

# Fostering European citizenship skills to elementary school students through virtual tours and cultural heritage digital collections presented by an educational robot. The design of an educational digital game

*Dimitrios Rammos*<sup>1</sup>, *Dimitrios Ziouzos*<sup>2\*</sup>, *Tharrenos Bratitsis*<sup>1</sup> and *Minas Dasygenis*<sup>2</sup>

<sup>1</sup>Department of Early Childhood Education, School of Humanities and Social Sciences, University of Western Macedonia. 53100, Florina, Greece.

<sup>2</sup>Department of Electrical & Computer Engineering, Faculty of Engineering, University of Western Macedonia, 50100, Kozani, Greece.

**Abstract.** Educational robotics is increasingly used in elementary schools. Teachers use robots to design interdisciplinary activities to promote digital and other skills. These activities are, often, designed as part of educational games. This paper presents the design of a digital game developed on the educational robot EI-EDUROBOT. The game contains multiple choice questions based on videos, digital stories and virtual reality tours. The main educational objective is to cultivate European citizenship and introduce children to the European Union.

## 1. Introduction

Educational robotics is becoming increasingly exploited in primary schools as it differentiates the teaching routine and gives more interest to the activities and projects that are being developed [1]. There are two main categories of educational robotics. In the first, children build and program a simple type of robot with materials that they find in a similar set. The emphasis is on the construction part and the planning is relatively limited. In the second case, students use ready-made robotic models with greater emphasis on their programming, which can be particularly complex, depending on the capabilities of the model and the level of knowledge of the students [2].

Of particular interest is the combination of robotics with digital storytelling through the integration of digital stories into robotic characters [3]. These characters can be the robotic models themselves or virtual, animated heroes who appear on a screen, embedded in them [4]. Through children's contact with robot characters and listening to digital stories, teachers can draw original didactic scenarios, taking advantage of the multimedia abilities offered and the "creative, discovery curiosity" caused to children by the presence of a "different" narrator [2,5]. Even greater educational interest can be given by the interactivity of robots which increases the immediacy and reality of the storytelling since students gain access to the educational process and shape its evolution [5]. In this case it is possible to develop interactive digital educational games that further enhance the differentiated and enriched teaching. Such teaching innovative practices and interactive educational games

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\*Corresponding author : [dziouzos@uowm.gr](mailto:dziouzos@uowm.gr)

can be realized through the technical characteristics of the robot, such as the capabilities of the operating system and the sensors placed on it [5,6].

This paper presents a teaching scenario that utilizes the interactivity of a robotic model and forms an educational quiz for primary school children, through digital storytelling and virtual reality tours. The entire project is based on the operation of the educational robot EI-EDUROBOT which has been built entirely by a Greek research team using a three-dimensional printer. In the robotic system there is a built-in screen that enables the viewing of audiovisual material with high definition. In addition, the robot offers the possibility of extensive interaction with children thanks to the possibility of real time customization of the embedded digital stories by a user located in a different room. Consequently, it is possible to develop a two-way interaction with students in the context of a quiz with points collected by students.

The content of the digital game concerns the history and institutions of the European Union. More specifically, students are virtually "guided" in the halls of the European Parliament and the European Court of Justice and watch works of art related to European culture through the digital collection of Europeana. This tour is accompanied by corresponding storytelling which children must hold back in order to answer the questions asked to them by the tour guide in order to collect points and emerge victorious. The teacher will have the ability to adjust the difficulty and the categories of the question according to the desire of the students - players while watching them from a different room through the activation of the camera on the screen - tablet.

This teaching scenario is an evolution of previous, corresponding educational activities in elementary school classes, based entirely on the EI-EDUROBOT robot. These activities led to the collection of specific research findings which were evaluated in order to form the basis of the present educational project. The implementation of the plan in the last grades of primary school will begin in the very near future.

