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Gaming climate change: assessing online climate change games targeting youth produced in Spanish

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Abstract

In search of innovative approaches to raise climate change awareness among digital natives, online and serious games are gaining currency as new platforms for communication, education and social change. Thanks to their interactivity and immersive narrative, games have capacity to convey to young people the problems that they will be facing in the future and enable them to experience these problems directly through the game. In addition, online games can offer the possibility to be implemented in educational contexts as a didactic tool for teachers. This study aims a) to present a checklist with validated evaluation criteria identified through the Delphi method; and b) to conduct a qualitative evaluation of communicative and educative elements of a sample of 24 online climate change games targeting youth and produced in Spanish. Our findings suggest that the games evaluated seem to be on the right path, making the topic of climate change local, visual and connected, although there is still room for improvement in terms of contents, gameplay and didactics.

Keywords: Climate change; Environmental education; ICT; Evaluation; Youth

1. Introduction

The commitment of the new generation is crucial for changing the world and critical for avoiding the worst impacts of global challenges such as climate change, but surveys show that awareness of the issue is still limited and a notable lack of commitment to adopting measures for mitigating and adapting to climate change can be seen (Bofferding & Kloser, 2014; Meira et al., 2013). Scholars acknowledge the limitations of conventional media and traditional

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education programs in delivering information, such as the one-way transmission of messages, the lack of contextualization, and the negative and alarmist tone of the content (Aparici & Silva, 2012; León et al., 2013; Díaz-Nosti, 2013; Moser, 2010; Reig, 2013) and call for innovative strategies to engage youth in climate change. Taking into consideration the communicative paradigm of the so-called "interactive generation" (Aguaded-Gómez, 2011) or "digital natives" (Prensky, 2001) and the hours they spend playing online games, it would be logical to pay more attention to these tools. Videogames in general, and online games in particular, can offer active engagement and experiential learning, transforming passive consumers of information into active players who absorb new information more readily; simulate unfamiliar circumstances that aren't possible in real life, liking decisions to consequences; and inspire out-of-the-box and critical thinking. In addition,

When talking about *online climate change games* we are focusing on games available on the Internet specifically themed around climate change and/or topics related to this phenomenon, with communicative and educational purposes, which does not exclude that they can involve some degree of fun and entertainment. These types of videogames are then considered as *serious games,* understood as games intended to fulfill a purpose, to convey ideas and values and sometimes at persuading the players (Frasca, 2007). They have experienced most of the progress in the last 10 years (Reckien & Eisenack, 2013). So what types of online games tackling climate change are out there? What are their communicative and educational characteristics?

To our knowledge, not much empirical research is available to date researching their educommunicative nature, and the existing studies mostly focused on English-speaking games ignoring other languages such as Spanish (Katsaliaki and Mustafee, 2014; Reckien & Eisenack, 2013; Wu & Lee, 2015). Therefore, the main objective is to assess the communicative and educative elements of online climate change games produced in Spanish. A secondary objective is to offer a checklist with validated evaluation criteria to judge these games, which can help not only to understand more their nature and reveal explicit-implicit meanings, but also to teachers when deciding appropriate games as pedagogical resources.

2. Methodology

The research presented here is characterized as interdisciplinary, exploratory and evaluative. Our qualitative study makes use of the Delphi method to develop a checklist with validated evaluation criteria, and of the content analysis, narratology and ludology to evaluate a sample of games produced in Spanish. We describe below the steps and research methods carried out in this study.

2.1. Checklist with validated evaluation criteria

In order to develop criteria that reach consensus among experts on their relevance and usefulness for evaluating communicative and educative elements in online games focusing on climate change contents, we made use of the Delphi method, a structured and interactive process to collect opinions that establish consensus, based on the experiences and judgments of experts (Scapolo & Miles, 2006). In our case, a total of thirteen experts from Spain and abroad participated in the study. The experts were chosen for their theoretical and practical knowledge, motivation to participate in the study and feasibility of contact; their areas of expertise are communication, education, games and climate change. The technique consisted in three consulting rounds: in the first round, an open question was sent to the experts to assess the relevance and usefulness of preliminary dimensions (categories of evaluation) and criteria (indicators of evaluation), identified through an extensive literature review and pre-selected for their potential to provide useful information from a narratological and ludological point of view, inspired by the "Social Discourse of Videogames Analysis Model" by Pérez-Latorre (2010), which integrates both analysis perspectives. They also propose new dimensions and/or criteria if necessary. The second consulting round consisted of a questionnaire in which experts assessed in ordinal terms (high, medium, low) the relevance and usefulness of the evaluation criteria. The criteria that got a consensus of 90% (high + medium) were selected. In the third and last round, we requested a final assessment of the criteria that did not pass the second phase, confirming whether or not they should remain outside of the final set of criteria.

