

- PROJECT PANTHEON -

Welcome to the Temple of Knowledge

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Overview

Education is the foundation of any prosperous society, but our current system is trapped in a cycle of stagnation and insufficient innovation. It is time for a profound change, a **revolution** that transforms the way students learn and relate to knowledge and incorporates the importance of our planet's sustainability into education from an early age.

Pantheon is our response to this need. Inspired by the ancient Roman temple dedicated to all the gods, Pantheon stands as a system of worlds of knowledge, where each realm represents a key discipline of knowledge. For example, Ceres, the Roman goddess of agriculture, symbolizes the world of biology; while Apollo, the Greek god of the sun, represents physics and astronomy. At Pantheon, each subject is brought to life through iconic figures, creating a symbolic and emotional connection to learning.

Pantheon is an application through which we intend to revolutionize education. We are not merely focusing on an aesthetic change. We firmly believe that **education should be entertaining** to capture the innate curiosity of the youngest students and, at the same time, improve their performance. That's why we integrate **innovation into every corner of Pantheon**, where learning becomes an interactive adventure, full of challenges, achievements and rewards. Imagine a class league where students have a plant and earn points by taking good care of it and winning educational games. Not only would it be entertaining, but they would learn about caring for nature, biology and environmental awareness.

The **reliability of knowledge** is essential, and in Pantheon we guarantee it through an intelligent chatbot designed to solve doubts in real time. This assistant not only answers general questions, but also **extracts answers directly from the materials provided by teachers** through an intuitive "drag and drop" function. Thus, every question is addressed with precision and relevance and the answers must be trust-worthy.

In addition, we harness the power of the most advanced generative intelligences. For example, students can **upload a photo** of their plant and Pantheon will provide detailed information about its species, possible diseases and care tips. This is just one of many examples of how technology can transform the way students interact with knowledge in practical and enriching ways and how Pantheon will implement it.

Challenge



SDGs in the Classroom

Event
2024 NASA Space Apps Challenge

Difficulty
Beginner/Youth **Intermediate**
Advanced

Subjects
Arts Climate Diversity & Equity Earth Games Software

In 2015, the United Nations created the 2030 Sustainable Development Goals (SDG) Agenda—a set of 17 goals focused on addressing global concerns such as climate change, global poverty, pollution, inequality, and many more. As we embark on the halfway point of the SDG Agenda, we aim to find new ways to engage youth with the tools available to advance these goals and measure our progress in achieving them. Your challenge is to develop a lesson plan that educates high school students about an SDG, and can be integrated into a science unit that may already be part of the curriculum (e.g., a unit on weather, geology, soil health, etc.).

The challenge we have chosen is **SDGs in the classroom**. As university students, our team is quite concerned with the sustainability of the system we live in today. Year after year, we keep seeing in the news more information about inequalities, climate change, poverty... and we believe the only way to change this situation comes from proper education. In this challenge we not only want to plan only a lesson plan on one of the 17 goals proposed, but we want to **revolutionize education**.

During the last few decades, global IT development has increased exponentially. Phones have become an essential tool in our daily lives, and the Internet the most important source of information we have access to. Not only that, but also recently artificial intelligence has made its stellar appearance in this world. Some people think it could be a new danger, but we believe it opens **new opportunities** to change what should have changed long ago. It is time to have an educational system that corresponds to the era we live in and uses its tools to maximize the learning experience of young students.

Some **articles** have already shown the **positive impact that games can have on education**: “*Applying game elements in the main page of the website such as Top 10 and Leaderboard to make students see their result in real time. That is, (gamification) leads to increased students' engagements and motivation in learning.*” (Khaleel, Ashaari, and Meriam Tengku Wook, “The impact of gamification on students' learning engagement.” [10.11591/ijece.v10i5.pp4965-4972](https://doi.org/10.11591/ijece.v10i5.pp4965-4972)). It is time to actually implement it.