## **2. The concept of European Citizenship in the educational context**

One of the European Union's most direct initiatives has been to cultivate active citizenship among all citizens, especially the youngest [7]. The concept of citizenship includes a series of important aspects that guarantee the well-being and progress [8]. Some of these aspects are democracy, respect for rights, diversity acceptance, participation in policy and decision making, harmonization with sustainability and respect for natural resources [7,9].

European citizenship skills provide above all for an understanding of coexistence and cooperation with different people, living in a system of diversity and multilingualism [10]. All these people follow a common objective which is peace, security and development of the Union and the Member States individually [7,9].

It is very important, therefore, to come into contact with other people's culture in order to strengthen the sense that everyone belongs to a wider European family. In modern times, people's connection has become much easier due to technology and digital applications that are available through smart portable electronic devices [9].

At the same time, free transportation among citizens of the European Union has made it easier and more accessible to travel for business, educational or tourist purposes. A typical example is the Erasmus+ program of the European Commission, which enables thousands of pupils, students, teachers and researchers to travel to the countries of the European Union and gain valuable experience by participating in partnerships and trainings [7]. Travel and tourism, of course, have been hardly hit by the Covid-19 pandemic since the beginning of 2020. On the other hand, the management of the pandemic at European level

and the financial support given to member states to respond to the emergency needs, have highlighted the value of solidarity and a common response to a global, crucial problem.

### **3. Virtual reality tours in education**

Many studies have shown that virtual reality can be especially useful in education. Virtual reality has already been used in courses such as Biology, Chemistry, Physics, Astronomy, and Medicine [11]. Three-dimensional imaging, interactivity, and immersion make virtual reality a useful method that can stimulate motivation to learn and make the learning environment more engaging and effective [12].

For example, astronomy is a key issue in science in which students face difficulties. Many children have difficulty understanding concepts such as the size and shape of the Earth, the phenomenon of day and night, the phenomenon of the seasons, and the orbits of the Earth, the Sun and the Moon. Research has shown that many misconceptions of astronomy were found in children from different countries [13].

The usual disc-methodical methods of these topics make use of lectures, websites, two-dimensional diagrams, Flash animations, scientifically quality telescopes, and images with NASA space data. However, Parker and Heywood [13] showed that two-dimensional diagrams that try to represent 3D space are difficult to interpret and do not help to understand these issues.

Also, Pena and Quilez[14] showed that images and diagrams in textbooks do not always facilitate the understanding of concepts. Misleading 2D diagrams and images can promote misconceptions in children.

In contrast, research has shown that the use of virtual reality can pre-emptive spatial perceptions and can provide students with an immersive learning environment [13].

Virtual and augmented reality technology has also been leveraged in the field of digital, educational applications and games [14]. At a practical stage, however, the use of virtual and augmented reality in the classroom is at an experimental stage, especially in terms of the extensive use and utilization of corresponding applications in the context of teaching courses and chapters of the curriculum [15].

A tool that utilizes virtual and augmented reality applications that are of increasing interest in the educational world, is virtual tours and projections of three-dimensional models and objects. It is a form of virtual tour of open locations, interiors of buildings, works of art and culture, or a virtual processing of objects and models in their three dimensions [16].

In the case of three-dimensional projection of objects through augmented reality, students have two basic options. One concerns the viewing and processing of the projected models in the three-dimensional imaging environment of smart electronic devices and the second integrates and adapts the objects in real, realistic environments utilizing the camera of the devices and the corresponding augmented reality software [15, 16].

The development of an educationally oriented tour may include the above two cases in combination, organizing for the students a virtual walk/tour along with the processing of models and objects of the selected space in three-dimensional form [13].

In addition, a virtual tour can help educators form questions and quizzes in the context of an educational game. In this case, tours can be combined with corresponding digital stories with corresponding information to the students. An educational robot with audiovisual projection capabilities could be the most realistic and attractive environment for such an educational game. The presence and technical capabilities of the robot could add the element of surprise and subversion as opposed to a traditional projection on the classroom whiteboard via computer.

