An Educational Cultural Game for an Industrial Urban Landscape

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Abstract: This paper presents an educational game that aims to enhance students' logical, mathematical, linguistic, and other skills by introducing them to the landscape of Drapetsona, an area in the southern part of Piraeus, Greece, with rich labor history and many industrial monuments, highlighting its industrial heritage and its remains. This educational game is a point-and-click puzzle game with multiple character control. It is aimed at students between the ages of 8-18 years, with graded difficulty depending on the player's age, making it interesting and attractive for any child with moderate access to technology. Our educational structure incorporates inventory, map, and game. A modern platform has been selected for its development that does not require programming and can be easily used by anyone who wants to improve the design of the game. With those digital tools, designing the game is a creative, enabling experience that is accessible to all. The game is currently under construction and a way of evaluating it is proposed.

Keywords: educational games, culture, education, industrial heritage, local history

1. Introduction

Considering the need for a change in educational policy, and therefore in teaching methods, it is necessary to enforce them with the utilization of digital media, as we live in the era of transition to digitality, in which the structure of the world and society will necessarily adapt to the new circumstances (Ghavifekr & Rosdy, 2015). This transformation toward digitality leads to the debate on Digital Culture and its interpretation. According to Jean-Sébastien Guy (Guy, 2019), the digital transformation of society sets digital technology as a necessary, albeit insufficient, condition. A necessary condition is for digital technologies to acquire social meaning. Today's digital civilization has emerged, not as an extension of the possibilities offered by digital technology, but as a social choice with consequences for digital technology itself, as well. Digital culture does not reflect reality, that exists before or outside it, but it creates its own. Jean-Sébastien Guy uses the extremely apt example of the car to explain the distinction between technology and car culture.

Since digital technologies are beginning to define people's lives, from their work to the simplest activities of daily life, they cannot be absent from education, where they are both useful tools for learning and for instructing students on how to use them, since they will gradually become necessary for every field. While supported and implemented by most educators, traditional teaching methods have failings and shortcomings, especially in our rapidly evolving society, due to new technologies. Those can be summarized in four points:

- They do not succeed in piquing the learners' interest and the learning objects are often perceived as chores. For this very reason, they are treated by students superficially to satisfy their teachers or to just get a grade on each subject without any intention of further deepening.
- They struggle to provide meaningful knowledge, since they promote sterile memorization of the learning material provided by the teacher, without the intention of enabling the students to actively participate and prompting them to discover on their own or even question the accepted knowledge.
- Students have difficulty combining the knowledge provided at school with contemporary reality and everyday life and thinking.
- Traditional teaching methods also seem to mainly aim at providing ready-made knowledge rather than cultivating critical thinking and filters for processing data and allowing students to reach their conclusions. In other words, the emphasis is on information ('what') rather than on the way of thinking and concluding ('how') (Husbands, Kitson & Pendry, 2003).

The purpose of this research is the design an educational game that will be used as a means of teaching the local history of Drapetsona and its industrial inheritance. This publication will attempt to implement the promotion of cultural elements through digital media to create an innovative educational approach, by digitizing material concerning the industrial heritage of Drapetsona, both tangible and intangible, and incorporating them in a

digital game that will attempt to interact with the players thus creating a dynamic learning experience. The present paper attempts to highlight the importance of local history in general and industrial heritage in particular and the necessity of its introduction in the educational process (Fig. 1).

