

Symposium pour l'électronique & le numérique durables

Le 12 décembre 2024, Grenoble

Digital Escape and Digital Odyssey: two pedagogical tools on sustainable ICT

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Abstract — *Our society is becoming more and more digitalized and new information and communication technologies (ICT) hatch every day. Consequently, their social and environmental impacts increase significantly. One of the keys to address these stakes, is for people to gain consciousness on this topic. This paper presents two pedagogical tools aiming at giving the basis for understanding ICT impacts, their variety, where they occur, and which good practices to adopt: Digital Escape, a game that outlines facts about digital sustainability through riddles and puzzles; and Digital Odyssey, a workshop leading the participants to get a first understanding of the stakes through exchanges about their thoughts and knowledge. They were used with around 40 students in two engineer schools, who gave good feedbacks: these tools accomplish their mission of giving an introduction and basis knowledge of the social and environmental impacts of an increasing digital world.*

Keywords — *pedagogy, serious game, sustainability, digital, ICT*

I. INTRODUCTION

Digital technologies occupy a central spot in our society: we use them several times a day, in both professional and personal lives. A study in 2019 [1] recorded 34 billion digital equipment spread among 4.1 billion users in the

world, around 8 equipment per person. Within this equipment, “Internet-of-Things” (IoT) devices accounted for about 10 billion in 2019. This number grew to 16.6 billion in 2023 and is expected to grow rapidly to reach 40 billion IoT devices by 2030 [2].

In 2019, digital technologies (from production to use) accounted for 4% of worldwide greenhouse gases (GHG) emissions [3], 66% of it being due to user equipment [1]. Apart for GHG emissions, environmental impacts such as mineral and water resources depletion, land-use change, or water, soil and air pollution stem from the production, use and disposal of ICT. Making the global environmental footprint of the sector twice or thrice this of France [1]. The number of devices exploding, these impacts can only worsen.

Environmental issues are not the only skeleton in ICT' closet: according to the Walk Free Foundation [4], it is the global sector most involved in modern slavery. Furthermore, with the digitalization of our societies come many risks for privacy, data protection, equal access to services, identification of real and true information, etc.

Although ICT are present in our daily lives, many people fail to see these potential social and environment harms. In fact, digital technologies are often associated with pure and clean imaginaries: we talk of “dematerialized”, or “cloud” which erases completely their materiality. ICT are often presented as THE way to achieve ecological

transition, ignoring the threats their development poses itself. According to a study by Ifop and the consulting company in ecological transformation Eco CO2 [5], 37% of the 1003 service-sector employees surveyed think that ICT have a positive impact on the environment. Of the remaining 63% that recognize the environmental problems they raise, many do not have the keys to act appropriately and lack information on the topic.

II. MATERIALS

Digital Escape and *Digital Odyssey* are two pedagogical tools that aim at helping spreading knowledge and comprehension about the stakes of digital technologies, for people to have better understanding of their potentialities and risks, and to use them in a responsible way. Both tools were created as part of the “future investment program, IRT Nanoelec, ANR-10-AIRT-05 (Chif training program)”.

They were improved sequentially through testing phases with teachers and staff members of Grenoble INP – Ense3, UGA. Overall about 10 people tested *Digital Escape* and 15 people tested *Digital Odyssey* before reaching their final version.

A. *Digital Escape* (Fig. 1)

Digital Escape is a card game that can be played in autonomy, alone or as a group. There is no need for specific prior knowledge and it can be played around age 12 and up.

Players are launched into the digital world and will be led along the life cycle of a smartphone to discover the social and environmental impacts it generates from manufacturing to disposal. All of this using the cards and the gameplay mechanics: as if they were trying to escape, players need to find their way out of the cards, by finding the number of the following card(s), in texts, in images, by solving riddles or doing jigsaw puzzles.

Players will start by diving into the composition of a smartphone. They will then go along its lifecycle, from the impacts of its manufacturing to good practices via what happens once we get rid of it. A final quiz enables the players to validate the knowledge they gathered through their journey.

The game takes between 45 to 90 minutes to complete depending on players’ habits with this kind of game.

All facts and data presented in the game are sourced, a reference table can be found in the game introduction cards and a solution booklet is provided.

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Figure 1: Students playing *Digital Escape*

B. *Digital Odyssey* (Fig. 2)

Digital Odyssey is a workshop needing more guidance than *Digital Escape*. The presence of a facilitator who knows the workshop mechanic is advised, a booklet with all details being provided. Their role will be to ensure time management and constructive discussions within the participants. The workshop can be set up with a minimum of 4 and up to 12 participants. Over 12 participants, the workshop can technically take place but it will be harder to ensure good listening and communication through the participants, which are separated in groups of 4 to 6.

Each group will have several decks of cards:

- One “story line” deck which sets the context, quizzes and gives introduction and conclusion for the 3 activities that the workshop comprises.
- A deck for the first activity which aim at making participants know the order of magnitudes for GHG emissions in the digital technologies’ sector. Two versions (A and B) of this deck exist, which fuel the discussion between the groups.
- A deck for the second activity whose goal is to lay out the life cycle of a smartphone and the social and environmental impacts it generates.
- A deck for the last activity, about the potentialities and risks of ICT associated with the ONU’s Sustainable Development Goals (SDG). Two versions (A and B) exist.

With this workshop, participants will need to question themselves on the materiality of ICT, the social and environmental impacts along its life cycle and on its position for a social and environmental transition.

The duration of the game may vary according to the time required for reflection and exchange between participants and their number. A minimum of 2 hours is advised.

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Figure 2: Students during the first activity of *Digital Odyssey* workshop

Both tools can be used independently or can be combined one after the other, with two options:

- Starting by *Digital Escape* to lay out the terms and some figures through a game, then make sure participants have a good understanding by doing *Digital Odyssey*.
- Starting by *Digital Odyssey* then play *Digital Escape* to summarize in a game setting what they learned in the workshop.

III. RESULTS

As for now, 40 students have played *Digital Escape* and 40 other students have followed the *Digital Odyssey* workshop in their final versions. The feedbacks are encouraging, showing that both tools helped them to grasp what is at stake with the developing of digital technologies, and made them want to know more about the subject. For *Digital Odyssey*, 18 participants filled out the satisfaction questionnaire. 8 of them were "Very satisfied" with the workshop and 9 "Satisfied" with it. For each of the 3 activities they were asked to rate it from 1 to 5 based on how relevant and interesting they found it. All 3 activities

received an average grade above 4. 17 out of 18 respondents would recommend the workshop to others. Through the final quiz given in *Digital Escape* we can see that participants have knowledge about the social and environmental impacts of ICT: for each question, more than half have the right answer.

IV. CONCLUSIONS

These two pedagogical tools are a way to give an introduction on sustainable ICT and to enable participants to grasp the social and environmental impacts ICT can have. The formats used, which encourage play and exchange, favor engagement by the participants.

Work is currently under way to test if *Digital Escape* can be used as an introduction within educational capsules for different school levels from middle school to master degree. The goal is to make both tools available online for download and use and to advise educational settings in which to include them.

Taking into accounts the feedbacks received, further tools, in both game and workshop format, could be developed to address more precisely specific topics such as the extraction of resources needed for ICT or the social impact of the digitalization of society.

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