematic analysis was applied for identifying, analysing and reporting recurrent themes within the data [30]. According to Voyatzis [31], "a theme is a pattern found in the information that at the minimum describes and organizes the possible observations or at the maximum interprets aspects of the phenomenon" (p. 161).

IV. FINDINGS OF THE STUDY

In this paper we report the findings of the data analysis we

performed with regards to the following two research questions:

1) Did playing with the half-baked game microworld (PerfectVille) initiated and supported discussion and reflection among postgraduate students/ teachers upon its underlying assumptions on 'sustainability' and 'sustainable ways of urban living'? (For a more elaborated presentation of the data analysis related to this research question, see also [33])

2) What were the structural changes in PerfectVille the students/ teachers suggested when discussing about re-constructing the game?

Our findings indicate that the concept of 'half baked' game microworld was hard to grasp for the teachers participating in the study. At the beginning of the activity most of the participants were quick to argue that playing with PerfectVille had nothing to offer to them or to their pupils. It was during the second round of discussion which followed their questioning of the game's principles where they got involved in a collective process to define the meaning of 'sustainability' and 'sustainable way of life', that the teachers started to realize the learning potential the whole activity could have for them.

Playing with and discussing on the PerfectVille game led the participants to challenge the game's underlying assumptions and triggered reflection related to the criteria of defining 'sustainable urban living'. It was especially the students' discussion on the winner's record that raised many issues regarding the main assumptions based on which the game was built. Most of the participants focused particularly on the winning mechanism of the game by stating that it is based on the idea that a 'sustainable' route in the city is equated with a kind of 'hectic' way of life, since it demands from the players in order to gain points to visit as many sites as possible. However, this is, as they claimed, a distorted view of sustainability which by no means ensures equilibrium between all parts and properties of the system. By questioning the 'axioms' embedded in the game microworld the participants started thinking about and discussing issues related to sustainability, urban life, individual and social lifestyles, etc.

It is quite interesting that all participants agreed that the model of life upon which the game was built indicated the western and highly consumerist modern way of living, which they characterised as incompatible with sustainability. This is a model of life that identifies very much with what is described by Lange and Meyer [32] as the 'western new middle-class' lifestyle. Its core element, high purchasing power to satisfy all individual-based needs, embodies the idea of the welfare society in most industrialised countries. Having enough money to spend, acquiring a recognizable social identity, attaining the general standards of good life (good health, a proper education, sense of security, etc), outline some of the basic features of the modern 'western' lifestyle. The neo-liberal deification of 'needs' and their gratification stands at the basis of rampant consumerism, which is the inherent mechanism for securing and reproducing the current socio-economic system.

Most of the students also note with some criticism that the game reflects an individualistic and self-centered attitude of leading one's life today. They mainly focus on the properties of the city-sites themselves that prescribe the criteria for the players' choices, prevalent among which are 'money' and 'social recognition'. What they also extensively share is the view that the model projected in PerfectVille is far from reflecting any idea of 'sustainability'. They justified their claim by either referring back to the core elements of the western model of life, and its incompatibility with any criteria or principles of sustainability; or by highlighting the deficiencies of the game's model, such as that it leaves out any social dimension or that it does not address the appropriate values.

With regard to the changes the participants suggested while discussing and/or constructing PerfectVille, 113 messages were exchanged among them which they (a) openly questioned and challenged PerfectVille, (b) offered particular ideas for changes in PerfectVille, and (c) discussed about the design of a new game. Among the participants' main objections regarding PerfectVille is that variations in the values of a sustainable system cannot be linear as shown in the game, in the sense that 'eating regularly', for example, 'in a fast food' might not have an impact on health the first two years but the effect might be radical after the third year. What they also reported is that they wished the microworld offered them the opportunity to express more complicated conditions for indicating when the game was to be over or in sending warning messages. They noticed that the way PerfectVille is constructed allows users to describe only 'or' conditions for each parameter separately. Consequently, game over comes when the 'money' value is less than zero, or when the 'environment' value is less than 100, or when 'action' value is less than 50, etc. The point for the students was to be able to create more complex conditions such as in the case where game is over when 'money' is less than 50 and at the same time 'health' is less than 20.

In general, most of the students' discussions about the games to construct focused on the analysis of the concept of 'sustainable lifestyle' and on the ways of representing their own views in the games. Both groups included the properties of 'money', 'individual or social action', the 'physical environment' and 'environmental ethics' in their game. Where they mainly differed is that the game constructed by the secondary education group involved also the use of 'good/bad health' and 'good/bad mood' properties, whereas the primary education group included the property of 'personal harmony'. Finally, while constructing their own games the two groups suggested specific structural changes in a SusCity game, such as adding various means of urban transportation as objects on the city terrain apart from the particular city-sites, replacing the city-sites as stand-alone physical places by the activities hosted in them, introducing the time spent by a person when visiting a place as one of the variables, considering the possibility to include different uses of the city by different

groups/profiles of citizens, etc.

REFERENCES

[1] European Council, *Council conclusions on education for sustainable development.* Brussels, 2010, Retrieved in 19/11/2010, from: http://consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/educ/117 855.pdf

[2] J. Huckle, and S. Sterling (Eds.), *Education for Sustainability.* London: Earthscan, 1996.

[3] B. B. Jensen, and K. Schnack, "The Action Competence Approach in Environmental Education", *Environmental Education Research*, vol. 3, no. 2, pp. 163-178, 1997.