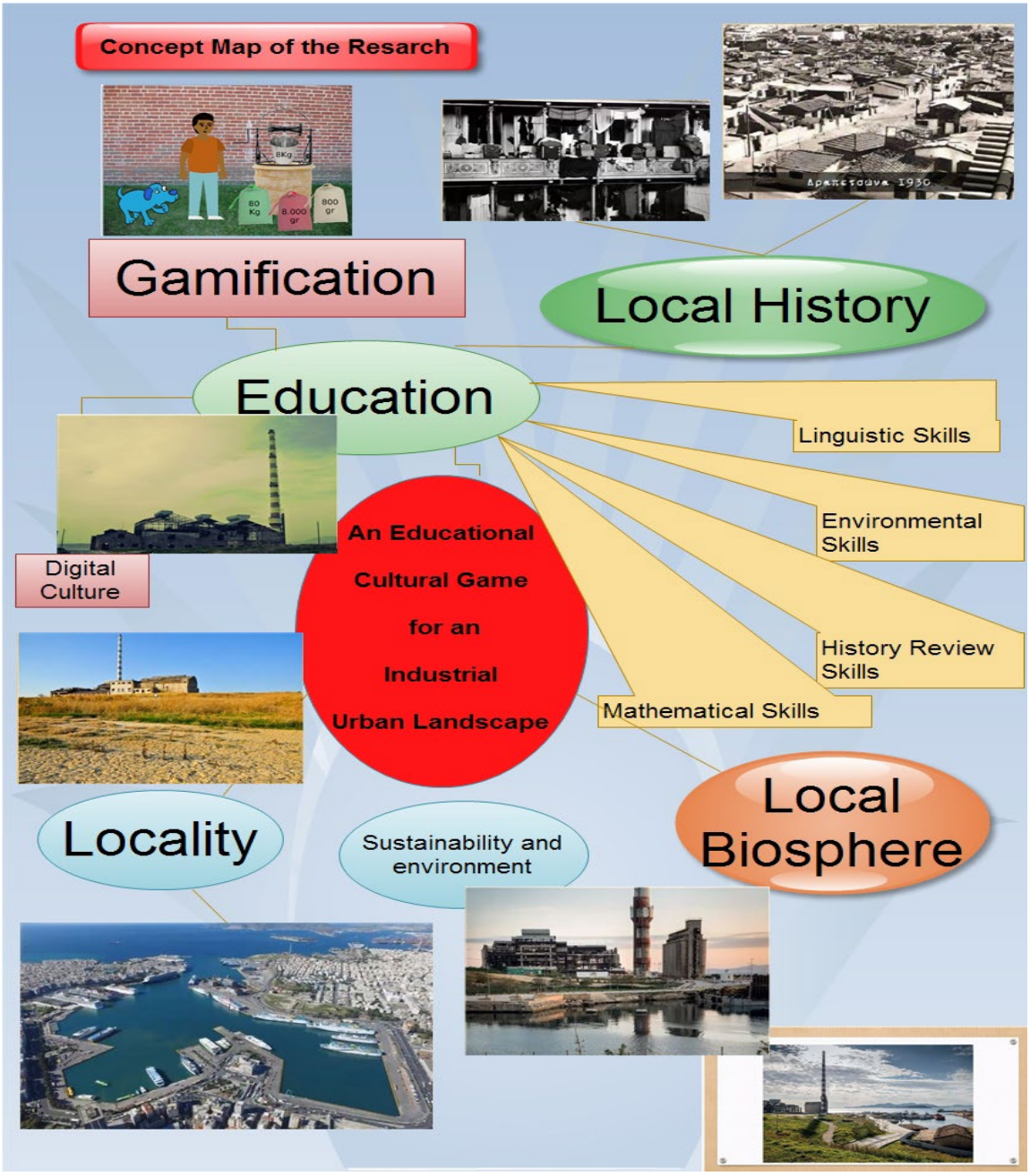

Figure 1: The conceptual map of the educational cultural game development

Our first attempts derive from the importance of preserving collective memory and the way a place's past has the power to define its character and its citizens, so it seems crucial to inform young people and provide them with knowledge about the cultural heritage of their place or even other places. The fact that this is attempted through a digital game is because another objective is to stimulate the interest of children, adolescents, and young people generally, by introducing them to a more entertaining way of learning, and also to raise their awareness of their place and cultural issues in general. Apart from enriching the cultural aspect, we strive to improve the skills students develop through the educational process within the school environment, such as those relating to mathematics, language, history, etc. This aims at upgrading and modernizing the educational process to meet the needs and habits of young people, which are largely influenced by technological progress, thus requiring the use of advanced digital technologies. This article, in addition to the introductory part, contains a second chapter dedicated to learning about Local history and industrial heritage in education through digital

games, a third chapter on the Cultural Educational Game for the Industrial Heritage of Drapetsona, and a fourth part analyzing Game Semantics. Finally, it concludes by presenting the Results - Conclusions and listing the Bibliography.

