



Supporting the continuation of teaching STEM subjects during the COVID-19 Pandemic through project-based online practices

## IO3 – Pilot activities with students

### SUMMARY

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# Declaration

This report has been prepared in the context of the BEREADY project. Where other published and unpublished source materials have been used, these have been acknowledged.

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# Funding Disclaimer

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# 1. Introduction

Intellectual Output 3 was titled “**STEM projects and OERs for students**”. Its idea revolved around the development of Open Educational Resources that followed the project methodology and introduced an additional set of interdisciplinary STEM projects for online education.

These resources were produced by the participant teachers with the support of the project team of experts. As planned, 4 new STEM projects for online/distance learning were developed (1 from each participating school), building on the experience gained in the context of the online course (Output 2).

The 4 STEM projects and resources targeted secondary school students 14-16 years old. Each school translated the developed STEM project into the local language (that the school represents) in order to enable the piloting with students.

The 4 projects after the piloting were refined and improved based on the feedback retrieved by the students that participated in the pilots.

Uni of Mihno had the overall overview of the output 3 development. WUT, Uni Siena and Edumotiva facilitated this process contributing to the design of the resources, ensuring the quality of the developed outputs. WUT supported the Polish school, Edumotiva played a key role towards supporting the Greek school, Uni of Mihno supported the Portuguese school and Uni Siena supported the Italian school.

The Tasks in this output were described as follows:

- Task 1: Review of scenarios for interdisciplinary STEM project design and selection of 4 scenarios (schools, ALL)
- Task 2: Drafting the STEM project scenario and highlighting the STEM concepts that are addressed in each project
- Task 3: Design OERs to support students' engagement in the selected STEM project scenarios (schools and ALL) recalling knowledge gained in the online course
- Task 4: Localization process: the school translates the project that developed in the national language so that to enable the piloting with local students
- Task 5: Finalization and refinement of the 5 STEM projects and the related OERs for students

This report presents the initial conception of the course with its final evaluation and reflection after pilots with students in each country.

Legal notice: for each course the following documents were signed by participants:

- “Terms and conditions of participation in the trial of the BeReady project”:  
<https://docs.google.com/document/d/11xiZ290g0GABulyAORRLH222qa2qYxSu/edit?usp=sharing&oid=110900831486675351527&rtpof=true&sd=true>
- Student consent (under age):  
[https://docs.google.com/document/d/1uUGJ6Pu3xD2J076NWkRJO-gyVZl3Xsyf/edit?usp=drive\\_link&oid=110900831486675351527&rtpof=true&sd=true](https://docs.google.com/document/d/1uUGJ6Pu3xD2J076NWkRJO-gyVZl3Xsyf/edit?usp=drive_link&oid=110900831486675351527&rtpof=true&sd=true)
- Student consent (adult)  
[https://docs.google.com/document/d/19GwwK-uK8aK0Wst7HKa3hbCsTZvMtRva/edit?usp=drive\\_link&oid=110900831486675351527&rtpof=true&sd=true](https://docs.google.com/document/d/19GwwK-uK8aK0Wst7HKa3hbCsTZvMtRva/edit?usp=drive_link&oid=110900831486675351527&rtpof=true&sd=true)

## 2. BEREADY Pilots in Italy

### 2.1. Initial idea for course - Italy

Braga, 27.05.2022

#### **Intellectual Output 3:**

The development of Open Educational Resources that follows the project methodology and results in STEM projects and OERs for students for online education.

#### **Task 1:**

Review of scenarios for interdisciplinary STEM project design and selection of 4 scenarios

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As a result of discussions and reviews the following project was chosen to be developed

**Country: Italy**

**Leader of the course: Annamaria Lisotti**

**Title of project: UNDERSTAND THE WORLD THROUGH DATA**

**Project description:** The 5-week project is meant to develop students' data awareness:

1. make them understand that data are all around us a) either produced by ourselves through the use of devices and social media (with all related risks to privacy and safety) or b) as a source of knowledge if correctly handled and interpreted;
2. develop their skills to select and interpret data;
3. fight misconceptions and stereotypes;
4. teach them to communicate and represent results effectively in both written and verbal form through storytelling and non-conventional artistic and physical models with an eye to inclusiveness

#### **Goals of the course:**

The goal of our project is to develop knowledge and skills in theoretical, computational and application-oriented statistics.

At the end of the module students will have to:

1. be able to restate an investigative question in terms of a statistical model or algorithm;
2. communicate statistical results verbally and in writing;
3. successfully relate theoretical concepts to a real-world problem;
4. demonstrate the ability to find sources appropriate to the investigative task;
5. be able to carry out a statistical analysis appropriate to the investigative question(s);
6. provide statistical analyses using appropriate tools/resources
7. produce data physicalization representing data with physical models: design and 3D printing
8. create effective and inclusive storytellings with data

## 2.2. Teacher's diary - IIS Cavazzi, Pavullo nel Frignano Italy

### Please briefly describe the STEM project that you have released online

Data is everywhere and is constantly gaining momentum in our life and in society- just think of Big Data and AI. However Statistics is still a much neglected part of the Math curricula. According to students one of the most boring ones! A shift in Statistics Education is urgently needed stressing its cross curricular potential and its focus on Civics as a lens for interpreting the World around us, fighting misconceptions and helping citizens in taking informed decisions.

Actually if you want to work on real cases with real data it can be very time consuming and therefore hardly practicable with the right in - depth insight and understanding during school time. On the contrary this approach is particularly suited to BEREADY project purpose as most of the work can be easily done at distance and autonomously by the students with a wide plethora of new and free digital tools for Data Analysis and representation. The best approach to Statistics is definitely real-life, project based, autonomous work in a flipped class modality for restitution.

A particular focus - and the most innovative part of our OER - was on Data Communication. This is because we think that there's no use for Data if you are not able to communicate and engage with them. This eventually brings a certain amount of freedom and creativity for the outreach part and it is also one of the reasons why the Art teacher was involved.

Statistics has traditionally privileged the visual channel to convey info. This is far from inclusive as it cuts off the visually impaired who rely on other senses to access knowledge and favors visual learners against the established principle that Education should promote all learning styles.

Students explored different options from *Data Visualization* to a wider concept of *Data Physicalization*. Sonification, QGIS datamaps modeling and 3D printing, Kirigami statistics, participatory statistics were tested. The driving idea was to deliver data through multiple sensory channels making it a real 360° experiential data fruition both for the uneducated public and for the experienced one with the aim to enhance comprehension, add new layers in data understanding and last but not least enrich data storytelling.

As a result of our work we produced 6 modules (each one with its own resources and tools: tools tutorials, teachers' guides, students'sheets, presentations, lists of additional resources. Most of the resources are editable to ease customization.

The modules can be implemented at different years of both junior and senior high school and in a modular way as they are self standing and not necessarily subsequential. So every teachers can adjust them according to his /her own needs. We worked with 15-18 years old.

**MODULE 1 Gapminder** - Data to "read" World and Society- Intro to Statistics and fact-checking. Testing preconceived ideas and refocusing on World Global issues

**MODULE 2 Sustainability and SDG Goals** - Data as a tool for interdisciplinary analysis 1

**MODULE 3 EdPuzzle** - a tool for data mining and issues analysis through videos:

interdisciplinary analysis 2

**MODULE 4 Graphical visualization:** Infographics and not conventional graphic representations.

**MODULE 5 Communicating Data through virtual Data Exhibitions** - ArtSteps

**MODULE 6 Data Physicalization-** Interactive multisensorial Data Experience: Sonification, Interactive Art, Haptic data (3D printing data and mapped data models, Kyrigami Statistics)

**Please briefly describe the context under which the engagement in the STEM project takes place and the pilots run** (i.e. online, in a hybrid mode, during school hours, after school hours, under a specific formal curriculum, in a non-formal way, with a serie of webinars and more...)