Table 1. Dimensions and evaluation criteria in the checklist

Dimensions	Evaluation criteria
Identification	game title
	URL: link to the website; and availability of mobile app
	language/s
	type of creator: author behind the creation of the game and type of institution
	communicative purpose: communicative intentions and objectives of the game
	brief description: summary according to the genre, objectives and back story
Narrative	relevance of narrative: narrative elements can acquire importance or be irrelevant
	global storyline: the story in its entirety, the logical or causal succession of the events
	character depiction and role: characteristics and qualities of the character/avatar
	representation of the environment: the world in which the character/player develops
	dimension/space/scale: general context and scale of the scenarios
	dimension/time: period in time that the story spans
Contents	term used: terminology used to describe the phenomenon being studied
	existence of false concepts and misconceptions
	explicit use of scientific concepts: definition of climate change terms
	explicit use of information sources: the sources of information and data are cited
	convergence with other media or social networks: links to social networks are included
	message framework: themes, causes/consequences and tone
Gameplay	number of players and type of use: individual or multi-player
	player type: players' profile depending on their interests
	degree of interactivity: user intervention in the content
	length of playing: time employed to play the game
	game mission
	game dynamics and mechanics: structure, rules and basic elements
	feedback system: message that the player receives in light of certain actions
	reward system: actions that incentivise and the rewards themselves
	availability of game instructions and possibility of saving the game
Didactics	competences: knowledge and attitudes that students can reach
	abilities: mental operations that students can reach
	problem resolution conditions: type of reasoning to solve problems
	need for previous knowledge
	learning curve: level of learning difficulty
	possibility of group work
	accessibility: availability of the game for students with functional diversity
	interdisciplinarity: combination of two or more academic disciplines
	availability of didactic guidelines: document or link with educational information

2.2. Study sample

A web search was carried out in the time period August-December 2015 in the main search engines formulating the following search request: ("videogame" OR "online game" OR "educative game" OR "eco-game") AND ("climate change" OR "global warming" OR "sustainability" or "environment"), in Spanish. Particular emphasis was placed on

searching climate change-related government and NGO directories, as well as websites specializing in education 2.0 and videogames. In order to identify a sample of online climate change games produced in Spanish, the following requirements were taken into account: that they are hosted on a web platform and are free to access; that they are played over the Internet; that they have communicative and educational objectives; that the focus of the storyline is climate change or related aspects such as recycling, energy efficiency, sustainability; and that they are aimed at an adolescent audience (12+). In addition, snowball and interviews with key users from online videogame communities were also employed to identify the following 24 games: *Actúa con tu consumo* (Greenpeace Spain); *Alerta CO2* (Acción Natura / Generalitat de Catalunya); *Alto a los desastres!* (UN-ISDR); *Climántica* (Xunta de Galicia); *Concurso del Cambio Climático* (European Union); *Controla* (Red Eléctrica Española); *De primero, reciclaje* (Ecoembes); *El juego de la separación en casa* (Consorcio para la Gestión de los Residuos Sólidos de Asturias); *Eneragen, el juego de la energía* (Asociación de Agencias Españolas de Gestión de Energía); *Enercities* (Paladin Studios, ROC Nijmegen, Qeam, LMC, Akademie Klausenhof, KEK, LUV, Agencia de la Energía de Granada/ European Union); *Energy 2020* (Universcience, France TV Éducation, Tralalere / European Union*); *Fluvi y el ciclo del agua* (Expo Zaragoza 2008); *Game sostenibilidad* (Iberdrola); *Isla 100%* (Instituto Tecnológico y de Energías Renovables and Agencia Insular de Energía de Tenerife); *Misión posible, salvar el planeta* (Cruz Roja Española); *My Green Energy Planet* (Fundación AXA, WWF Spain); *Multijuegos forestales* (Edufores*); *Oca de la bioenergía* (CESEFOR, Junta Castilla y León, Alida Ingeniería del medio SL); *Switch them off* (WWF); *Todo un mundo de energía* (Endesa); *Vinyl Game* (Vinyl – European Union program); *Water alert* (UNICEF); *Where the rivers meet the sea* (NOAA); *3rd World Farmer* (IT- University of Copenhagen).