Of course, crucial for the educational success of this teaching approach is the quality and completeness of the educational material which is utilized in the development of virtual

tours [17]. These tours can be created by teachers, individually or in working groups or, respectively, students under the guidance of teachers [16]. The content for the composition of a virtual educational tour can be drawn from ready-made collections with three-dimensional virtual tours and three-dimensional objects, such as those that have museums and archaeological sites around the world. Alternatively, the material can be configured from scratch with the use of 360° photos and the use of special software for the synthesis of three-dimensional material [14]. This software can be found open and free of charge for educational use and are easy to use.

In conclusion, virtual and augmented reality tours in education are defined as those didactic interventions in the classroom that include the virtual tour of geographical locations or buildings and the projection of three-dimensional models on screens or robotic [13]. The didactic process is directed by a user / guide who handles the evolutionary course of the tour while the rest of the users share the same virtual experience on the screen or on their individual devices, while having the ability to record their impressions and observations in the context of an educational activity or a game [13, 15].

#### **4. Educational robotics**

Educational Robotics is a powerful teaching and learning tool that enables students to put their ideas into practice, composing a mechanical entity and directing it with the help of a simple and easy-to-use programming environment [4]. Robotics is considered an interdisciplinary activity, which is mainly based on Science, Mathematics, Informatics and Technology and offers significant benefits at all levels of education [6]. Over the past decade it has attracted the interest of researchers and teachers as a powerful teaching tool to support learning and develop students' cognitive-social skills [4]. ER is introduced in many learning environments as an innovative teaching and learning tool which transforms classrooms into dynamic learning spaces that support students: (a) the development of high-level skills, (b) the creation of multiple representations of understanding the subject and c) the constructive communication and cooperation between them and d) the development and improvement of their learning, solving complex authentic problems [18].

Robotics enables students to implement abstract design ideas, reflect and observe directly the results of this effort [18]. In this way, students move from the stage of "learning about technology", which prevails in the educational system, to the stage of "learning with technology" [4]. ER activities promote problem-based learning, as they focus on research and analysis of a complex real-world problem [2,18]. Designing and programming a robot to do even a simple task enhances students' creativity and problem-solving ability [18]. On the other hand, interacting with a ready-made robot increases digital and communication skills and gives greater immediacy to the achievement of learning goals [1,4]. Also important is the aspect of the game that robotics involves, which is an important factor of positive motivation and encouragement, especially in primary education [4]. Overall, educational robotics activities are considered to cultivate a positive learning environment, which according to Rogers [6] provides:

- an ideal environment for experimentation and search by students and teachers
- immediate feedback to the students on the way of solving the problem.
- the opportunity for students and teachers to familiarize themselves with new methods and materials, using technology for experimentation.
- the ability to develop complex cognitive skills, critical thinking and other important skills of students, such as collaboration, innovation, project management.
- the possibility of implementing interactive educational games thanks to the technical characteristics and capabilities of hardware and software.

- the opportunity for active participation of students and the prerequisites to cultivate creative thinking, insight and originality.
- support for the teaching of various fields, such as Mathematics, Programming, Culture, Physics, Technology, History.
- the possibility of collaborative learning through the assignment of joint tasks to groups of students.

#### 4. The educational robot EI-EDUROBOT

EI-EDUROBOT is a humanoid robotic system that has been developed entirely by a Greek research team with a child-friendly constructional form and educational orientation. The robot is developed with the thought of Open Source so as the research community and anyone with basic programming knowledge will be able to develop it further. With this philosophy the robot was designed in a three-dimensional printer (3D printer) and the electronic systems used are easily acquired by the market. As with any robot, the design is divided into hardware and software, including the robot's own code, the electronic platform via the internet and the smartphone application (app).

All parts of the robot have been created using polylactic acid (PLA), as they are biodegradable and bioactive. The robot's frame has been designed with the aim of stability, endurance and protection of the robot itself and the children, as the highest priorities, in order to achieve the optimal distribution of its weight, resulting in a stable and smooth movement, as shown in Figure 1. The interior space of the robot has been allocated to electronic components and structural elements. The robotic system has two arms with double hinges and are designed in such a way as to allow the user to add various components to the robot's hands, which should also be designed on a three-dimensional printer. The head can move on two axes: the horizontal axis (right-left) and the vertical axis (up and down).