Our STEM project ran in Hybrid mode.

We mainly worked in the classes live during school hours in a formal curriculum.

In addition to this for each class we simulated one full day of lockdown. We asked permission from the school to have students working from home and teachers running lessons at distance through instructional webinars sessions and tutoring time of autonomous students' work individual or in groups.

Last but not least we worked on single activities (not really part of the pilot) with 4 more classes in the context of the dissemination. This was extremely useful for us also for OER's refinement.

**How many teachers are engaged in the pilots?** (provide the profile of each teacher in 2 -3 lines (i.e. subject they teach, experience in making practices etc)).

1. Annamaria Lisotti Math and Physics- Project coordinator- teching at IIS Cavazzi 33 years service. Designer and author of innovative practices in Science teaching and related OER in 3 more Erasmus+ projects and in other projects both at National & EU level

2.Lorenzo Mazzacurati Math and Physics- 22 years service - codesigner and coauthor in 2 previous Erasmus+ projects

3.Carla Rovandi Math and Physics- 21 years service- codesigner and coauthor in 2 previous Erasmus+ projects

4.Orietta Benassi 22 years service - Math - codesigner and coauthor in 2 previous Erasmus+ projects

5.Illaria Venturelli - Math and Physics - teaching at IIS Cavazzi 4 years service- codesigner and coauthor in a still running Erasmus EU project

6.Alessandra Gianelli - English - 39 years service- Language curator in 2 previous Erasmus EU project



7.Giorgia Vicini- Art - 15 years service- no previous experience in EU projects

**How many groups/classes are engaged in the pilots** (add as many rows as you need). For each group please fill in the required information

|                       | Age range | Number of boys | Number of girls | Total number of students | Period of engagement in pilots (i.e. Oct 2022 - Feb 2023) |
|-----------------------|-----------|----------------|-----------------|--------------------------|---|
| Group 1/<br>Class 3A  | 16-17     | 9              | 9               | 18                       | Nov 22 - Feb 2023   |
| Group 2/<br>Class 3D  | 16-17     | 9              | 9               | 18                       | Nov 22 - Feb 2023   |
| Group 3/<br>Class 4A) | 17-18     | 8              | 7               | 15                       | Nov 22 - Feb 2023   |

**Which resources you have developed so far. Please provide a characteristic title and a brief explanation. Finally add a link to the material you developed.**

| Title of resource/material  | Brief explanation   | Link  |
|---|---|---|
| <b>Mod1 Gapminder: data to read World &amp; Society</b>                         | 2 teacher's guide: one on the basics of Statistics, the other on the use of Gapminder<br>2 presentations: each corresponding to one of the guides | <a href="https://drive.google.com/drive/folders/1WSNL9PjMXX-avbPXrrO-FPmNGW8CmyJC">https://drive.google.com/drive/folders/1WSNL9PjMXX-avbPXrrO-FPmNGW8CmyJC</a> |
| <b>Mod2 Sustainability and SDG Goals through data</b>                           | 1 teachers' guide<br>1 presentation for students  | <a href="https://drive.google.com/drive/folders/1nvr9vCn96HKs3lpcczq80A0s5mTm3Vzp">https://drive.google.com/drive/folders/1nvr9vCn96HKs3lpcczq80A0s5mTm3Vzp</a> |
| <b>Mod3 EdPuzzle</b>  | 1 teachers' guide<br>1 presentation for students  | <a href="https://drive.google.com/drive/folders/1VUWKbEpXxyW25rluSP2dXdWtXsNpwnFd">https://drive.google.com/drive/folders/1VUWKbEpXxyW25rluSP2dXdWtXsNpwnFd</a> |
| <b>Mod4 Lesson1- A World in data Lesson2- Data collection and visualization</b> | 2 teachers' guides<br>2 students' sheets<br>2 presentations<br>2 lists of tools one for   | <a href="https://drive.google.com/drive/folders/1F3ZShZ5N0AW8ONPG0I4e61SQq8loSp6G">https://drive.google.com/drive/folders/1F3ZShZ5N0AW8ONPG0I4e61SQq8loSp6G</a> |

|   |  |  |
|---|--|--|
|   | <p>presentations and one for Infographics</p> <p>1 template for students diary for data collection</p> <p>1 tutorial on the use of Mentimeter</p>  |  |
| <p><b>Mod5</b></p> <p><b>Virtual data exhibitions</b></p> | <p>1 teachers' guide</p> <p>1 presentation for students</p>  | <p><a href="https://drive.google.com/drive/folders/1glxJJgSTO2AhjnFNmaCxXSnxE4-XPtbC">https://drive.google.com/drive/folders/1glxJJgSTO2AhjnFNmaCxXSnxE4-XPtbC</a></p> <p><a href="https://www.artsteps.com/view/6388cef4237bc9083ac5bdf">https://www.artsteps.com/view/6388cef4237bc9083ac5bdf</a></p> <p><a href="https://www.artsteps.com/view/638a5b9abbf82fd11bcfc144">https://www.artsteps.com/view/638a5b9abbf82fd11bcfc144</a></p> <p><a href="https://www.artsteps.com/view/638cb83c461d8d8726348a06?currentUser">https://www.artsteps.com/view/638cb83c461d8d8726348a06?currentUser</a></p> <p><a href="https://www.artsteps.com/view/6388ac5a84eb0c44acb76dc3?currentUser">https://www.artsteps.com/view/6388ac5a84eb0c44acb76dc3?currentUser</a></p> <p><a href="https://www.artsteps.com/view/638b5aecdb47568e2525cee">https://www.artsteps.com/view/638b5aecdb47568e2525cee</a></p> <p><a href="https://www.artsteps.com/view/638e02a8b33fe2e07f4a8e60">https://www.artsteps.com/view/638e02a8b33fe2e07f4a8e60</a></p> |
| <p><b>Mod6</b></p>  | <p><b><u>Sonification</u></b></p> <p>1 Teachers' guide</p> <p>1 Students' sheet</p> <p>1 Presentation</p> <p>2 tutorials: TwoTone, Highcharts</p> <p>1 Examples list</p> <p><b><u>Tangible data</u></b></p> <p>1 Presentation</p> <p>Participatory statistics,</p> <p>3 Tutorials</p> <p>From Geogebra to 3D print</p> <p>Mapping geolocalized Data and 3D printing part 1 &amp; 2</p> <p><b><u>Interactive Dynamical Data Art</u></b></p> <p>1 Teacher's guide</p> <p>1 Students' sheet</p> <p>3 tutorials:</p> | <p><a href="https://drive.google.com/drive/folders/1JuoiY8QZbClbeC9Qa6FtXVPIJKPFfz4h">https://drive.google.com/drive/folders/1JuoiY8QZbClbeC9Qa6FtXVPIJKPFfz4h</a></p>   |

|  |   |  |
|--|---|--|
|  | Intro to Processing<br>Arduino to Processing<br>from CSV to processing<br>+ Code sheets |  |
|--|---|--|

