

# Co-design of treasure hunts for a Natural History Museum

Pablo Gutiérrez-Sánchez<sup>[0000-0002-6702-5726]</sup>, Irene  
Camps-Ortueta<sup>[0000-0002-2635-9041]</sup>, Pedro P.  
Gómez-Martín<sup>[0000-0002-3855-7344]</sup>, and Pedro A.  
González-Calero<sup>[0000-0002-9151-5573]</sup>

PadaOne Games, Spain  
<https://www.padaonegames.com>

**Abstract.** This paper describes 3 iterations of co-design of educational treasure hunts for a natural history museum in Spain. Game designers have collaborated with primary and secondary school teachers, and museum educators to find good solutions to the problems we faced in the design of a visit to the museum that serves to draw children’s attention to the problems of biodiversity loss, and to understand the impact that our consumption habits have on nature.

**Keywords:** Serious games · Game design · Educational escape room.

## 1 Introduction

Serious games have been applied for decades in areas such as education, health, defense, art and culture seeking to improve the user engagement and increase their motivation [3]. Education is a major museum function, and museum educators engage in a broad range of activities including: tour programs; informal gallery learning programs; and family programs. Typically, educational activities involve some type of interaction with or around objects in the museum [6] which in many occasions may include some form of game [1]. In the last years, there is a growing number of educational activities in museums using mobile devices to support interactive activities [4] and games [5].

The work presented here describes several iterations in the design of treasure hunts around different exhibitions of the National Museum of Natural Sciences (MNCN) in Madrid, one of the oldest museums of Natural History in Europe<sup>1</sup>. This is one of the five case studies in the EU-H2020 SPICE project aimed at enabling museum audiences to share interpretations and reflections of cultural heritage to gain better understanding of other communities and increase social cohesion and participation in the society [2].

The general objective of the games developed for the MNCN in the framework of the SPICE project is to ensure that a visit to the museum serves to draw

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<sup>1</sup> <https://www.mncn.csic.es/>

children’s attention to the problems of biodiversity loss, and to understand the impact that our consumption habits have on nature.

The games, which include elements of image recognition and augmented reality, run on a tablet and are played simultaneously by a group of children in the same class, consisting of between 20 and 30 students. The game is usually played by pairs of children sharing a tablet and take around 1 hour to be completed.

We describe 3 iterations of co-design of the games where we designers have collaborated with primary and secondary school teachers and MNCN educators to find good solutions to the problems we faced in achieving the overall goal of the game mentioned above:

- How to introduce children to the concept of biodiversity and the problems involved in its loss.
- How to turn the game into a tool for museum educators so that the educator’s explanations are naturally interspersed between the phases of the game, maintaining the children’s interest in the activity and their attention to the explanations.
- How to collect information on children’s opinions and habits related to human impact on the planet.

## 2 First iteration

In this iteration we co-designed with museum educators in the design of the game script, and the questions about consumption habits. We worked with 6 school groups, for a total of almost 120 participants from fifth and sixth grade (10 to 12 years old) and second year of secondary education (13 to 14 years old) in November 2021.

To make the museum workers feel more involved in the game, we asked them to choose the main characters, and they decided that they would like to have in the game two colleagues from the museum, Fernando Valladares and Pilar López.

The main conclusions of this iteration were:

- A mechanic was introduced that asked the player to look for the educator and wait until the educator provided a code to continue the game. We checked that this mechanism allows the group to coordinate and direct their attention to the educator’s explanations in a satisfactory way.
- The concept of biodiversity was developed through the educators’ explanations, but we found that the concept was too complex to be explained in the time available during the game.
- Multiple-choice questions were interspersed to elicit participants’ opinions. These questions were presented during the pause following the educator’s explanations and before the educator provided the code to continue, in order to get the children’s attention while answering them.

### 3 Second iteration

In this iteration we co-designed with school teachers in the design of the complete experience envisioned in the use case. We worked with 3 school groups, for a total of almost 60 participants from fifth grade (10 to 11 years old) in November 2022. The overall activity consisted of three individual activities:

- The first, a few days before the visit to the museum, consisted of a talk where we explained to the children the concept of biodiversity, its relationship with evolution and the risks that are currently causing biodiversity loss.
- The second, which took place at the museum, consisted of the treasure hunt game where the search and problem solving phases were interspersed with explanations from the museum educator who again spoke to the children about biodiversity, evolution and biodiversity loss. To end the visit to the museum, the educator talked about two species, one a success story in the effort to conserve nature and the other a failure. The Iberian lynx was on the verge of extinction 20 years ago when there were only a few dozen specimens left, while today, thanks to the efforts of the institutions, there is a growing population of over 1,000 individuals. In contrast, the thylacine became extinct at the beginning of the 20th century due to hunting and loss of habitat.
- Finally, back at school, the teachers gave the children a third activity: they had to choose the lynx or the thylacine and write their story and draw it.

The experiment showed that the design of the experience was satisfactory. The presentation at school made it possible to adequately introduce the concept of biodiversity, which was then reinforced by the educators' explanations interspersed in the game. In addition, the writing work that the children did in the days following the visit effectively facilitated their process of reflection and assimilation of the concepts presented in the activity.

### 4 Third iteration

In this iteration, we focused on improving the design of the game mechanics. We worked with 4 school groups, for a total of almost 100 participants from first and third year of secondary education (12 to 15 years old) in February 2023. Our goal was to develop and test more sophisticated game mechanics that would be more challenging for older players. In addition, we wanted to test the authoring tools and see if we were able to quickly iterate versions of the game.

We came up with 3 versions of the game developed and tested in the same week. The last one resulted in a very satisfactory combination of game mechanics with a 15-question quiz on energy consumption habits, dietary habits, and consumer habits of the participant teenagers. It is also important to note that in this iteration the treasure hunt structure with sequentially organized trials was replaced by an escape room organization with 4 trials per room that could be run in any order to collect clues to escape the room.

## 5 Conclusion

Through successive iterations of co-design with school teachers and museum educators we have been able to design an experience that meets the stated objective of effectively communicating to children and young people between the ages of 10 and 15 the importance of caring about biodiversity conservation. Playing a central role in this experience is an hour-long activity in the form of a game that takes place in the museum and serves to promote the engagement of the children and make them more receptive to the educators' explanations.

The development of authoring tools that allow to quickly compose new versions of the game will make it easier in the future to continue experimenting with this type of activities and to adapt them to the specific context of each class group, allowing the teacher to be in charge of designing her own games.

## Acknowledgements

The research leading to this publication has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements "SPICE - Social Cohesion, Participation, and Inclusion through Cultural Engagement" (Grant Agreement N. 870811), <https://spice-h2020.eu>. The publication reflects the authors' views. The European Research Executive Agency is not liable for any use that may be made of the information contained therein.

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