2. Local history and industrial heritage in education through digital game

Each country's industrial history is important because the preservation of collective memory helps us understand the relations of production and how these relations were formed. After all, Art isn't solely focused on aesthetics but it also aims at showcasing the evidence of the real, hard everyday life of the poor strata, i.e., the great majority of the Greek population, and that is of equal - if not greater - importance and significance for our history and culture as any archaeological find. The images of refugee camps, factories, strikes, strike mobilizations, and traditional popular music ("etiquettes and rebetiko" bands), may seem distant, but if someone visits Drapetsona, they will realize that the area has been shaped and has formed its characteristics and physiognomy precisely by these elements, that now constitute history. Therefore, since history, as always, leaves behind its indelible traces, even in forms that are not always visible to the naked eye, it is of primary importance that it is studied and highlighted and, above all, protected from fading into oblivion. The remaining industrial monuments of Drapetsona constitute the "Parthenon" of the Greek industrial heritage from a historical, social, architectural, and anthropological point of view and it is a necessity to introduce industrial heritage in education in combination with the importance of local history.

This research focuses on solving a problem with dual restrictions. The first one is the inability of traditional educational processes to stimulate the student's interest and motivate them towards better performances. The second one is the alienation of young people from cultural heritage and specifically the cultural heritage of their place. The introduction of local history in general and industrial heritage in particular into education is vital for the students' cultural cultivation and the protection and preservation of collective memory. ICTs can contribute to the integration of local history in education in interactive and experiential ways, alongside the traditional method of linear narrative, which seems poor and sterile in comparison, as it does not foster critical faculties and mainly aims at rote learning. The digital game, specifically, with vehicles for visualization, challenge, problem-solving, and discovery makes learning more active and efficient.

2.1 Local history and industrial heritage in education

The educational process, apart from creating a common ground aiming at offering students a standard level of education characterized by homogeneity, can also take on more individualized characteristics, in the same way, that after the completion of compulsory education, there are both common general education and directional courses, which prepare the student for specific fields of interest. Similarly, each school unit can promote local history through various means, in this case, digital media, and this does not exclude the possibility of pupils developing tendencies to explore the historicity of other areas. Therefore, local history can be a learning subject, since its contribution is considered to be important in the overall scheme of things. Initially, pupils show more interest in local history, as it is associated with localness and emotional closeness. It is typical that while they think they know a lot about their local area, it turns out that they know very little (Leontsinis, 1996). Local history can be used as a tool for developing historical judgment and awareness in different ways than a general history. Firstly, local history delves into social, cultural, and popular culture, folklore, and art issues much more successfully and extensively than a history course that focuses on people and the wars between them (Vaina, 1997). By learning about local history, children can make more tangible connections, they can better comprehend history in general, draw parallels and understand how it relates to real-time and space. Hence, the need to integrate local history into General History either on a spatial or a temporal axis. In addition, students can form a view of the present, especially concerning the field of Industrial Culture, as it is more 'contemporary' and also connecting past and present is easier to happen since many industrial elements still coexist with the temporal elements and still shape the character of the place. At the same time, young people can better understand the people who inhabit the place. Involving children in their local history creates a sense of belonging and intensifies the need to participate in the community, in such a way that can lead to the formation of active citizens who are aware of issues affecting the local community.