Taking into account that the subject matter is videogames, two researchers took part in the coding of the material making use of Table I. Levels, missions and episodes were used as analysis units, similar to scenes in movies or strip-frames in comics. The evaluation therefore encompasses a mix of content analysis, which provides more quantitative information, as well as narratology and ludology, focusing on the relationships between game narrative and design, on the context of the messages, and on the transmission of implicit values and meanings.

3. Results

In this section we present the results from the evaluation, categorized in each of the dimensions introduced in the checklist, allowing us to assess the communicative and educative elements of online climate change games produced in Spanish.

3.1. Identification

First of all, our evaluation have noticed that the majority of games (58,3%) are located in an independent website from the institution, and that only three of them count with a mobile application version. Other language options apart of Spanish include Galician (1 game), Catalonian (2 games) and English together with other languages (10 games). Those games that have been financed by European Union are the ones that offer more languages apart of Spanish and English (e.g. *Enercities; Energy 2020*). Our study distinguishes between various actors as messengers: NGOs occupy the first place in the ranking (25,0%), followed by the private sector (20.8%), and intergovernmental organizations (16,7%). Only one game has been developed by a University or research institution. Results also reveal cooperation between different types of actors in creating and producing games. For instance, *My Green Energy* Planet was developed by an environmental NGO (WWF) and an insurance company (Fundación AXA).

Most of the cases aim to provide some basic knowledge on climate change and related issues, developing familiarity with the topic (79,2%). Raising awareness of causes and consequences can be seen in 58,3% of the games evaluated, and the same percentage applies to promoting a change in attitude and behavior. Raising awareness causes-consequences is revealed for instance through the type of questions posed to the player in a quiz format or the type of challenges presented in a skill/puzzle game, such as relating the images of causes/consequences. To a lesser extent, we find that 41,7% of the cases stimulate the development of solutions and ideas through creativity. This last purpose can be clearly seen in the game *Act on your consumption*, where the character Eva suggests that the player look around and check how many items are made of plastic in order to encourage the player to reflect and think how they can be substituted. She also encourages the player to write down his/her own plans for a sustainable diet and mobility low in

CO2.

3.2. Narrative

The results of our study show that the relevance of narrative in the games evaluated is mostly medium-high (70,9%). Arcade games, adventure/action games and simulations are the formats that contain more narrative weight. A great example of the narrative weight is *Water Alert*, where young people are engaged in an adventure of strategy and survival aiming to ensure that the people in a drought-challenged village, who are facing the threat of a flood, have water that is safe to drink and a clean and healthy school environment.

The findings on narrative reveal that global storylines are very diverse; however, it is noticeable how in half of the games, the players take on the role of an ordinary citizen who has to take sustainable decisions in their daily lives, such as saving energy and water, recycling, buying ecological food, etc. (e.g. *Actúa con tu consumo; De primero, reciclaje; Energy 2020*). In 20,8% of the games, the player takes the role of a major: in *Climántica*, the major has to create a sustainable territory to reduce CO2 emissions and keep population happy, while in *Alto a los desastres!* the major has to create a safe territory to reduce the risk of disasters. Other roles include being a superhero that has to save the world from greenhouse emissions (e.g. *Misión possible, salvar el planeta)* or an African farmer who manages a farm and has to deal with challenges like drought (e.g. *3rd World Farmer*). Some of the games make use of narrators in their stories, such as animals (e.g. the penguin CLIMI in *Climántica* or a monkey from outer space in *Eneragen*) or fantasy creatures (e.g. an elf in *Multijuegos Forestales*).

Despite the diversity of storylines in the games, all games tend to provide a better description of the environments than of the characters, partly because of the nature of the climate change topic. In *CO2 Alert*, for instance, the players are placed in the fictitious city of Metropolis and they can choose between different scenarios, such as roads, schools or houses, where CO2 emission needs to be reduced. Similarly, in the game *Climántica*, the player decides to leave for a new territory, and can choose between an inland territory, a rugged territory that gives way to the open sea, and a coastal territory. This first option allows the user to place themselves in a meaningful location, thereby adapting communication to the user's own context and interests.