**How often do you meet your students (online or in hybrid way)? What have you achieved so far?**

Note: the number may differ from class to class or group to group

|  | <b>Number of sessions during the piloting period</b> (i.e. 5 times approximately once a week, once or twice a week...)   | <b>Achievements</b> |
|--|--|---------------------|
| <b>Class 3D / Group 1</b>              | Once a week hybrid way with more intensive periods of instructions followed by autonomous project work periods (approx 30 days). During this period teachers offered tuition |                     |
| <b>Class 3A/ Group 2</b>               | Once a week hybrid way with more intensive periods of instructions followed by autonomous project work periods (approx 30 days). During this period teachers offered tuition |                     |
| <b>Class 4A/ Group 3 (if relevant)</b> | Once a week hybrid way with more intensive periods of instructions followed by autonomous project work periods (approx 40 days). During this period teachers offered tuition |                     |

**Can you briefly explain your role during the sessions?**

Math and Physics teachers led the informative Statistical part and made most of the presentations  
 Prof.ssa Orietta Benassi - Module 1 and 2  
 Prof.ssa Gianelli Alessandra English teacher helped in revising materials and with the students worked on SDG Goals Module 1 and 2  
 Prof.ssa Ilaria Venturelli Module 4  
 Prof. Lorenzo Mazzacurati Module 5  
 Prof.ssa Annamaria Lisotti provided expertise in 3D printing and QGIS mapping Module 6  
 Prof.ssa Giorgia Vicini Art teacher offered consultancy for the aesthetics of the manufactures: infographics, virtual exhibitions, 3D printed models Module 4,5,6

**Did the students implement the STEM project in teams or individually?**

During the sessions they worked also in groups the final project was individual or in groups according to the class

**Can you describe which tools have been used so far?** Feel free to add as many rows as you need and to delete tables that are not needed.

| Group 1/<br>Class 1 |  |                   |   |
|---------------------|--|-------------------|---|
|                     | <b>Stage</b> ( <i>introduction, planning, brainstorming, creation, sharing etc</i> ) | <b>Tools used</b> | <b>Photos of the final artefact (you can provide a link to a picture)</b>   |
|                     |  | Mentimeter        |   |
|                     |  | Infographic apps  | <a href="https://drive.google.com/drive/folders/1fM30ibtv5jtL3diiI4bLDIA6Z8luXMdL">https://drive.google.com/drive/folders/1fM30ibtv5jtL3diiI4bLDIA6Z8luXMdL</a> |
|                     |  | Padlet            | <a href="https://drive.google.com/drive/folders/1dU7HLV596SxGQFlvAaRLqGO3CabOTtNk">https://drive.google.com/drive/folders/1dU7HLV596SxGQFlvAaRLqGO3CabOTtNk</a> |
|                     |  | Classroom         |   |
|                     |  | Mural             | <a href="https://drive.google.com/drive/folders/1HYoXwBAbnNLFuV2Df6GCPX6vDoQtifFr">https://drive.google.com/drive/folders/1HYoXwBAbnNLFuV2Df6GCPX6vDoQtifFr</a> |
|                     |  | TwoTone           | <a href="https://drive.google.com/drive/folders/1HYoXwBAbnNLFuV2Df6GCPX6vDoQtifFr">https://drive.google.com/drive/folders/1HYoXwBAbnNLFuV2Df6GCPX6vDoQtifFr</a> |
|                     |  | HighCharts        | <a href="https://drive.google.com/drive/folders/1HYoXwBAbnNLFuV2Df6GCPX6vDoQtifFr">https://drive.google.com/drive/folders/1HYoXwBAbnNLFuV2Df6GCPX6vDoQtifFr</a> |
|                     |  | Canva             | <a href="https://drive.google.com/drive/folders/1hZKzKb4vJ8JdnB2DhwIJZ_CaYuFymrJI">https://drive.google.com/drive/folders/1hZKzKb4vJ8JdnB2DhwIJZ_CaYuFymrJI</a> |
|                     |  | EdPuzzle          | <a href="https://youtu.be/B5kO21Y-8Sc">https://youtu.be/B5kO21Y-8Sc</a><br><a href="https://youtu.be/yaNOSD49mpU">https://youtu.be/yaNOSD49mpU</a>              |

|  |  |                  |  |
|--|--|------------------|--|
|  |  |                  | <a href="https://youtu.be/B5kO21Y-8Sc">https://youtu.be/B5kO21Y-8Sc</a><br><a href="https://youtu.be/GBemZPD2XA8">https://youtu.be/GBemZPD2XA8</a>   |
|  |  | ArtSteps         | <a href="https://drive.google.com/drive/folders/1o2aZIDYK17mMDm9UK5FG1X2b5CcuZxAQ">https://drive.google.com/drive/folders/1o2aZIDYK17mMDm9UK5FG1X2b5CcuZxAQ</a>  |
|  |  | GeoGebra         | <a href="https://drive.google.com/drive/folders/1pI7IFMWEbB79TIUORCcEdN2Rt96Qy-Vs">https://drive.google.com/drive/folders/1pI7IFMWEbB79TIUORCcEdN2Rt96Qy-Vs</a><br><a href="https://drive.google.com/drive/folders/1vdAvgCfqawX0XkNmOm84Rtg_cPmAAb3q">https://drive.google.com/drive/folders/1vdAvgCfqawX0XkNmOm84Rtg_cPmAAb3q</a> |
|  |  | QGis             | <a href="https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl">https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl</a>  |
|  |  | Tinkercad        | <a href="https://drive.google.com/drive/folders/1pI7IFMWEbB79TIUORCcEdN2Rt96Qy-Vs">https://drive.google.com/drive/folders/1pI7IFMWEbB79TIUORCcEdN2Rt96Qy-Vs</a><br><a href="https://drive.google.com/drive/folders/1vdAvgCfqawX0XkNmOm84Rtg_cPmAAb3q">https://drive.google.com/drive/folders/1vdAvgCfqawX0XkNmOm84Rtg_cPmAAb3q</a> |
|  |  | Blender          | <a href="https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl">https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl</a>  |
|  |  | FreeCad          | <a href="https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl">https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl</a>  |
|  |  | Cura/CampuSprint | <a href="https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl">https://drive.google.com/drive/folders/1z8h9zbHqV2xzhQjZUI96W73VXvzZR4dl</a>  |

**Students' reactions related to the Beready experience** (in case you have observed anything)

Not so very at ease with the "fake" lockdown(day they were at home) with regard to online presentations but appreciated the autonomous working hours under tutor supervision  
Very interested in real data Analysis  
Quite amazed on how beautiful and interesting Statistics can be and how many things we can discover with it about our World  
  
SEE also questionnaires (students and teachers)

**Please refer to the challenges that you have faced so far** during the piloting period.

Main challenge: simulating the online experience when it actually was NOT needed  
Also in teachers: online piloting when the pandemic was really over and after such a stressing long period was particularly challenging to some teachers also from an emotional point of view  
  
Minor challenges: some technical difficulties in finding free software and managing some of them

**Any other note related to the piloting phase...**

Quite an interesting experience.  
We are a mountain school so we may needed this kind of online didactics in the future for instance during snow storms. Next year part of our school will be a building site and we may have a lack of spaces. Beready experience may help in organizing meaningful rotation of the classes with a mixture of live and at distance lessons.

## 3. BEREADY Pilots in Greece

### 3.1. Initial idea for course - Greece

Braga, 27.05.2022

#### **Intellectual Output 3 :**

The development of Open Educational Resources that follows the project methodology and results in STEM projects and OERs for students for online education.