This is how we present **Pantheon**: the new educational application that we aim to introduce to every school in the world. It is based on Rome's monument, a building dedicated to all Gods. In this context, the different Gods will be the area of the different subjects of the course the students will learn. Every God will be represented by a world in which they rule: Ceres will be the realm of biology, Apollo will be the realm of science... They all will live in harmony in the Pantheon, easily accessible to students and teachers.

Pantheon

Pantheon concept

Pantheon is the **new application that will revolutionize education**. As it was presented before, it will be an application in which the different areas of knowledge will be represented by an accessible world for the students and teachers. The different worlds are named after a God that describes the subject that is studied in each area.

We want to introduce a **new learning experience**. The new technologies that have been developed are yet to be fully integrated into the educational system that has remained untouched in the last decades despite all the development that has been implemented in our daily life. We believe that artificial intelligence (AI) and gamification can make a significant impact on how students learn and their experience.

This project was born as an evolution to our initial idea: a way of introducing the 2030 Sustainable Development Goals (SDGs) to the classroom. We not only wanted to create a platform in which their presence would be important, but we also wanted to create a new educational method for them. But, if we want to make a new tool for the SDGs, why can't we change the whole system? We believe Pantheon will be able to do just that.

Pantheon App



The main tool of pantheon will be its application, which will be available for any mobile device or tablet. Students will be able to **play and learn at any place**, at any moment. In the next sections we describe how the application will work.

Worlds description

Pantheon will be the **temple of knowledge**, and its worlds will transport you to the different subjects it has that are taught at the school. First, the students will have to create an account and login to the environment of their school, where the teacher will personalize the worlds that are available for the students and the material that the chatbot will read. From their account, students will have **immediate access to all the material** the teacher has provided.

The first option that the teacher will have to personalize to the environment is the worlds (the subjects) that are offered at the school. Each world will contain:

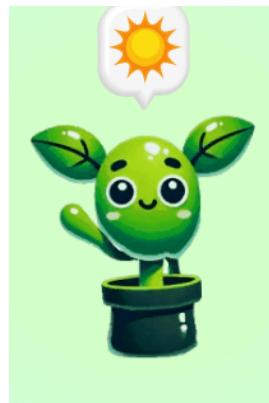
- A **personalized chatbot** that will answer the questions of the students using the material the teacher has uploaded for the subject.
- **Different mascots** for the different subjects. It will be interactive and will have an evolution depending on the project that is being done at that subject.
- Different **games are available** depending on the project that the teacher has enabled for the students.
- **Real-time rankings** of the games that are available.
- Personalization options for the students, such as changing some details of the mascots.
- **Statistics** on how well the projects that the teacher has proposed are being developed. This includes a **new method of evaluation** that does not rely on exams, more detailed statistics on the students effort and knowledge.
- **Real-time data** that could be relevant for the subject or a specific project, such as weather data.

Two worlds have been developed so far: **Ceres (first image), for the biology and natural science area**, and **Apollo (second image), for the science area**. We have focused on developing Ceres the most as a more complete example of the opportunities each world can offer. It contains a project that is almost fully developed that would be available to propose for any teacher: taking care of a plant. In this project, all students participating will have to buy a plant and, depending on which one it is, give it the care it needs, depending on what species it is.



Example project: taking care of your plant

This project is **full of innovation**, games and options to make it more entertaining. The students will have to record their actions related to the plant: watering it and their changes of locations (inside or outside the house). Real-time data will notify the student about daily sunlight levels, the water the plant needs, the weather in the area and the humidity, as well as recommendations on all the important areas of the plant.