In addition, 66,7% of the scenarios are fictitious, while 33,3% are real (e.g.: Spanish islands, Andes, the Caribbean Sea, Africa). The stories can also be set on different scales. The local scale refers to decisions taken by private households at their own homes or in the context of a virtual city. The majority of games evaluated focus mainly on this scale (70%), followed by a combination between global-national-local (12,5%). If we evaluate the "time" dimension of the stories, the results show that the majority of the games are focused on the present (54,2%). A combination of present and future settings is particularly common in simulation games. For instance, the game *Climántica* is set in the year 2015 at the beginning of the game and time passes until the year 2034. Through this present-future connections, online games try to offer opportunities to convey to young people the problems that they will be facing in the future and enable them to experience them directly through the game.

3.3. Contents

Since language is never neutral, the first step to start evaluating the messages is to consider the creators' preferred terms to describe the phenomenon. Half of the games use the term "climate change" and just two of the games prefer "global warming". The rest of the games do not mention any of these terms, mostly because their main topic is not the phenomenon of climate change but cross-over issues such as energy efficiency, waste management or consumption. A majority of games (58,3%) have chosen to explicitly define certain scientific or other concepts related to climate change to facilitate the player's understanding, such as greenhouse effect, renewable energy, etc. However, only eight cases provide the source of the information, and seven took advantage of their online format to converge with social networks. For example, in *Actúa con tu consumo* there are links to documentaries like *The Age of Stupidity*, extracts from the press, Facebook and Twitter accounts of Greenpeace and other ecologist organizations. *EnerCities* can be played on Facebook, encouraging the competition among players. We have also noticed that false concepts or misconceptions have not been found, although some of the games integrate other environmental problems and concepts such as acid rain or ozone depletion which can lead to misunderstanding and wrong relations among players.

Mitigation and adaptation are considered the main responses to climate change by the UN. According to our evaluation, the main focus in games is mitigation of greenhouse gases: 58,3% of the games address only this aspect, while 29,2% of the games address both mitigation and adaptation measures in their messages, and 12,5% address mainly adaptation, such as *Alto a los desastres!, Water Alert* or *3r World Farmer*. We also investigated content-related aspects by looking at the four themes that appear the most in each game. The games address a variety of climate-related themes, but the primary focus is energy (58,3% of cases), followed by mobility (45,8% of cases) and waste management (41,7% of cases). Other interesting main topics are the use of carbon sinks through replanting trees (e.g. *Multijuegos forestales*), water saving (e.g. *Fluvi y el ciclo del agua*), protecting biodiversity (e.g. *Where the rivers meet the sea*), and farming (e.g. *3rd World Farmer*).

The games make it clear that human action is the main cause of climate change. Half of the games explicitly expressed it, while few of them make reference to natural causes in combination with human activity (16.7%). The rest of the games (33.3%) do not explicitly mention causes, mainly because these games focus on cross-cutting issues and not to the phenomenon of climate change itself. As for the consequences of climate change, the games highlight extreme meteorological events, threat to ecosystems, raise of temperatures, health and economic impacts.

The tone of what is communicated or the author's attitude towards the audience can be revealed through words and sentence styles. We have analyzed the four tones that appear the most in each game. According to our research, the most used are pro-action (91.7% of the cases), informative (75,0%) and directness (45,8%). Examples for pro-action tone include "*Many futures are possible, do you dare to change the world? Take decisions today that will lead to a better tomorrow*" (*Energy 2020*); and for directness, "*Hi, I'm Eva, a young consumer like you*" (*Actúa con tu consumo*). The findings reveal the use of a positive tone in the games, focusing on providing information on solutions, encouraging action and implying empathy with the player. To a lesser extent, other tones chosen by the authors are alarmist, encouraging, and caring. Another aspect to highlight is the occasional use of humor, which can be a potential strategy to target young people (e.g.: "*Game accuracy is low, perfect if you're a beginner or chicken!*" in *Controla*).