2.2 Digital games in education

Digital Game-Based Learning (DGBL) promotes learning through a digital game, and this technique enables students to act within the game environment and acquire knowledge more enthusiastically. Supporters of DGBL

contend that it provides learning opportunities that engage students in interactive learning experiences and helps them prepare to actively participate in the globalized, technological society of the 21st century (Coffey, 2009). Drawing from the constructivist theory of education, DGBL combines educational content with a computer or video games and can be used in almost all subjects and skill levels. An “educational game” is the kind of game that is used primarily for teaching purposes and as result, today, there is a significant number of teachers and researchers who support the educational benefits of educational games.

In Game-Based Learning, the ideas are visualized and they can be understood by students better when they act like players in a game, than watch as spectators (Gee,2007). For that reason, an educational digital game creates an engaging environment, enriched by the use of multimedia, in which children can think, understand, and easily perform things. Therefore, digital games can be used as an alternative way of teaching. Some of the learning principles are directly related to all kinds of games (especially digital ones), and these are a) Interaction, b) Creativity, and c) Experiment.

According to Gee (2009), digital games provide a continuous learning environment through the attractiveness and entertainment they provide to their users. Children, like all people, are full of curiosity and they love to learn at any time, especially when they are not forced to do so. Games are a way of attracting students and motivating them to learn pleasantly; modern computers and video games provide young people, with such learning opportunities in a very short time, considering that one single click or the touch of a button takes mere seconds (Prensky, 2007). Educational games put students in the center of the learning process, which results in making this kind of learning easier, more interesting, and more effective. Some teachers, in addition, consider that Game-Based Learning is a solid educational approach (von Wangenheim & Shull, 2009). Digital Game-Based Learning (DGBL), is a learning approach that involves the use of computers and digital games for exploring and practicing educational materials. The creation of an educational game is not only for entertainment purposes, but it also focuses on the acquisition of knowledge and skills for situations that are not strictly game-related, but they focus on the course's learning objectives (Sarlis, 2018).

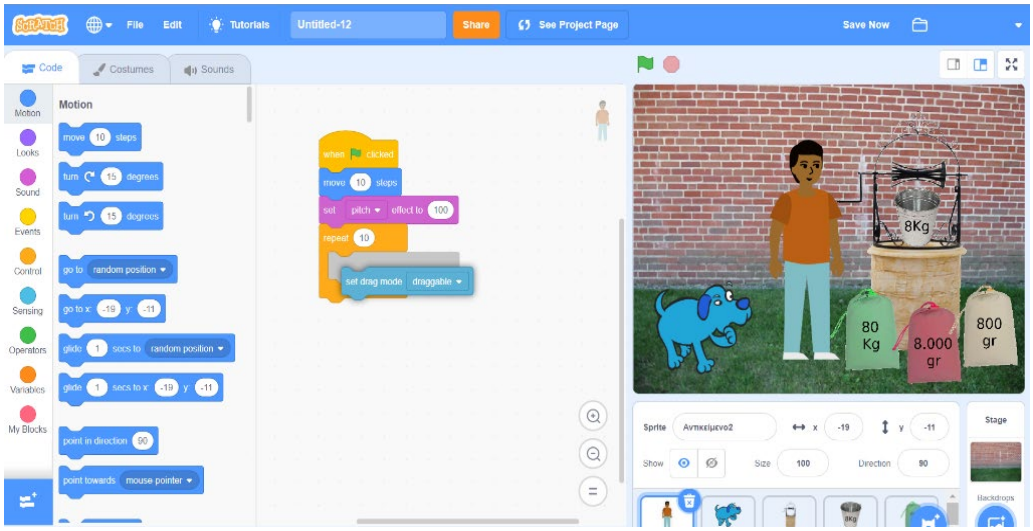

Figure 2: Development of the educational cultural game through M.I.T. Scratch Platform