But more importantly, the gamification of this project will be incorporated in a way it has never been implemented before, as it will be for any other project that is designed inside Pantheon. This **game gives points (px) to the students** depending on the actions that they have completed successfully and contains three levels:

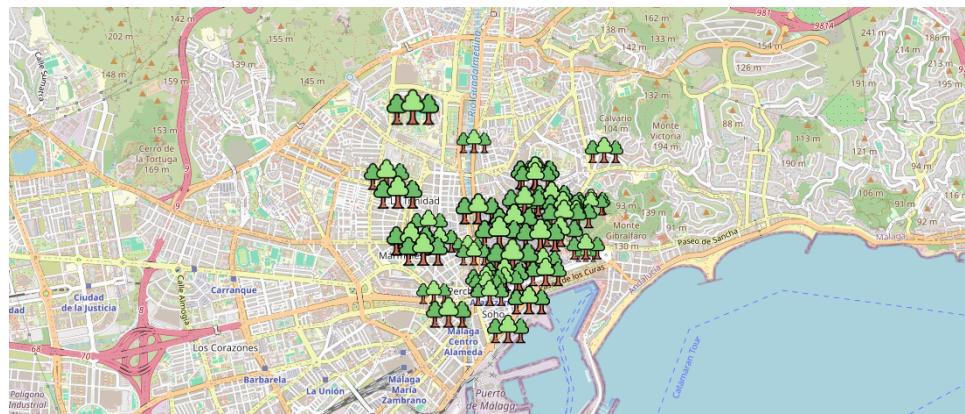
- **Level 1: Registration of the plant.**
 - Give the name a plant: 10px.
 - Personalize your plant (specify which species it is): 20px.
 - Register to your community (your school): 40px.
 - Survive three days: 30px.
- **Level 2:** Unlocked after reaching 100px.
 - Unlocks the use of the **chatbot**.
 - Play games with your plant, based on the subject:
 - Trivial: 50px.
 - Hangman: 40px.
 - Identification of species of plants: 40px.
 - Game of completing sentences about the life cycle of plants: 20px.
 - A correct care of the plant will give you extra points at the end of each day.
 - Survive 10 days: 40px.

- **Level 3:** Unlocked after reaching 200px.
 - Unlocks the **League of Plants**: a competition where the knowledge of the subject will be evaluated weekly in a trivial:
 - First place in the trivial: 50px.
 - Second place in the trivial: 25px.
 - Third place in the trivial: 10px.
 - Unlocks the leaderboard. In this ranking, all the students in level 3 will be shown their points.
 - First position in the ranking awards 30px each day.
 - Second position in the ranking awards 20px each day.
 - Third position in the ranking awards 10px each day.
 - Unlocks personalization of your plant: new outfits and wallpapers.
 - Survive 30 days: 100px.
 - For each extra plant registered, the student is awarded 100px.



To measure the correct care of the plant, the amount of watering it receives will be taken into account along with the correct ambiental conditions: humidity and temperature. The chatbot could be the most useful tool for this project. By **taking a picture of the plant, it will be able to identify its species, possible diseases** it may have and give recommendations on its state and its care. The leaderboard will be accessible at any moment in the application. Moreover, to make the community more engaged, a map with the location and the statistics of the plants of all registered users is included. To build this system, we relied on reference platforms such as [SEDAC](#), [NASA Earthdata Worldview](#), and the [UN-Habitat EO Toolkit](#). By using these tools, we have created a system that not only shows the location of the plants but also reflects their health and quality based on environmental factors, helping users better understand how to care for them.

The gamification of the project promotes learning and, in specific, will make students more motivated.



Teachers' options

If each subject has the name of a God, the teacher should be its most valuable companion. They should orchestrate the worlds and make them an enjoyable environment where students can learn. For this matter, Pantheon offers the perfect tool for them to motivate students and make them passionate about their subject.

The first step they will have to do is creating their world in the webpage. They will have to create an account and register to their school. In the webpage, they will have access to all the options they will need:

- **Upload the books and the notes** of the subject so they are always available for the students. The material that is provided by the teacher **will be used by the chatbot** to answer the students' questions.
- Create the world for the subject, with all their options:
 - Start new projects, along with their games.
 - Personalize the subjects and games the students will be able to access.
- The professors have access to the **statistics of all the students at any time**. Not only will they be able to evaluate the students using only results from an exam, but also from daily work and responsibility.