#### **Task 1 :**

Review of scenarios for interdisciplinary STEM project design and selection of 4 scenarios

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As a result of discussions and reviews the following project was chosen to be developed

**Country:** Greece  
**Leader of the course:** George Fragakis  
**Title of project:** “Balloon (air) powered car: From design to creation”

#### **Project description:**

Designing and creating a balloon powered car using 3D online design tools or handcrafting materials.

This car is powered by the elastic energy of a balloon.

Balloons are elastic and store potential energy when they are filled with air. When the air is released, the potential energy is converted into the energy of motion, which is also known as kinetic energy. This is the energy experienced when the car is propelled forward.

#### **Goals of the course:**

- Continuation of education using online tools as well as in the lab, depending on the circumstances.
- Learning to use 3D designing tools. Learn how to use and print with the 3D printer.
- Enhancing students' skills in creativity, art, real problem solving, imagination, inventiveness, teamwork.
- Student's involvement with several subjects, such as Physics, Geometry, Engineering and Arts

### 3.2. Teacher's diary - Greece

|  |
|--|
| <p><b>Please briefly describe the STEM project that you have released online</b></p>   |
| <p>Balloon (air) powered car: from design to creation.</p> <p>Designing and creating a balloon powered car using 3D online design tools or handcrafting materials.</p> <p><b>This car is powered by the elastic energy of a balloon.</b></p> <p>Balloons are elastic and store <b>potential energy</b> when they are filled with air. When the air is released, the potential energy is converted into the energy of motion, which is also known as <b>kinetic energy</b>. This is the energy experienced when the car is propelled forward.</p> |
| <p><b>Please briefly describe the context under which the engagement in the STEM project takes place and the pilots run</b> (i.e. online, in a hybrid mode, during school hours, after school hours, under a specific formal curriculum, in a non-formal way, with a serie of webinars and more...)</p>  |
| <p>The project ran mostly online, but there were some face to face meetings at certain checkpoints (beginning, middle, end). Those meetings took place after school hours.</p>   |
| <p><b>How many teachers are engaged in the pilots?</b> (provide the profile of each teacher in 2 -3 lines (i.e. subject they teach, experience in making practices etc)).</p>  |
| <p>3 teachers were actively involved:</p> <ul style="list-style-type: none"><li>-George Fragakis, Computer Science, 3D, Robotics, New Technologies Teacher of the school. Apart from the formal teaching, his experience involves participation in numerous STEAM Projects.</li><li>-Dimitris Vlassopoulos, Mathematics teacher, having some experience in STEAM projects</li><li>-Niki Kalomoiri, Economy &amp; Skills Lab teacher also has experience in STEAM projects</li></ul>  |



**How many groups/classes are engaged in the pilots** (add as many rows as you need). For each group please fill in the required information

|                     | Age range | Number of boys | Number of girls | Total number of students | Period of engagement in pilots (i.e. Oct 2022 - Feb 2023) |
|---------------------|-----------|----------------|-----------------|--------------------------|---|
| Group 1/<br>Class 1 | 13-15     | 7              | 13              | 20                       | Sep 2022 - Dec 2022                                       |

**Which resources you have developed so far. Please provide a characteristic title and a brief explanation. Finally add a link to the material you developed.**

| <b>Title of resource/material</b>  | <b>Brief explanation</b>  | <b>Link</b>   |
|--|---|---|
| <b>How is a balloon car powered?</b>   | Online voting after students viewed a relevant video  | <a href="https://www.menti.com/al6tqf-dbsymh">https://www.menti.com/al6tqf-dbsymh</a>   |
| <b>Tinkercad Basics for Kids</b>   | Title:Tinkercad Basics for Kids. Description:<br>How to use the basic tools in Tinkercad.<br>Used Amara online tool for the subtitling. Now the video can be used in both languages (English & Greek) | <a href="https://amara.org/videos/HAYOGSfIH7Jr/info/tinkercad-basics-for-kids/">https://amara.org/videos/HAYOGSfIH7Jr/info/tinkercad-basics-for-kids/</a>                                 |
| <b>Tinkercad tutorial: 1st part &amp; assignment (Introduction/account creation)</b> | 1st Tinkercad tutorial: Create your first 3D design online. Assignment: Account creating and navigation   | <a href="https://drive.google.com/file/d/1p01utvf-ciDEAZZT6w-7Qx7bTfI_Qc_8/view?usp=share_link">https://drive.google.com/file/d/1p01utvf-ciDEAZZT6w-7Qx7bTfI_Qc_8/view?usp=share_link</a> |
| <b>Tinkercad tutorial: 2nd part &amp; assignment (Design simple shapes)</b>          | 2nd Tinkercad tutorial: Create your first 3D design online. Assignment: Create the shapes in Tinkercad, as instructed.  | <a href="https://drive.google.com/file/d/11qfzJsAVxgyiUgUGmolHpl6832j01NC/view?usp=share_link">https://drive.google.com/file/d/11qfzJsAVxgyiUgUGmolHpl6832j01NC/view?usp=share_link</a>   |
| <b>Tinkercad tutorial: 3rd part &amp; assignment (Combine shapes)</b>                | 3rd Tinkercad tutorial with assignments: Combine simple shapes, as instructed   | <a href="https://drive.google.com/file/d/1CmdlZEIINR8Xukf5Vpbq-Xx6jbAfDyy1/view?usp=share_link">https://drive.google.com/file/d/1CmdlZEIINR8Xukf5Vpbq-Xx6jbAfDyy1/view?usp=share_link</a> |

|   |   |   |
|---|---|---|
| <b>Tinkercad tutorial: 4th part (Complete Tinkercad in 9 minutes)</b> | A complete mini-guide for designing in Tinkercad. Includes instructions of combining complex shapes and functions. Questions in EdPuzzle (both English and Greek) | <a href="https://edpuzzle.com/media/633f018ae3c6044124700c24">https://edpuzzle.com/media/633f018ae3c6044124700c24</a> |
|---|---|---|

**How often do you meet your students (online or in hybrid way)? What have you achieved so far?**

Note: the number may differ from class to class or group to group

|                          | <b>Number of sessions during the piloting period</b> (i.e. 5 times approximately once a week, once or twice a week...) | <b>Achievements</b>  |
|--------------------------|--|--|
| <b>Class 1 / Group 1</b> | 8 times/once a week  | Students got familiar, used online tools and designed a car in a 3d environment. |

**Can you briefly explain your role during the sessions?**

- Guide students by showing them the steps, ranging from how to use and access the tools, to how to organize themselves in order to successfully complete the project.
- Facilitate learning (to transfer knowledge and experience in a different way in the classroom and in the online format).
- Keep online learners motivated throughout the online course.
- Keep communication alive and active even when doubts and debates show up.

**Did the students implement the STEM project in teams or individually?**

They mostly did the project in teams. When they were online they used all the relevant tools to be in contact with their team members.