3. An educational cultural game for Industrial Heritage of Drapetsona

Drapetsona is a popular district whose character has been determined by two factors: the refugee flows and industrial activity. These two factors shaped the general landscape and what formed around them, namely the workers' houses, the rebetiko music, and the inhabitants' militancy, which appeared either as an attempt to protect the housing issue or as an attempt to improve their working conditions. The remaining industrial monuments in the area serve as a 'seal' of the above; historical events that defined the area, along with the workers' housing, of course. It is therefore considered necessary to pass on to new generations the importance of the need to protect, preserve, maintain, save and promote them. It is important to make efforts for the Industrial Heritage of Drapetsona to become public property, i.e., for this game to be a place of shaping the consciences of young people. Contact with culture should not be a privilege that only a portion of the population enjoys, who are more "sophisticated" or have a penchant for "literacy", but it must be acquired by the new generation of all social and economic backgrounds and all inclinations.

The present game (Fig 2) however, is not intended to be used during the educational process, in the classroom, or as an optional exercise for children, but mainly as an optimal recreational choice for children or adolescents, to familiarize themselves with cultural heritage in general and the industrial heritage of Drapetsona in particular, while at the same time contributing to the skills that the school environment attempts to cultivate. As such, its pedagogical and cultural character does not directly concern the teaching process but it does assist it in an optional and complementary way. Some studies have also shown the positive impact that digital games seem to have on cognitive development and visuospatial skills (Ferguson, 2007). Unsurprisingly, concerns about their use have also been expressed, but these are not relevant to this particular game because they mainly relate to digital games that present violent, aggressive, and/or racist and sexist behaviors (Barlett et al., 2009). The most important feature of the present game is the possibility it offers children to visit environments and experience older landscapes, which could not have been possible in any way other than through digital play (Dillenbourg, Schneider, & Synteta, 2002; Shaffer et al., 2005; Whitton, 2007).

The main underlying questions of this research concern digitality and how it serves the two fields of culture and education. In regards to the field of Culture, the first question is about the extent to which digital games, tools, and digitality, in general, can capture and highlight elements that are historical, ethnographic, sociological, anthropological, cultural, etc. The second question relating to culture is whether digital games can raise awareness among the younger generation about issues relating to cultural heritage, and finally, whether digital games can enhance local identity. In regards to the field of Education, the first question is to what extent and in what form (in the classroom or as an obligatory or optional activity at home, etc.) do digital games assist and complement the educational process. Finally, to what extent do they contribute to the development of the child's or adolescent's cognitive skills, such as logical, mathematical, linguistic, historical, environmental, etc.

This research presents a digital educational construction that focuses on an individual case, that of the Industrial Heritage of Drapetsona. This digital construction will be in the form of a game, which will collect, transfer and process elements that will capture and highlight the cultural heritage of Drapetsona, focusing on its industrial remains and will be addressed mainly to people aged 8-18 years old. This educational game aims to develop logical, mathematical, linguistic, and other skills in children by introducing them to the landscape while emphasizing its industrial heritage and remains.

Figure 3: The category classification of the educational cultural game

The educational game is a point-and-click puzzle game with multiple character control. It is aimed at students ranging from 8 to 18 years old, with graded difficulty depending on the age of the player, making it interesting and attractive for everyone. A prerequisite is the availability of access to moderate technology. The first thing that needs to be stated is the type of game, and that is because educational games should attract the interest of students in the same way that any video game would. This educational game is classified into the following categories (see Figure 3):

- Puzzle platformer. The player tries to overcome obstacles and get to the exit from one screen and advance to the next one, using the game's mechanisms.
- Adventure. The player assumes the role of a protagonist in an interactive story driven by exploration and/or puzzle solving. The game's focus on narrative, allows it to incorporate many elements from other narrative-based media, literature, and film, covering a wide range of literary genres.
- Storytelling. The main issue is the story. Actions and activities must be part of the narrative. But the player can influence the parts that are important to the development of the game and the story.

- Logical Thinking. The game contains mini-games of sequencing, grouping, and matching. The setup, rules, and questions vary in complexity and difficulty.