Students' options

The students will have **access to all the worlds** that their teachers enable for them. This includes:

- A **chatbot that will answer with the material** that has been provided by the teacher.
- **Games based on the subject:** trivial, completing sentences with the correct word, hangman...
- **Statistics on their performance**, as well as information about what they have learnt and what they are yet to learn.

Pantheon Web

The webpage will contain all the information about Pantheon. An interactive description of the project will be present, with detailed descriptions of all the worlds that are available. Furthermore, information on the mythology of the Gods that give name to the worlds will be available.

It will be the area the teachers will use the most. From the webpage, they will be able to upload the material of the subject for the students with a simple **drag and drop**. This information from the teacher will be used by the chatbot to **answer the students' questions** with more precision and knowledge of the subject. For the students, it will be a visual environment to use. After logging in, the worlds representing the different subjects appear. When you click on one of the worlds, it will direct you to the trained chatbot of the specific subject.

It uses:

- *Angular* for the web page frontend.
- *Java Springboot* for the web page backend.
- *OAuth2* for the security backend.
- *PostgreSQL* for the database.
- *Azure* for the database hosting.
- *Firebase* for the hosting frontend

To visit the webpage, use the following link: [Pantheon webpage](#).

Pantheon Chatbot

We have already mentioned the chatbot that is implemented in Pantheon, but it deserves its own section to describe its importance and functionalities. As students, we have all asked google and, more recently, artificial intelligence, questions about the subject we were studying. Sometimes we managed to obtain the answer we were looking for, but sometimes it seemed like there was no information about the questions you asked in the whole Internet!

Our developed chatbot is an OpenAI-40 agent which **can be given information and restrictions about certain topics** to give more precise answers to the questions. It uses all the information of the course to solve that: it will always be able to answer the questions you ask about a certain subject. Not only that, but also it will be able to help the student with the projects, recommending them approaches to develop fully their ideas and unlock their potential. To do this, our chatbot uses the OpenAI API, which we execute in python.

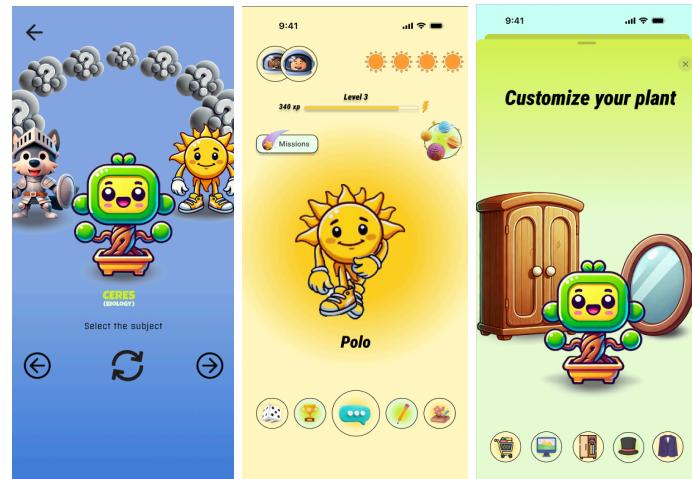
Current state of the project

So far we have talked in present tense for the features that have already been developed and in future tense for the future additions Pantheon will have. In this section we want to summarize the current state of the project after less than 48 hours working on it.