**Can you describe which tools have been used so far?** Feel free to add as many rows as you need and to delete tables that are not needed.

| <b>Group 1/<br/>Class 1</b> |  |                                     |   |
|-----------------------------|--|-------------------------------------|---|
|                             | <b>Stage</b> ( <i>introduction, planning, brainstorming, creation, sharing etc</i> ) | <b>Tools used</b>                   | <b>Photos of the final artefact (you can provide a link to a picture)</b>   |
|                             | Project Planning   | app.teamgantt.com                   | <a href="https://drive.google.com/file/d/1scm213jv7Ljb6XoR6HmjmhS0xFmCxVP0/view?usp=share_link">https://drive.google.com/file/d/1scm213jv7Ljb6XoR6HmjmhS0xFmCxVP0/view?usp=share_link</a> |
|                             | Introduction, Teaching   | Google classroom, Youtube           | <a href="https://drive.google.com/file/d/1_UJTqbny8T5iGGTz0cl0p_BAzFZWZH5e/view?usp=share_link">https://drive.google.com/file/d/1_UJTqbny8T5iGGTz0cl0p_BAzFZWZH5e/view?usp=share_link</a> |
|                             | Brainstorming  | Menti.com                           | <a href="https://drive.google.com/file/d/1oq403Fo3U1qUzM3oOLiJLyaRFVAFY0RZ/view?usp=share_link">https://drive.google.com/file/d/1oq403Fo3U1qUzM3oOLiJLyaRFVAFY0RZ/view?usp=share_link</a> |
|                             | Teaching/Online Quiz   | EdPuzzle.com                        | <a href="https://drive.google.com/file/d/1qG9f5598gLPt_0ORBeNL3BAgtJP26UYZ/view?usp=share_link">https://drive.google.com/file/d/1qG9f5598gLPt_0ORBeNL3BAgtJP26UYZ/view?usp=share_link</a> |
|                             | Teaching   | Amara.org<br>(Subtitling any video) | <a href="https://drive.google.com/file/d/17fSjSn4nc_I6lh1j6BITFxMpMQGrZeXS/view?usp=share_link">https://drive.google.com/file/d/17fSjSn4nc_I6lh1j6BITFxMpMQGrZeXS/view?usp=share_link</a> |
|                             | Learning - Worksheets  | Pdf                                 | <a href="https://drive.google.com/file/d/1DwJrOhO4IjPI2AYz-Hf6ZP1e1LBAESh6/view?usp=share_link">https://drive.google.com/file/d/1DwJrOhO4IjPI2AYz-Hf6ZP1e1LBAESh6/view?usp=share_link</a> |
|                             | Creation   | Tinkercad.com                       | <a href="https://drive.google.com/file/d/1Aqf7rBevUgBz1aStsOSwN1uV8dkVTkpE/view?usp=share_link">https://drive.google.com/file/d/1Aqf7rBevUgBz1aStsOSwN1uV8dkVTkpE/view?usp=share_link</a> |
|                             | Sharing  | Tinkercad/share option              |   |

**Students' reactions related to the Beready experience** (in case you have observed anything)

Students showed much interest in the Beready experience, by fully learning, using and exploiting tools for online STEM Education. Furthermore, they were excited in 3d designing (Tinkercad)

**Please refer to the challenges that you have faced so far** during the piloting period.

It was a challenge to keep students motivated and engaged to the project due to the nature of online education that can lead to distraction, lack of motivation, etc. This was reduced by setting realistic short-term goals and plans to help students stay on track with the project. Also, interaction between students and teachers was maintained at high levels.

**Any other note related to the piloting phase...**

After finishing the project, during the evaluation and refinement phase, it was concluded that some online sessions should be shorter to give more time to students to do things+ on their own.

## 4. BEREADY Pilots in POLAND

### 4.1. Initial idea for course - Poland

Braga, 27.05.2022

#### **Intellectual Output 3:**

The development of Open Educational Resources that follows the project methodology and results in STEM projects and OERs for students for online education.

#### **Task 1:**

Review of scenarios for interdisciplinary STEM project design and selection of 4 scenarios

---

As a result of discussions and reviews the following project was chosen to be developed

**Country:** Poland

**Leader of the course:** Andrzej Prusiński

**Title of project:** The shape of water - surface tension in nature

**Project description:** The project is aimed at acquainting the students with the task of conducting experiments and the use of IT tools for the purpose of analysis and presentation of the results.

#### **Goals of the course:**

- Making participants acquainted with conducting experiments
- Presenting the IT tools used with the aforementioned experiments' conduction
- Strengthening the abilities to analyse and present the results

## 4.2. Teacher's diary - Poland

|   |
|---|
| <p><b>Please briefly describe the STEM project that you have released online</b></p> <p>The presented project's name is minimum surface – a specific view on catenoid as a minimum surface of a cylinder.<br/>         The projects starts with a simple activity with soap bubbles and ends with creating a catenoid based upon two rings immersed in a soap solution adequate for creating soap bubbles.<br/>         The catenoid is created via simple tools which each and every participant of the project can make at home.<br/>         The students were also to apply its complex mathematical formula as an essential element for calculating its said surface area.</p>   |
| <p><b>Please briefly describe the context under which the engagement in the STEM project takes place and the pilots run</b> (i.e. online, in a hybrid mode, during school hours, after school hours, under a specific formal curriculum, in a non-formal way, with a serie of webinars and more...)</p> <p>The project was implemented mostly independently by the students at home or after school classes. One of the groups has conducted experiments at their outgoing mathematical camp during which they have elaborated the catenoid's surface area calculative methods under the teacher's supervision. The majority of the meetings with the students and the discussed results of their works were online.</p>  |
| <p><b>How many teachers are engaged in the pilots?</b> (provide the profile of each teacher in 2 -3 lines (i.e. subject they teach, experience in making practices etc)).</p> <p>Alicja Żelazko – IT and maths teacher dealing with programming and application of available software in education and programming.<br/>         Agnieszka Korniluk – maths teacher possessing experience in teaching various educational stages and in STEM subjects.<br/>         Wojciech Rzepczyński – geography teacher possessing experience in applying STEM methods.<br/>         Mateusz Kośnik – English teacher supervising language correctness and communication with other teams and possessing experience in the academia.<br/>         Andrzej Prusiński – maths, economics and physics teacher possessing experience in applying STEM methods and in the academia.</p> |

**How many groups/classes are engaged in the pilots** (add as many rows as you need). For each group please fill in the required information

|                     | Age range | Number of boys | Number of girls | Total number of students | Period of engagement in pilots (i.e. Oct 2022 - Feb 2023) |
|---------------------|-----------|----------------|-----------------|--------------------------|---|
| Group 1/<br>Class 1 | 15-16     | 20             | 5               | 25                       | November 2022 to January 2023                             |

Which resources you have developed so far. Please provide a characteristic title and a brief explanation. Finally add a link to the material you developed.