To clarify the genre, the game is also classified into sub-genres (see Figure 4):

- Casual game. A simple video game that is easy to play.
- Educational game. Intentionally designed for educational purposes. Aims at helping people understand concepts, gain knowledge and develop problem-solving skills as they play.
- Critical thinking game. Players are confronted with complex problems for which they must find solutions and take appropriate action.
- Exploration. Exploring an environment and discovering a narrative about the game. A similar subcategory is a trial-and-error game, i.e., a game that requires a problem-solving method in which multiple attempts are made to reach a solution. It is a basic learning method that virtually all organizations use to learn new behaviors. Trial and error are the tests of a method, observing if it works and if it doesn't work prompts us to try a new approach.

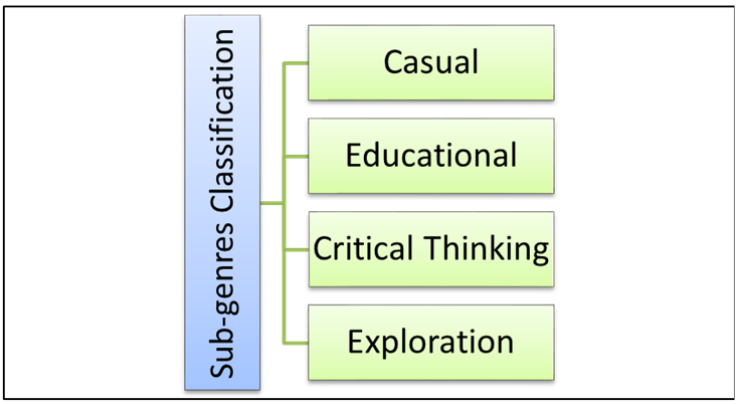

Figure 4: Sub-genres classification of the educational cultural game

The player's objective is to save landmarks in the area. There are two main characters, a boy with his pet and a non-player character. The boy wakes up on an ordinary day and realizes that some of the city's landmarks and industrial monuments have disappeared. At the same time, he realizes that all the townspeople have forgotten that they ever existed and do not remember their history, as if someone has erased their memory. There are three modes: inventory, map, and game. In inventory, he keeps all the items he collects that will be needed to solve one of the subsequent puzzles. The map shows the points that need to be saved and they are depicted as blurry. When the player restores the point, the corresponding point on the map becomes unblurred and the player proceeds through the map to the next point that needs saving. The theme of the game is inspired by the history of the industrial culture of Drapetsona. The locations where the game takes place correspond to real places in Drapetsona, they are thematic and can be either indoor or outdoor. Examples of such places are the Glassworks, the Fertilizer factory, and the Labor - Refugee housing.

It seems appropriate to mention some of the game's features. There is no main menu. The game starts with an introductory narration of the story through a video with no voiceover. The game sequence is semi-linear. This means that the actions required for the boy to advance to the next point on the map are predetermined and are not influenced by the player's will. However, because the actions could be performed in a different order, they cannot be characterized as linear, but semi-linear. In terms of players, the game features multiple character control. Each of the two characters has their skills. For example, the child lifts objects with his hands but cannot jump, while the pet cannot open something, but jumps on surfaces, such as shelves, that are high up. There are also non-player characters who help either in terms of solving the puzzles by giving clues or information about a specific part of the city. The player interacts both with the environment and the non-player characters. The visuals are the third person’s point of view. The game is a point-and-click, which means that the player only needs to operate the computer mouse. He clicks on objects to move them, lift them or climb on them. In the mobile version of the game, the logic is the same. After each mission's fulfillment and before the player moves on to the next screenplay, a cut scene is inserted that presents a visual 2D narrative that contributes to the story's plot progression. The game contains Mini games, such as hidden objects, tile-matching, and text puzzles that will be integrated for the boy to receive an object he found and place it in the inventory. To avoid points

where the player gets stuck and frustrated there will be Hints by pressing a button located at the bottom right of the screen, which will make an object glow to indicate to the player what his next move will be.