This design option allows the robot to express the desired feelings (agreement, denial, irritability, etc.) with high accuracy.



Figure 1. The form of the EI-EDUROBOT

The robot has a plethora of sensors that can be divided into two major categories: i) security issues and ii) functional issues. As far as the first category is concerned, the robot has ultrasonic sensors (ultrasonic sensors) front and rear, which are activated when the robot moves. If an obstacle is detected, the robot stops the movement. Also, at the bottom there are infrared sensors, so if the robot is placed at an elevated point such as a bearing, it stops the movement when it reaches its edge. The second category concerns the functions of the robot, where the trainer can utilize as he sees fit. Specifically, it has two pressure sensors in the hands (right-left), one on the head and one button on the chest. Depending on the scenarios they can perform different functions.

Finally, as far as software is concerned, three main tools have been developed for the use of the robot: i) the platform for the use of the robot, ii) the code of the robot and iii) the

application for smartphones with Android operating system. Through these tools the trainer can utilize all the functions of the robot and develop them even more.

## **5. Pilot testing of the EI-EDUROBOT educational robot at primary school**

The main pilot implementation of the educational robot in a real school environment took place at a Primary School of Attica during the second semester of the school year 2020 - 2021. The members of the research team, in collaboration with the teachers of the school, created an educational scenario which acquired the physical presence of the robot in the classroom. The whole project followed "problem-based learning" as the robot formed an educational problem through digital storytelling. Then, the students were asked to provide a solution (problem solving) to the problem, interacting with the robot. The scenario of the pilot testing concerned the awareness of children on the issue of climate change and included four stages of implementation.

Phase A: The teacher made a brief reference to the concepts of sustainable development and climate change. Indicatively, he stressed the great importance given worldwide to the issue/problem. He then asked the children, working in groups, to record in digitized mind maps their views on the issue.

Phase B: As for the theoretical framing of climate change, the educator presented information about the causes of the problem and its impact on people and global ecosystems in the present and in the future. The students then, under his guidance, studied audiovisual material on the United Nations Sustainable Development Goals in order to clarify the term sustainability through practical examples and applications of everyday life.

Phase C: This phase involved the utilization of the robot. Specifically, the robot introduced itself to the children informing them that it transfers an important message from the climate level of the world in 2050. This message was carried out through digital stories, both from the robot itself, and from a twelve-year-old Iranian peer, Reza, who appeared on the robot's screen in digitized form describing to children his own, difficult daily living, due to global warming. Reza's digital stories were intended to activate students' empathy as students' emotional reflexes are raised when they come into contact with people who experience or describe, respectively, difficult emotional situations. These stories ended to the description of the "educational problem" of the project which was actually a mission to the students to act effectively in order to reverse the future climate state, as described in the digital stories. The robot asked the students to make suggestions in order to immediately address the issue of climate change and prevent the gloomy image of the climate in the future, as it appeared, at the predictive level, in Iran in 2050.

Phase D: During the fourth phase, the children worked in teams to formulate proposals and find solutions to the mission/challenge assigned to them by the robot. The proposals were announced in the plenary of the class and there was discussion and comparative recording of the most important results. The robot recorded the results of children's work and, according to the educational scenario, traveled back to 2050 to check if there had been a significant impact of children's initiatives on the evolution of climate change. Finally, he returned to earth again in order to announce the results of this audit and to draw the final conclusions.

Phase E: In the fifth phase of the pilot scenario, the collection of research data was carried out in order to evaluate it. Specifically, the children filled in worksheets in order to test the knowledge gained from the scenario's activities. Also, the teachers completed the weighted

rubics regarding the degree of activation and participation of children and the level of empathy towards the issue of climate change, as presented by the robot's digital narratives. These five stages took place in five teaching hours, each lasting 45 minutes. All project activities were carried out in ten-member groups of students. A total of 150 students and 5 teachers of the school took part.