3.4. Gameplay

From a more ludological point of view, we find first of all that the majority of games (58,3%) are characterized as having a high degree of interactivity, providing players great power to intervene in the content. When looking at the game dynamics, challenge is the most common, followed by progression, discovery, ability, and status, the last one usually supported by rankings and leader boards. Game dynamics can be further interpreted into mechanics. Our research reveals that 20 out of 24 games clearly involved decision-making mechanisms, and 15 out of 10 games are under time pressure, supported mostly by points and levels. This reveals that challenge, through decision-making and time pressure, is the most common design strategy. In fact, decision-making under time pressure is considered a key skill to cope with climate change effects: players must take various parameters into account in real time, planning resources in a strategic way, by analyzing and evaluating information received on such important considerations as urban planning, energy or water management. Looking at the different types of player profiles, we have found out that the most popular player profile is the explorer (33,3%) and competitor (33,3%). Fewer cases are characteristic of the creator type of player (25%) and collaborator (8,3%). The fact that most of games respond to the explorer profile is correlated with the data on number of players and type of use, since the majority of the games are made for one player. Multi-player is mostly observed in board games format.

The individual actions that are carried out in the character/player's story can be accompanied by feedback (evaluation of the actions and their impact). Results show that most of the games use a mix of positive and negative messages in their feedback system (66.7%). Similarly, our study shows that the majority of games evaluated use an intangible reward system (58,3%) to reward individual actions, such as extra points, unblocking levels or virtual coins by answering a quiz question correctly, making sustainable decisions under time pressure or doing well in the skill games, whether it is by turning the street lights off quickly or by matching the cause/consequence images of climate change. It is also worth mentioning that most of the games´ length is less than one hour and that game instructions are available, which makes it easier to be implemented by docents in class.

3.5. Didactics

Games evaluated are characterized by having different learning curves and difficulties, facilitating the development of the majority of competences assigned by LOMCE such as knowledge and interaction with the physic world (100%), social and citizen competence (75,0%), autonomy and personal initiative (50,0%), digital competence (45,8%), and mathematical competence (41,7%). Following Bloom Taxonomy, the abilities that are promoted the most are applying, evaluating and creating. As positive aspects we highlight the interdisciplinarity of games, allowing their use for different courses, and the possibility of group work by sharing computers when playing; and as a negative aspect, the fact that the majority of games do not include didactic guidelines to help teachers implementing the game at class. In addition, just two cases are available for students with functional disability.

4. Conclusions

The games evaluated seem to have incorporated the recommendations given by scholars like Sheppard (2012) on how to communicate climate change: (1) make it local, (2) make it visual, and (3) make it connected. The majority of the games provides a local discourse and shows a general preference towards portraying an ordinary citizen and local scenarios, in which players make decisions at home or within their communities to reduce carbon emissions. Through the present-future connection, accompanied by contextual information with references to climate change causes and consequences, games allow players to make decisions in the present and then travel into the future, where they can see the consequences of their choices in a visual manner, an advantage corroborated by similar studies (Schroth et al., 2014). In addition, most of the games present a positive discourse, not only through the pro-action and direct tone of the messages, but also through the game design with the feedback and reward system. Focusing on solutions, as well as positive and localized stories, has been suggested as a strategy for raising awareness and enhancing engagement (Maibach et al. 2010, Sheppard, 2012).

On the other hand, there is still room for improvement in various areas. Regarding the messengers, we miss more participation from research and scientific institutions, as well as organizations and game developers from Latin America. Looking at the contents, there is a lack of a climate change adaptation perspective: just three games explicitly focus on these issues, and a good example of that is *Alto a los desastres!* A greater degree of critical perspectives on the issue, by for instance framing messages in terms of justice, solidarity, mobilization or sustainable life-styles, is also highly encouraged. Good examples include *Actúa con tu consumo* or *3rd World Farmer*. In addition to this, we believe that games that address climate change should avoid addressing other environmental concepts such as depletion zone or acid rain in order to avoid misconceptions and relations; incorporating a team of scientists will help to achieve this purpose and ensure scientific accuracy. In regards to gameplay, it seems there is a trend in using simulations for energy-related games and puzzles or ability games for waste management-related games. Some of the games evaluated tend to use very simplistic game structures, which can reduce players´ intrinsic motivation and provide limited learning experience. Challenge should be more encouraged. A greater integration of comradeship dynamics and cooperation mechanisms in their structure and design would also be highly recommended to call for collective action and efficacy. In this sense, the field of online climate change games could have a closer look at massively multiplayer online games, which enable players not only to compete but also to cooperate with each other in meaningful ways. Lastly, the inclusion of didactic guidelines and accessibility are also advisable.

Future research should focus on the impact and effectiveness of these games on players learning and engagement. We also encourage researchers, educators and game designers to make use of proposed checklist. The dimensions and evaluation criteria can be transferable to other types of online games in general, but especially those ones centred in scientific and environmental areas.

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