| Title of resource/material  | Brief explanation  | Link   |
|---|--|--|
| <p><b>Introduction – minimum surface</b></p>                                  | <p>It was aimed at showing the phenomenon of striving towards minimalism in nature based on case study of the catenoid.</p>                                    | <p><a href="https://app.mural.co/t/xliceumogolnoksztalcaceimkro9637/m/xliceumogolnoksztalcaceimkro9637/1667734260197/b8deffa2301ab1b304baa86a9eeeb2a75857d041?sender=u5cfeeb5c2714048b77947273">https://app.mural.co/t/xliceumogolnoksztalcaceimkro9637/m/xliceumogolnoksztalcaceimkro9637/1667734260197/b8deffa2301ab1b304baa86a9eeeb2a75857d041?sender=u5cfeeb5c2714048b77947273</a></p> <p><a href="https://edpuzzle.com/media/63623acf258d8a40eca0bee5">https://edpuzzle.com/media/63623acf258d8a40eca0bee5</a></p> <p><a href="https://edpuzzle.com/media/6365171b3778f340c44518ff">https://edpuzzle.com/media/6365171b3778f340c44518ff</a></p> |
| <p><b>Catenoid modelling</b></p>  | <p>Use of Geogebra for mathematical visualisation of catenoids on the basis of pictures received in the conducted experiment.</p>                              | <p><a href="https://drive.google.com/drive/folders/1THUROSzaRHTiFjUWmuSbfF-psMpUK1rC">https://drive.google.com/drive/folders/1THUROSzaRHTiFjUWmuSbfF-psMpUK1rC</a></p>   |
| <p><b>Mathematical methods in calculating the catenoid's surface area</b></p> | <p>Introduction and application of the definition of definite and indefinite integral as the tools for calculating the surface area of the modelled solid.</p> | <p><a href="https://drive.google.com/drive/folders/1THUROSzaRHTiFjUWmuSbfF-psMpUK1rC">https://drive.google.com/drive/folders/1THUROSzaRHTiFjUWmuSbfF-psMpUK1rC</a></p>   |
| <p><b>Creation of gallery of minimum surfaces</b></p>                         | <p>Creation of a gallery with examples of the use of minimum surface in everyday life via Artsteps application.</p>  | <p><a href="https://www.artsteps.com/view/63d59f5777f5ea1d400289e7/?currentUser">https://www.artsteps.com/view/63d59f5777f5ea1d400289e7/?currentUser</a></p> <p><a href="https://www.artsteps.com/view/63d81255d8b47568e2a0523b">https://www.artsteps.com/view/63d81255d8b47568e2a0523b</a></p> <p><a href="https://www.artsteps.com/view/63d0063ef206093908aa1cae?currentUser">https://www.artsteps.com/view/63d0063ef206093908aa1cae?currentUser</a></p> <p><a href="https://www.artsteps.com/view/63d3ed2a384c4b2d09079ab7">https://www.artsteps.com/view/63d3ed2a384c4b2d09079ab7</a></p>  |

|                           |   |   |
|---------------------------|---|---|
| <b>Presenting results</b> | The students presented the received results of their work and enclosed the validity of the posed hypothesis regarding minimum surface of the catenoid as a surface received from the rotation of a chain curve around its axis. | <a href="https://drive.google.com/drive/folders/1wIMhxZnDq46wV0v5DJntzubCVCiKfj30">https://drive.google.com/drive/folders/1wIMhxZnDq46wV0v5DJntzubCVCiKfj30</a> |
|---------------------------|---|---|

**How often do you meet your students (online or in hybrid way)? What have you achieved so far?**

Note: the number may differ from class to class or group to group

|                          | <b>Number of sessions during the piloting period</b> (i.e. 5 times approximately once a week, once or twice a week...) | <b>Achievements</b>   |
|--------------------------|--|---|
| <b>Class 1 / Group 1</b> | 4 times within 2 months  | The students presented validity of the posed hypothesis regarding catenoid's minimum surface as a surface received from the rotation of chain curve arounds its axis. |

**Can you briefly explain your role during the sessions?**

I led the students, showing them next steps in the process with the use of basic tools for creating a catenoid and showing them how to apply the given formula for calculating its surface area and comparing it with the surface area of a sphere and a cylinder of similar dimensions. The entire supervision over the work and calculations was conducted online on the basis of the MS Teams platform.

**Did the students implement the STEM project in teams or individually?**

The project was implemented for the group of 25 people; for organisational purposes, the students divided themselves into subgroups of 3-4 people.



Can you describe which tools have been used so far? Feel free to add as many rows as you need and to delete tables that are not needed.

| Group 1/ Class 1 |  |                   |  |
|------------------|--|-------------------|--|
|                  | <b>Stage</b> ( <i>introduction, planning, brainstorming, creation, sharing etc</i> ) | <b>Tools used</b> | <b>Photos of the final artefact</b> (you can provide a link to a picture)  |
|                  | Moduł 1  | mural             | <a href="https://app.mural.co/t/xliceumogolnoksztalceimkro9637/m/xliceumogolnoksztalceimkro9637/1667734260197/b8deffa2301ab1b304baa86a9eeeb2a75857d041?sender=u5cfeeb5c2714048b77947273">https://app.mural.co/t/xliceumogolnoksztalceimkro9637/m/xliceumogolnoksztalceimkro9637/1667734260197/b8deffa2301ab1b304baa86a9eeeb2a75857d041?sender=u5cfeeb5c2714048b77947273</a>  |
|                  | Moduł 1  | menti             | <a href="https://www.menti.com/al9jnpapwm2i">https://www.menti.com/al9jnpapwm2i</a>  |
|                  | Moduł 1  | edpuzzle          | <a href="https://edpuzzle.com/media/63623acf258d8a40eca0bee5">https://edpuzzle.com/media/63623acf258d8a40eca0bee5</a><br><a href="https://edpuzzle.com/media/6365171b3778f340c44518ff">https://edpuzzle.com/media/6365171b3778f340c44518ff</a>   |
|                  | Moduł 2  | GeoGebra          | <a href="https://drive.google.com/drive/folders/1THUROSzaRHTiFiUWmuSbfF-psMpUK1rC">https://drive.google.com/drive/folders/1THUROSzaRHTiFiUWmuSbfF-psMpUK1rC</a>  |
|                  | Moduł 3  | artsteps          | <a href="https://www.artsteps.com/view/63d59f5777f5ea1d400289e7/?currentUser">https://www.artsteps.com/view/63d59f5777f5ea1d400289e7/?currentUser</a><br><a href="https://www.artsteps.com/view/63d81255d8b47568e2a0523b">https://www.artsteps.com/view/63d81255d8b47568e2a0523b</a><br><a href="https://www.artsteps.com/view/63d0063ef206093908aa1cae?currentUser">https://www.artsteps.com/view/63d0063ef206093908aa1cae?currentUser</a><br><a href="https://www.artsteps.com/view/63d3ed2a384c4b2d09079ab7">https://www.artsteps.com/view/63d3ed2a384c4b2d09079ab7</a> |
|                  |  | canva             | <a href="https://www.canva.com/design/DAFYtUv3c/iibzHPLQhWRXGy2BYDXL-A/edit">https://www.canva.com/design/DAFYtUv3c/iibzHPLQhWRXGy2BYDXL-A/edit</a>  |

**Students' reactions related to the Bready experience** (in case you have observed anything)

The students were involved in the conducted empirical experiments and their calculation results. The greatest interest was caused by final outcome and its comparison between the subgroups.

**Please refer to the challenges that you have faced so far** during the piloting period.

A huge challenge was to elaborate a calculative method for the created idea. The study of the catenoid's surface area occurred to be quite complicated. The derivation of an integral crucial for conducting calculations and explaining it to the students was quite a difficult task and required a large dose of involvement from the teacher. Teams' support ultimately brought the anticipated effect in each and every team.

**Any other note related to the piloting phase...**

# 5. BEREADY Pilots in Portugal

## 5.1. Initial idea for course – Portugal

Braga, 27.05.2022

### **Intellectual Output 3:**

The development of Open Educational Resources that follows the project methodology and results in STEM projects and OERs for students for online education.

#### **Task 1:**

Review of scenarios for interdisciplinary STEM project design and selection of 4 scenarios

---

As a result of discussions and reviews the following project was chosen to be developed

**Country: Portugal**

**Leader of the course: Márcia Barbosa (leader), Cristina Maia, Olga Carvalho e Silvina Soares**

**Title of project: A new post-war cost of living**

#### **Project description:**

The war in Ukraine changed the economy of Europe, influencing the cost of living in our country, with repercussions in terms of eating habits, product prices, energy consumption and healthy living.