4. Game semantics

The boy's effort to save people's memory is equivalent to the actual effort of saving historical memory by preserving the industrial heritage of the place. It is important for education to ensure that young people are informed and sensitive to cultural heritage issues. The purpose of the game is therefore identical to the ultimate goal of raising awareness among children and adolescents about the preservation, conservation, and promotion of cultural heritage. The game challenges students to save the place and more specifically to save the memory of local history. This in itself puts the student in a position to defend and protect the historicity of the area and to feel responsible for it. This creates a sense of place, a sense of belonging, and an awareness of the public space. These feelings are deliberately evoked to lead them to search for their local and social identity, which they will find through historicity. A prerequisite for satisfying the feelings for the place created by the digital game is the knowledge of history and the exploration of the place. This purpose is served by the game levels, whose graphics correspond to the past and present character of the place, and the challenges that the player is required to face are related to actual challenges, whether present or past. Information and knowledge are also provided by cutscenes referring to the place and its history, as well as by the non-player characters with whom the player interacts.

Table 1: Examples of puzzles of the educational cultural game for an industrial urban landscape

Examples of puzzles		
Field	**Puzzle**	**Solution**
Mathematical and Environmental Skills	They need water from the well to water the Fertilizer trees, but they cannot lift the bucket of water. At the end of the rope is another empty bucket with 8kg of water.	Somewhere on the screen, there are 3 sacks and each of them says 8,000gr, 800gr, and 80kg. They have to place the correct sack in the bucket so that the bucket of water rises to the desired height. If they go with the wrong sack, the bucket of water will either rise too low or too high.
History Review Skills	To unlock a padlock, they have to write the date of the foundation of the municipality of Drapetsona.	First, click on the padlock and then type the 4 consecutive numbers until the desired answer is formed.
Linguistic Skills	They have to open a locker that says "When?" and has 3 sentences underneath.	They have to find the tenses of the 3 sentences to open the cupboard.
Engineering/ STEM Skills	They have to reassemble a broken machine.	Moving levers, moving pieces, etc.

These allow the players to search for further information on their own or in cooperation with their classmates - teammates or the teacher who stands by to assist in this whole process of discovery. In addition to guiding and solving questions about the history of the place, the teacher can also assist with the other skills that the game claims to foster, such as ecological awareness or solving a mathematical problem. These can also serve as an opportunity to broaden the dialogue beyond local history to general history or the current cultural, industrial, political, etc. scene. Furthermore, the digital game is an opportunity for pupils to visit local places, listen to relevant music, or collect folklore and historical oral information from their grandparents.

The map functions as a spatial introduction to the place and teaches the player to identify the locations of current industrial sites, industrial monuments, and industrial sites that have been demolished and their physical traces no longer exist. Each time players try to save a digital industrial landscape, in addition to being entertained, they receive information about that landscape in many ways. First, through the image where they see certain features of the industrial facility. Then, they receive information through the puzzles which in some cases may be about the industrial facility itself, for example, the restoration of a machine that was part of the factory's equipment for the production of the product. Finally, they receive information through the cutscenes that each time provide clues and images that make up the whole story of the game, which is none other than the industrial history of the place. As the purpose does not focus on a specific field, but on a wide range of aspects of education, in addition to the objective of raising awareness, informing, and assisting the player in the protection of the industrial heritage, the game also aims at assisting children's other skills related to the

educational process. In particular, there are puzzles to be solved, which require and also help to develop students' mathematical, logical, linguistic, historical, and environmental knowledge and skills. Indicative examples of such puzzles are shown in Table1.

5. Next steps - conclusions

5.1 The evaluation of the game

The construction of the described digital game is still in progress; thus, we will attempt to present the evaluation plan that will be implemented after its completion. Initially, three high schools in Drapetsona will be selected, where questionnaires will be distributed to the students which will test their knowledge and interest in the history of the place in general and the industrial heritage in particular.