### **5.1. Student reactions to the presence of the robot**

The educational robot impressed the students from the first moment. Although the pilot testing was applied to half of the children of the school unit (the last three grades of the Primary School), there was a great mobilization from the rest of the students (of the three smaller classes) in order to get to know the robot. There was no negative reaction or fear towards the robot, on the contrary all the children tried to approach it and explore its constructional form and its possibilities in motion and other reactions.

Particularly great was the response of the students to the application of the robot in smart devices that enabled them to move it and activate its various functions. This process took place after the end of the educational scenario activities. All the children wanted to handle this application and shape their own "behavior" in the educational robot in the classroom.

Similarly, there was an increase in children's interest in seeing the technological parts of the robot, their cables, sensors, the screen and the plastic parts. This interest was so intense that the members of the research team proceeded to a partial disassembly of the robot in order for the children to see its interior and become familiar with this unprecedented technological environment.

The fact that all the plastic parts were created through a three-dimensional printer, also impressed the children who asked if they could attend a relevant demonstration. The members of the research team committed to implement it in the future.

### **5.2. Teachers' reactions to the presence of the educational robot**

The positive response of the teachers was a very positive surprise for the members of the research team. The teachers showed particular interest both in the technological and constructional part of the robot, as well as in its educational philosophy and usability.

So, initially, there was a demonstration by the researchers. Great emphasis was placed on ways of customization and configuration of the robot in a new educational scenario. The teachers designed their own examples of scenarios and introduced them with the help of researchers in the application of the robot. In this way, they became familiar with the simple programming language and realized the extensive teaching capabilities of educational robotics.

In terms of educational utilization, the most useful element for teachers was the ability to shape the digital stories, movement and reactions of the robot, in real time, through the application on their mobile phones. Moreover, this feature becomes even more impressive, considering that this customization can be done even by users who are in a different room, thanks to the activation of the remote connection, the camera and the tablet speakers located on the head of the robot.

Finally, teachers actively participated during the activities of the pilot testing at school, detecting the quality of students' involvement and making comparisons with their previous, general presence in the classroom. Their role was discreet but crucial, as they offered experience and evaluation to the members of the research team. Overall, there was a very

positive, collaborative atmosphere and there was interest both in guiding the school to acquire its own educational robot, as well as in future collaboration in similar projects.

### 5.3. Achievement of educational goals

The students who took part in the project were able, after its completion, to give the definition of climate change, at a rate of 77%. Additionally, prior to the implementation of the educational intervention, 25% of students gave correct or relatively correct answers about the effects of climate change. After the completion of the intervention activities, this percentage increased to 72%. In addition, in the students' answers to the open-ended activities and questions, 65% of the relevance of the vocabulary used was noted, compared to the corresponding vocabulary of the digital stories. This high percentage demonstrates the degree of concentration of children and the extent of their influence when listening to digital stories. Finally, 65% of the students were able to adequately define the content and goals of the 17 Sustainable Development Goals of the United Nations, while an even larger percentage, about 70% successfully executed the matching of the icons of these 17 targets with the corresponding titles. During the pilot testing, the learning footprint was combined with the development of the children's empathy. This was mainly expressed by the rubrics decoding for the children's participation and behavior during the activities and the messages addressed to their peer who sent his message from Iran, 2050.

The decoding highlighted the high degree of empathy of the children, especially towards Reza's personal story (Figure 2). On a quantitative level, 75% of the students recorded words, expressions and dependent sentences that suggest some form of emotional expression.