#### **Goals of the course:**

The main objective of our project is to lead students to analyze a real event in our society, acquiring and applying knowledge in different areas of knowledge

- Historical and geographical framework of UKraine
- Define inflation, deflation and disinflation concepts.
- Apply the concepts of inflation, deflation and disinflation in real life situations,
- Define Export/Import concepts,
- Explain the implications of the change in prices of raw materials (cereals) in the Portuguese economy;
- Explain the consequences of changes in prices on eating habits;
- Explain how changing eating habits influences healthy living;
- Define the concept of renewable energy;
- Identify renewable energy sources;
- Explain the costs of producing renewable energy;
- Explain the use of renewable energies as an alternative to the use of fossil fuels.

## 5.2. Teacher's diary - Externato de Vila Meã, Amarante, Portugal

|  |
|--|
| <p><b>Please briefly describe the STEM project that you have released online</b></p>   |
| <p><b>Project description:</b></p> <p><b>The war in Ukraine changed the economy of Europe, influencing the cost of living in our country, with repercussions in terms of eating habits, product prices, energy consumption and healthy living.</b></p> <p>The main objective of our project is to lead students to analyze a real event in our society, acquiring and applying knowledge in different areas of knowledge</p> <p>Historical and geographical framework of UKraine</p> <ul style="list-style-type: none"><li>- Define inflation, deflation and disinflation concepts.</li><li>- Apply the concepts of inflation, deflation and disinflation in real life situations,</li><li>- Define Export/Import concepts,</li><li>- Explain the implications of the change in prices of raw materials (cereals) in the Portuguese economy;</li><li>- Explain the consequences of changes in prices on eating habits;</li><li>- Explain how changing eating habits influences healthy living;</li><li>- Define the concept of renewable energy;</li><li>- Identify renewable energy sources;</li><li>- Explain the costs of producing renewable energy;</li><li>- Explain the use of renewable energies as an alternative to the use of fossil fuels.</li></ul> |
| <p><b>Please briefly describe the context under which the engagement in the STEM project takes place and the pilots run</b> (i.e. online, in a hybrid mode, during school hours, after school hours, under a specific formal curriculum, in a non-formal way, with a serie of webinars and more...)</p>  |
| <p>Disclosure of the project</p> <p>Session 1- online</p> <p>The project started on October 18th with a webinar guided by the coordination (Profª Márcia) for all the teachers of Externato Vila Meã involved in the project and the students of classes 10C, 11C, 9A, 9B, 10A.</p> <p>The project and the way in which the training sessions were organized and their dates were presented.</p> <p>Session 2</p>  |

1st week of project development - face-to-face (10/31 to 11/11)

The historical and geographic framework was carried out with the guidance of Professor Alfredo Costa and Vitor Fernandes by the 10<sup>o</sup>C class, during 3 sessions. The professors provided documents that were explored by the students, who then did research work that culminated in the construction of a Thinglink per workgroup. This final product served to introduce the theme and continue the project in the second week in the 11<sup>o</sup>C class.

### Session 3

2nd week of project development - face-to-face (11/14 to 11/25)

Professor Cristina Maia, in the 11th grade Economics class, presented the students with the objectives of the project that they should develop and the work already carried out by their 10th grade colleagues in order to have a better perception of the scope of the entire Erasmus+ Project. Then the students were divided into 3 groups, where group I (3 elements) was responsible for developing a work with concepts related to inflation (a powerpoint and a flyer); group II (4 elements) developed a work on the concepts of imports and exports (a powerpoint); and group III (4 elements) develop a work on renewable energies (a video).

These works were then presented by the students to their 10th grade classmates (available on video), explaining the concepts and providing them with resources so that they could develop their part of the project. [://www.thinglink.com/scene/1319716232345157634](http://www.thinglink.com/scene/1319716232345157634).

The next step consisted of the elaboration of the works by the 10th grade students, having also been divided into groups. Group I (4 elements) developed their work by analyzing Portuguese imports and exports and the impact of the war on them (making a powerpoint); group II (5 elements) presented a work in canva on the impact of the war on prices and consumption habits of the Portuguese. Group III (3 elements) developed their work in a powerpoint presentation on energy consumption in Portugal. These works are compiled at

<https://www.thinglink.com/scene/1654444570911440897>.

Session 4 (30 january to 3 february)

2 sessions to prepare the survey

1 session to apply the survey to a sample of 20 students from each school year from the 5th to the 12th grade

Session 5 (20 march to 24 march)

4th week

1 online session to explain to the students what they would have to do in the work to be done

1 face-to-face session to carry out the count and respective tables of the collected data

Session 6 Compilação de todos os trabalhos no frame vr

**How many teachers are engaged in the pilots?** (provide the profile of each teacher in 2 -3 lines (i.e. subject they teach, experience in making practices etc)).

Cristina Aparício, Philosophy, Secondary School, 30 years of teaching service,  
 Cristina Maia, Mathematics - Third cycle; Economics - Secondary, 26 years of teaching service,  
 Alfredo Costa, History, Secondary School, 20 years of teaching service  
 Vitor Fernandes, Secondary Geography, 22 years of teaching service  
 Silvina Soares, Secondary English, 31 years of teaching service  
 Olga Carvalho, Secondary Portuguese, 31 years of teaching service  
 Márcia Barbosa, Natural Sciences, Third cycle, 22 years of teaching service

**How many groups/classes are engaged in the pilots** (add as many rows as you need). For each group please fill in the required information

|      | Age range | Number of boys | Number of girls | Total number of students | Period of engagement in pilots (i.e. Oct 2022 - Mar 2023) |
|------|-----------|----------------|-----------------|--------------------------|---|
| 10 C | 15 years  | 6              | 17              | 23                       | October   |
| 11 C | 16 years  | 7              | 5               | 11                       | November  |
| 10 A | 15 years  | 6              | 6               | 12                       | November  |
| 12°C | 17 years  | 7              | 13              | 20                       | January / February  |
| 9ºA  | 14 years  | 18             | 11              | 29                       | March   |
| 9ºB  | 14 years  | 13             | 15              | 28                       | May   |

**Which resources you have developed so far. Please provide a characteristic title and a brief explanation. Finally add a link to the material you developed.**