Table 2: Questionnaire A (before game distribution)

Questionnaire A (before game distribution)	
Closed type questions	**Answers**
How often do you visit the Fertilizer Space?	Often/sometimes/rarely/never
Do you know where the name comes from?	Yes/No
Do you know what the Bridge of the Rebbe is?	Yes/No
Are you familiar with the poem Drapetsona by Tasos Livaditis?	Yes/No
What feelings do you have about the Oil One operation?	Neutral/negative/ positive/I don't know
Open type questions	
What do you know about the battle of electricity?	
What do you know about the shack battle?	
What do you know about the refugee issue?	

Table 2: The Questionnaire B (after-game distribution)

Questionnaire B (after game distribution)	
Closed type questions	**Answers**
The game was easy	Yes/No
I had fun playing this game	Yes/No
I would like to play again this game	Yes/No
The game was interesting	Neutral/negative/ positive/I don't know
I had difficulties playing this game	Neutral/negative/ positive/I don't know
Open type questions	
What do you know about the battle of electricity?	
What do you know about the shack battle?	
What do you know about the refugee issue?	

The game will then be distributed to these high schools, not as a compulsory task, but as an optional activity for one month. The teachers in charge will be history majors, who will have to agree to devote one hour a week - 4 hours in total - to solving questions or discussing the issues addressed by the game. At the end of the implementation month, two types of questionnaires will be distributed (see Tables 2 & 3). One questionnaire will be addressed to the pupils and will contain the same questions as those mentioned in Table 2, to examine the extent to which the game has contributed to the pupils' knowledge of local history. It will also include some additional questions asking for their impressions of their experience of the game and suggestions for improvement, additions, and changes. It will primarily examine whether the desired feelings and interests were evoked in the students. The second questionnaire will be addressed to the teachers and will examine their observations on the student's interest in Drapetsona and its history in general, as well as its industrial heritage in particular. It will also assess the contribution of digital media to the educational process. The questionnaire will revolve around the following questions:

- Did the children show interest in local history?
- Did they show interest in the industrial heritage?
- Was there fruitful dialogue in the classroom?
- Were they challenged/sensitized?
- How do you think digital media contributed to the process?

Conclusions will be drawn by comparing the pre-game questionnaires with the post-game ones, as well as from the teachers' evaluations. In this way, the extent to which students gained knowledge about local history and industrial heritage and whether they liked the way that it was accomplished, i.e. the digital game, and to what extent they reflected on it, will emerge.

5.2 Added value

It is widely accepted that video games have become a key part of people's everyday lives, especially younger ones. Their widespread acceptance and appeal have been followed by their introduction into education since they motivate players to achieve certain goals through their interaction in a rule-based environment. Culture and Education have the common goal of improving people's lives through knowledge. Therefore, Education that focuses on Cultural Heritage can help in understanding history, arts, literature, and society, at large, by fostering in students the value of respect and acceptance of diversity (Luigini, Parricchi, Basso & Basso, 2020). Furthermore, it shapes the future generation of informed, cultured and active citizens who, beyond the often-sterile knowledge imparted by the school, acquire sensitivities and reflections with a positive connotation. The added value of this article lies in the presentation of an innovative application that will pique the interest of young people in matters of industrial heritage. It stresses the importance of place in the educational process and proposes the cultivation of cultural awareness at a young age. Finally, it serves as an incentive for the construction of similar games concerning other places and perhaps other types of local cultural heritage beyond the industrial one.

5.3 Suggestions for future research

The findings of this study can be used to build games in areas that have a rich industrial heritage and there is a need to raise awareness about their conservation. We suggest that this game should be implemented by teachers of the school units in Drapetsona. After the conclusions of this research, it will be possible to finalize the game, but it will also provide guidelines for the construction of games related to and inspired by the cultural heritage of other areas, without excluding the use of the game by the residents of other places.

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