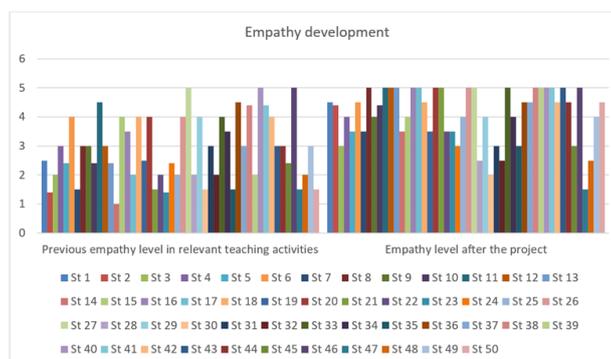


Figure 2. Comparative representation of 50 students' empathy level.

In the context of the qualitative analysis of children's messages, it was important to record expressions of sympathy and understanding towards Iran's rough living life in 2050, due to the climate. The use of emotional words and expressions in the specific texts of children showed an increasing variation of 40% compared to the previous production of their written language. Also noteworthy was the willingness of children to change their attitudes and behavior after the revelations about the evolution of climate change. As shown by the analysis of children's texts, on the one hand, the change in attitudes and behaviors concerns personal harmonization with daily habits, and on the other hand taking initiatives to raise awareness among the members of children's school and family environment.

As it emerged from the evaluative process, what impressed and strongly piqued children's interest, was that the educational robot was built with the technology of three-dimensional printing. This happened because three-dimensional printing is a tempting technological application for the majority of children at this age. Additionally, they

considered it highly compatible and innovative to combine a "recyclable" robotic character with a project concerning sustainability and ecological consciousness.

Finally, in an overall view, there was a particularly increased interest of the students towards the teaching methodology followed in the specific educational scenario. The differentiated teaching method and the presence of the robot-with a role as their teacher-, increased the participation and involvement rate of students in the project activities. The elements that impressed them the most were the interactivity of the robot and especially its ability to alternate its digital stories according to the content of their own decisions. Therefore, the relatively realistic interaction with the robot seemed to importantly motivate children.

## **6. The design of the new educational game**

After the positive results of the implementation of the educational project on climate change, the members of the research team proceeded to the design of a new project with the educational robot EI-EDUROBOT.

Taking into account the evaluation of the previous project, the research team decided this time to give a more playful feature, forming an interactive, knowledge game.

The subject of the game concerns the concept of European citizenship, through questions about the institutions and institutions of the European Union, the history, culture and rights of European citizens.

Each question is accompanied by a related video and a corresponding digital story. Videos and accompanying digital stories show, for example, three-dimensional virtual tours of buildings, monuments, museums or attractions from European capitals. They also include the presentation of historical and cultural exhibits from the Europeana collection. The corresponded questions relate either to the information presented in the digital stories or require attentive observation and critical thinking on a visual or sound element that was projected.

The questions are rated, from very easy to very difficult, while a corresponding scoring application is designed for the gained points. The game includes other parameters such as the right to watch the video again or to focus on a specific part of it. For this reason, there are corresponding help buttons that each team can use once in order to go further in the game.

All these features take place on the screen located on the head of the robot. This screen, in addition to viewing videos and digital stories, acts as a touchscreen, allowing zoom in/out and guiding virtual tours.

The whole game is guided by a platform where the names of the teams and the gained points are recorded. Videos with digital stories and embedded questions are also installed on this platform. The platform is operated remotely, from the special robot's guidance application installed on smart mobile devices. The operator of this application can be located in the same room as the children and the robot or in a different room, using the camera and headphones on the robot's head. From this camera, the operator can gain full control of picture and sound of the classroom and thus increase the immediacy and interactivity of the game. Students' answers can either be recorded by the app's operator or by the children themselves by pressing the buttons on the touch screen on the robot's head.

### **6.2. The Europeana collection**

Most questions in the database created for the game were based in the Europeana collection. Europeana platform opened its doors to the public in November 2008 and provides access

to millions of works, representative of Europe's great cultural diversity [19]. Europeana brings peoples culturally closer together, highlights their multiculturalism and provides access to valuable and rare material. In less than 8 years it gave access to 36 million objects such as:

- Images: paintings, drawings, maps, photographs and images of museum objects
- Texts: books, newspapers, letters, diaries and manuscripts
- Sound recordings: musical works, radio broadcasts and spoken language digitized by cylinders, films, discs
- Videos: excerpts from movies, newsreels and TV shows.

