



Educational games to sustainability

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1. Introduction

There has been an increasing interest in supporting sustainable development education, specially through scientific and technological interdisciplinary innovation. In this context, recent research suggests that serious games, i.e. those that do not have entertainment as their primary purpose, offer unique possibilities for creating educational tools towards sustainability. Serious games allow experimentation in controlled environments, useful, for instance, for simulating future scarcity scenarios. They can also be used as persuasive tools to influence players idea and behaviors, and can provide compelling experiences helping to create engagement towards sustainability.

2. Objectives

The main objective is to go deep in the design, deployment and evaluation of educational serious games for application in environmental issues and public resources management. This work passed through the following specific targets:

- to investigate the formal aspects of the research domain: the problems to solve, the fundamental research questions and goals, the formal methods and techniques applicable, the evaluation metrics, and the existing tools and frameworks
- to design a technical architecture, which supports the conceptual design of the designed games
- to design and deploy the games, using game design, game modelling, and best practices of game design and development
- to perform extensive experimental validation, by collecting and evaluating data generated by the games, using the identified evaluation metrics

3. Method

To effectively convey instructional contents to players, educational games need to be grounded on sound learning theories, and provide engaging and entertaining experiences. So, at first, we investigated the theoretical background that underlie educational games design from two aspects: educational and entertaining. We identified and compared the theoretical frameworks that were recently proposed for educational game design [1], and under the lens of player experience, an emerging concept that focus on players emotions while interacting with a game [4]. In short, these studies identified several proposed design tools in recent literature, considering both educational, and player experience aspects. However, none of these tools have been extensively applied or thoroughly assessed.

To obtain a broad view over educational games for sustainability, which allow position our research in areas that would benefit, we surveyed the possible approaches for serious games in sustainability issues [5]. This study had the following main objectives: (i) to identify current applications for serious games to sustainability, (ii) to present possible design strategies for sustainability games, and (iii) to summarize research questions that may be approached by further research in the field.

From a practical point of view, we designed and developed two serious games: WaterOn! and Sustain. WaterOn! is focused on concepts of the water natural cycle, and Sustain focus at raising players awareness of the different actors and domains involved in sustainability scenarios. Both games are collaborative and feature players interaction through tablets, exploiting both multitouch, tangible interaction (WaterOn!) and augmented reality (Sustain). Each game is based on a different theoretical framework to support its design and, to the best of our knowledge, these are the first examples in the literature of the adoption of these frameworks during game design and development.

4. Results

Sustain and WaterOn! passed through several refinement phases, including tests with both experts and users, focused in the game usability and ballancing. Preliminary evaluation indicated the tools success in making players collaborate towards the serious objective [2,3].

We are currently working on the quantitative evaluation of both games. We developed an evaluation protocol, which includes: objective comparison with a paper-based tool, structured observation, and analysis of reports generated through game learning analytics.



Sustain



WaterOn!

5. Conclusions

Although sustainability educational games reunite several features indicating promising potentialities, the approaches developed so far often fail to fully leverage such capabilities. Therefore, several research questions were identified: which are the design models most suited to guarantee that sustainability educational games achieve their pedagogical goals? Since collaboration is a relevant dimension, which are the design elements and technological tools that can foster such cooperation? How innovative user interaction paradigms can be exploited to improve the expected outcomes of sustainability educational games? Hopefully, the insights from this PhD research helps to aggregate knowledge to such questions, aiding the expanding field of sustainability educational games.

6. References

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