[4] W. Scott, and S. Gough (Eds.), *Sustainable Development and Learning. Framing the Issues.* London: Routledge Falmer, 2004.

[5] M. Robertson (Ed.), *Sustainable Futures: Teaching and Learning: a Case Study.* Victoria: Acerpress, 2007.

[6] A. Dobson, *Justice and the environment: Conceptions of environmental sustainability and theories of distributive justice.* Oxford: Oxford University Press, 1998.

[7] G. Liarakou, M. Daskolia, and E. Flogaitis, "Investigating the Associative Meanings of 'Sustainability' among Greek Kindergarten Teachers", *International Journal of Interdisciplinary Social Sciences*, vol. 1, no. 5, pp. 29-36, 2007.

[8] J. Fien, and D. Tilbury, "The global challenge of sustainability", in *Education and Sustainability. Responding to the global challenge*, D. Tilbury, R. Stevenson, J. Fien, and D. Schreuder, Eds. Gland: IUCN, 2002, pp. 1-12.

[9] B. Jickling, "Wolves, environmental thought and the language of sustainability", in *Education and Sustainability. Responding to the global challenge*, D. Tilbury, R. Stevenson, J. Fien, and D. Schreuder, Eds. Gland: IUCN, 2002, pp. 148-154.

[10] M. Bonnett, "Education for Sustainability as a Frame of Mind", *Environmental Education Research*, vol. 8, no. 1, pp. 9-20, 2002.

[11] F. Rauch, "The potential of Education for Sustainable Development for Reform in Schools", *Environmental Education Research*, vol. 8, no. 1, pp. 43-51, 2002.

[12] M. Redclift, "Reflections on the 'sustainable development' debate", *International Journal of Sustainable Development & World Ecology*, vol. 1, no. 1, pp. 3 – 21, 1994.

[13] S.L. Star & J. R. Griesemer, "Institutional ecology, 'translations' and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939", *Social Studies of Science*, vol. 19, pp. 387-420, 1989.

[14] R. B. Stevenson, "Schooling and environmental education: Contradictions in purpose and practice", in *Environmental Education: Practice and Possibilities*, I. Robottom, Ed. Geelong: Deakin University Press, 1987, pp. 69-82.

[15] D. Orr, *Ecological Literacy: Education and the transition to a postmodern world.* Albany: SUNY Press, 1992.

[16] S. Papert, *The Childrens' machine. Rethinking School in the Age of the Computer.* New York: Basic Books, 1993.

[17] J. Huckle, and S. Sterling (Eds.), *Education for Sustainability.* London: Earthscan, 1996.

[18] P. Posch, "Social Change and Environmental Education", *Australian Journal of Environmental Education*, vol. 13, pp. 1-6, 1997.

[19] UNESCO-UNEP, "Environmentally educated teachers: the priority of priorities?", *Connect*, vol. 15, no. 1, pp. 1–3, 1990.

[20] UNESCO, *Guidelines and recommendations for reorienting teacher education to address sustainability.* Paris: UNESCO, 2005.

[21] A. E. J. Wals, and B. Jickling, "Sustainability in higher education: from doublethink and newspeak to critical thinking and meaningful learning", *International Journal of Sustainability in Higher Education*, vol. 3, no. 3, pp. 221-232, 2002.

[22] I. Harel, and S. Papert, *Constructionism.* Norwood, NJ: Ablex Publishing, 1991.

[23] Y. B. Kafai, and M. Resnick (Eds.), *Constructionism in Practice: Designing, Thinking, and Learning in a Digital World.* Mahwah, NJ: Lawrence Erlbaum Associates, 1996.

[24] S. Papert, *Mindstorms: Children, Computers, and Powerful Ideas.* New York: Basic Books, 1980.

[25] J. Sarama, and D. Clements, "Design of Microworlds in Mathematics and Science Education", *Journal of Educational Computing Research*, vol. 27, no. 1, pp. 1-3, 2002.

[26] L. Healy, and C. Kynigos, "Charting the microworld territory over time: design and construction in learning, teaching and developing mathematics", *The International Journal of Mathematics Education*, vol. 42, pp. 63-76, 2010.

[27] C. Kynigos, "Half-Baked logo microworlds as boundary objects in integrated design", *Informatics in Education*, vol. 6, no. 2, pp. 1–24, 2007.

[28] P. Cobb, J. Confrey, A. diSessa, R. Lehrer, and L. Schauble, "Design Experiments in Educational Research", *Educational Researcher*, vol. 32, no. 1, pp. 9–13, 2003.

[29] The Design-Based Research Collective, "Design-Based Research: An Emerging Paradigm for Educational Inquiry", *Educational Researcher*, vol. 32, no. 1, pp. 5–8, 2003.

[30] V. Braun, and V. Clarke, "Using thematic analysis in psychology", *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77-101, 2006.

[31] E. R. Voyatzis, *Transforming qualitative information: Thematic analysis and code development.* Thousand Oaks, CA, Sage Publications, 1998.

[32] H. Lange, and L. Meier (Eds.), *The New Middle Classes. Globalizing Lifestyles, Consumerism and Environmental Concern.* Heidelberg: Springer, 2009.

[33] C. Kynigos, and M. Daskolia, "Collaborative design and construction of digital games to learn about sustainable lifestyles", in *International Technology, Education, Development Conference Proceedings INTED2011*, L. Gómez Chova, I. Candel Torres, and A. López Martínez (Eds.). Valencia, Spain: International Association of Technology, Education and Development (IATED)., 2011, pp. 1583-1592.