Europeana opens up new avenues for exploring European cultural wealth and makes Europe's culture available to all and at all points without hindrance: all those interested in literature, arts, science, politics, history, architecture, music or cinema have free and fast access to Europe's most important collections and masterpieces; a single virtual library through an online portal available in all EU languages [19,20].

Europeana makes it possible to search and navigate the digitized collections of European libraries, archives, museums, audiovisual archives and cultural institutions in a unified search and navigation [19]. More than 2,200 cultural organisations from all over Europe offered material to Europeana. Various European museums, including the Louvre in Paris and the Rijksmuseum in Amsterdam, have offered digitized paintings and objects from their collections. These paintings were greatly utilized in the creation of the questions of the digital game.

Open access to cultural data offered by Europeana encourages and facilitates the creative reuse of its collections, which in turn increases the ways in which European Union citizens can engage in the field of cultural heritage [19,20]. Thus, the children, playing the digital game, got to know the Europeana collection since there was the reference to the source of the material in each question.

### 6.3. Virtual reality tours used in the game

The virtual reality tours used to create questions about the digital game came mainly from the website <https://artsandculture.google.com/> and more specifically from the category of collections <https://artsandculture.google.com/partner> in which there are more than 2000 museums that have given open access to digitized exhibits or the virtual tour of their premises.

In addition, digital tours of the buildings in which the European Union institutions, such as the European Parliament, the European Commission and the European Court of Justice, are based, have been used (Figure 3).

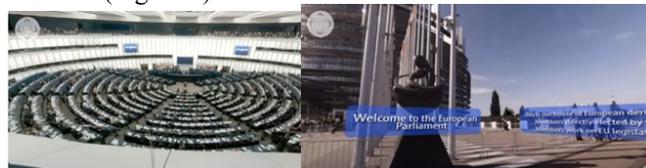


Figure 3. Snapshots of the EU institutions' digital tours, used in the game.

These tours, in addition to digital stories about the operation of these instruments, were combined with information about their geographical location. Therefore, the questions concerned both geography and understanding of the purpose and function of the European institutions.

#### 6.4. Educational objectives of the game

The main educational objective of the game is to cultivate the concept of European citizenship among students. Citizenship is mainly approached through gaining specific knowledge about the institutions of the European Union and their function. Additionally, through the promotion of the values that have historically been the inspiration and vision for the creation of the Union. At the same time, researchers aim to highlight the common and different historical and cultural elements of each culture through the prominence of museum exhibits.

Digital stories and corresponding questions are intended to cultivate the value of peaceful negotiation and cooperation, as essential elements of European citizenship.

Finally, playing this educational digital game aims at promoting digital skills in students regarding the operation and capabilities of educational robotics. In addition to the game, students will get to know the construction of the educational robot and its programming through the digital application for smart devices.

#### 7. Conclusion

Gamifying teaching activities allows for provoking more attention and promoting motivation and active involvement in students [21]. In this way, teachers have the opportunity to develop alternative projects aimed at cultivating skills in students. In addition, the use of educational robotics cultivates the digital potential of students and can be combined with many other subjects. The educational game designed and presented in this article, combines educational robotics, digital storytelling and virtual reality tours in order to gain knowledge about the European Union and to cultivate European citizenship among primary school students. Following the results of the previous pilot testing of the educational robot in the classroom, the researchers took advantage of its interactive character and assigned it the role of presenter of the game. At the same time, a member of the research team undertakes the operation of the robot, in real time but from a different room. The game has not yet been tested in children due to measures to prevent the spread of the Covid 19 pandemic. However, there has been contact with two Primary Schools for the testing and it is expected that, when the entrance of the group in schools is allowed, the research results on the effectiveness of the game will be collected and published for 200 children aged 8 to 12 years.

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