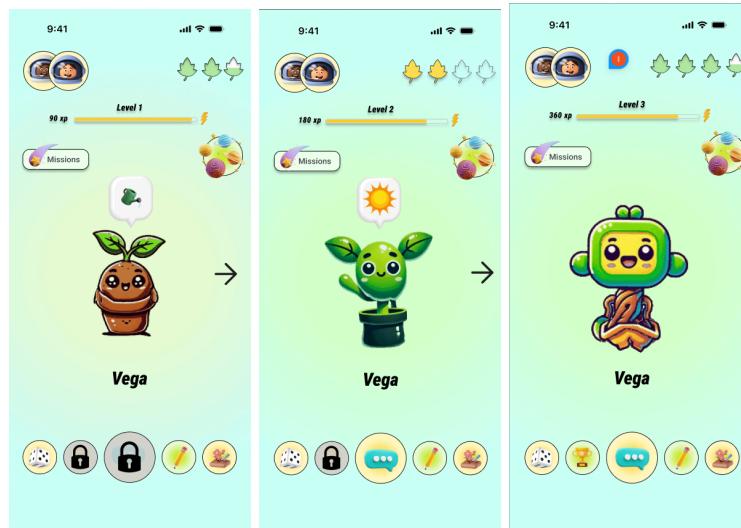
Pantheon Application

A **mockup of the application using Figma** with **original graphics** has been done. The mockup includes many of the screens the application will have, along with animations to navigate through the screens. More specifically, in the following pictures some of the screens and the explanation on how they work are shown.

Initially (first image) the selection screen for the world you want to open is the first image. When you open a specific world, you will find the mascot of that world along with many options such as the chatbot (as in the second image). In the last image one of the options has been opened, and the personalization of the character is enabled.



For a more clear example of the animations and the evolution of a mascot over time, the growth of the plant of the project designed for Ceres (named Vega) is shown:



After each level, the plant grows. In the bottom, the different utilities of Ceres are unlocked after upgrading to a new level. From left to right, the different options are the games (trivial, hangman...) that are available for this subject, the points ranking of the class, the chatbot, the personalization of the mascot (shown in the next image) and the statistics of the plant (how well it was treated and real-time maps of the community and the plants that are registered).

For Ceres, all the options in the bottom menu have already been implemented in the mockup. For Apollo, only the chatbot has been developed. Furthermore, in the selection screen (first image) you may notice a third mascot that has been selected for the history class, named Hercules.

Pantheon Webpage

The webpage includes a visual environment where the project of Pantheon will be explained in detail. It can direct you to the implemented worlds screen (Ceres and Apollo) and their respective chatbots. To visit what has been implemented so far, visit [Pantheon webpage](#).

Data Analysis

The different worlds and projects use real time data to give more precise information. Here, a description of the data that is used and its analysis is provided.

- **The [open weather APIs](#):** they provide information about weather forecasts, solar irradiance, historical and current weather data, maps collections and air pollution among many others. We use the air quality, rain and current weather.
- **OpenAI API:** it gives access to a personalized chatbot as we have developed, to which information can be given so it bases its answers to the questions using it.

To put together the information by the APIs and the data from the users of Pantheon using a program in python. The following libraries are used to generate graphs and histograms with the historic evolution of the leaderboard and the data from the APIs:

- ***Pandas* and *numpy*** for data analysis.
- ***Seaborn*.*scipy* and *matplotlib*.*pyplot*** for data visualization.

Future implementations

We plan on implementing all the details that have been exposed before. This includes a different world and different unique mascots for each of them, as well as finishing the webpage and making the back-end of the application.

Impact

The world has been asking for a **revolution in education** for a long time, and with Pantheon it has finally arrived. We believe the impact of this application will be global: finally **innovation and AI** will be introduced in the educational system and will help students improve their learning experience.

A **personalized chatbot** for each class that uses the material the teacher has given it will clearly improve the **accessibility of the educational material**, all without the problems that a non personalized chatbot may have and providing only clear and accurate information to the student. There is no such application like this in the world.

Furthermore, gamification would improve the involvement of the students in education. Historically, education has lacked the ability to motivate students and create exciting studying situations. We believe that introducing games into an educational platform will improve students' involvement and awaken their curiosity.

When discussing the project Friday night, one member of the team shared a story about how they learnt how gravity works by playing *Angry Birds*. We firmly believe Pantheon will be able to make all students have such experiences in the future. We want to make them enjoy the process of learning. Pantheon will be the definitive tool to help students extract all their potential. **Welcome to Pantheon, the temple of knowledge.**