| Title of resource/material                                    | Brief explanation   | Link   |
|---|---|--|
| <b>Ukraine's Geography and History</b>                        | Support document and introduction to the topic.   | <a href="https://www.publico.pt/2022/03/15/infografia/historia-ucrania-sete-mapas-caminho-ate-soberania-673">https://www.publico.pt/2022/03/15/infografia/historia-ucrania-sete-mapas-caminho-ate-soberania-673</a>  |
| <b>Video of the 1st week synchronous session</b>              | Inform students about the applications they could use, as well as how they should proceed to use them.  | <a href="https://drive.google.com/drive/folders/1KMnyUdDaZookKbj79mD-yG7xsbYv-k4X8?authuser=0">https://drive.google.com/drive/folders/1KMnyUdDaZookKbj79mD-yG7xsbYv-k4X8?authuser=0</a>  |
| <b>Work done during the 1st week</b>                          | Work that the students carried out based on the research carried out, and that will serve as an introduction and motivation for the students who will continue with the project the following week. | <a href="https://docs.google.com/document/d/14q2LiJGBPnSeMWD_AOd3p8l_hFIKy6awnct9IMz_gl3o/edit?usp=drive_web&amp;authuser=0">https://docs.google.com/document/d/14q2LiJGBPnSeMWD_AOd3p8l_hFIKy6awnct9IMz_gl3o/edit?usp=drive_web&amp;authuser=0</a>        |
| <b>Material for the 2nd week's work</b>                       | Powerpoint with information about the objectives of this stage of the project   | <a href="https://drive.google.com/drive/folders/1tOCxtq92ocdAfgnHKI24Vim3s1KLk7hA?authuser=0">https://drive.google.com/drive/folders/1tOCxtq92ocdAfgnHKI24Vim3s1KLk7hA?authuser=0</a>  |
| <b>Video of the synchronous session of the first 2nd week</b> | Video, based on the powerpoint provided by the Economics teacher with information about the objectives of this stage of the project   | <a href="https://drive.google.com/drive/folders/1XjDY2UBmkwKKXkRXVYzWiaQ93Pw-YPBq?authuser=0">https://drive.google.com/drive/folders/1XjDY2UBmkwKKXkRXVYzWiaQ93Pw-YPBq?authuser=0</a>  |
| <b>Work done during the 2nd week</b>                          | Work that the students carried out based on the research carried out, and that will serve as an introduction and motivation for the students who will continue with the project the following week. | <a href="https://www.thinkinglink.com/scene/1319716232345157634">https://www.thinkinglink.com/scene/1319716232345157634</a><br><a href="https://www.thinkinglink.com/scene/1654444570911440897">https://www.thinkinglink.com/scene/1654444570911440897</a> |

**How often do you meet your students (online or in hybrid way)? What have you achieved so far?**

Note: the number may differ from class to class or group to group

|      | <b>Number of sessions during the piloting period</b> (i.e. 5 times approximately once a week, once or twice a week...) | <b>Achievements</b>   |
|------|--|---|
| 10 C | 3 face-to-face sessions<br>Alfredo Costa, Vitor Fernandes  | 1st session - Professor Alfredo showed material related to the History and Geography of Ukraine and the students<br>In the 2nd and 3rd sessions, a task was given, which consisted of collecting online material on the History and Geography of Ukraine and creating a ThingLink with the collected informatio   |
| 11 C | 2 face-to-face sessions<br>Cristina Maia   | 2nd week of the course<br>The 1st session allowed the students to become aware of what their colleagues from 10 C had done: the historical and geographical framework and inform and guide them about the task and objectives that the group had to develop.<br>In the 2nd session (in the same week) they carried out the activities related to the subject of Economics, namely, the concepts related to Inflation, Imports/Exports and Renewable Energies.       |
| 10 A | 2 face-to-face sessions<br>Teacher Cristina Maia   | 2nd week of the course<br>The 1st session (still in the same week) served for students to become aware of what their colleagues from 11 C had done, having them present a class explaining the concepts<br>In the 2nd session (in the same week) they carried out activities related to the discipline of Economics, namely on the impact of the war on Prices, on consumption habits in Portugal, on Portuguese imports and exports and on renewable energies<br>. |
| 12 C | 3 face-to-face sessions<br>Teacher Cristina Aparício   | 3ª semana curso<br>2 sessions to prepare the survey<br>1 session to apply the survey to a sample of   |



|    |  |  |
|----|--|--|
|    |  | 20 students from each school year from the 5th to the 12th grade   |
| 9A | 1 face-to-face session<br>1 online session | 4th week<br>1 online session to explain to the students what they would have to do in the work to be done<br>1 face-to-face session to carry out the count and respective tables of the collected data   |
| 9B | 2 face-to-face session<br>1 online session | 4th week<br>1 online session to explain to the students what they would have to do in the work to be done<br>2 face-to-face sessions to organize the data collected by the 9A colleagues in graphs and carry out the respective analysis and conclusions |

**Can you briefly explain your role during the sessions?**

- Professor Márcia (project coordinator) was with the teachers involved in an online session (10/18/2023) to explain the project to the students.
- Professor Márcia was with the 10 C students (in person) together with the subject teacher (Vitor Fernandes), to show some applications (ThingLink, Frame, Canva, Classroom), and explain how they worked and could be used in the project.
- Professor Márcia was with the 11 C students (in person) together with the discipline teacher (Cristina Maia), to show some applications (ThingLink, Frame, Canva, Classroom), and explain how they worked and could be used in the project.
- She collaborated with professor Sara Cruz from UMinho in organizing spaces on the Classroom platform.

**Did the students implement the STEM project in teams or individually?**

In all classes, students were organized into groups of:  
 10 C - 4 groups of 4 elements, 1 group of 3 elements and 1 group of 3 elements  
 11 C - 2 group of 4 elements, 1 group of 3 elements  
 10 A - 1 group of 4 elements, 1 group of 5 elements and 1 group of 3 elements.  
 12th C- 1 group of 7 elements  
 9ºA- 6 groups of 4 elements and 1 group of 5 elements

9<sup>o</sup>B- 7 groups of 4 elements

Each group was responsible for a subtheme developing a work that will be a contribution to the final work

**Can you describe which tools have been used so far?** Feel free to add as many rows as you need and to delete tables that are not needed.

| <b>Group 1/ Class 1</b> |   |   |   |  |
|-------------------------|---|---|---|--|
|                         | <b>Stage</b><br><i>(introduction, planning, brainstorming, creation, sharing etc)</i> | <b>Tools used</b>   | <b>Photos of the final artefact (you can provide a link to a picture)</b>   |  |
| 10 C / 11 C /12C/9A/9B  | Criation  | ThingLink   |   |  |
|                         | Criation  | Canva   |   |  |
|                         | Sharing   | Classroom<br><br><br><br><br><br><br><br><br><br><br>Frame vr | <a href="https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTU2Nzc0MDU3OTk4">https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTU2Nzc0MDU3OTk4</a><br><br><a href="https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTY4Njk4OTU4ODQz">https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTY4Njk4OTU4ODQz</a><br><br><a href="https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTU2NzczNTY0NTY0">https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTU2NzczNTY0NTY0</a><br><br><a href="https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTU2NzczNDU5MDQ3">https://classroom.google.com/w/NTU1NTc5OTEzMzA3/tc/NTU2NzczNDU5MDQ3</a><br><br><a href="https://framevr.io/erasmus">https://framevr.io/erasmus</a> |  |

**Students' reactions related to the Beready experience** (in case you have observed anything)

The dynamic that was established with the 10th and 11th grade students was very positive, ultimately promoting teamwork and strengthening ties.

The 10th year economics students found it interesting to have their classmates come to their class to explain the concepts of economics, ending up having a class different from the ones they are used to. On the other hand, the 11th grade students, who were initially not very motivated to participate in the project, with its development and the reaction of their 10th grade colleagues, ended up feeling very fulfilled with the work they developed. In addition, the experience allowed the creation of bonds of friendship between the two classes, with the 11th grade currently serving as a focus of reference and exchange of experiences for younger colleagues

**Please refer to the challenges that you have faced so far** during the piloting period.

The fact of deviating from the traditional norm in which each teacher is responsible for his area of knowledge and does not feel the need to articulate and do collaborative work with the other teachers

It turned out very well that the 11th grade students attended the 10th grade classes in Economics, breaking the routine of the more traditional classes and promoting interaction between the two graders. This will be, perhaps, the added value of the project, which allowed for a much closer contact between these students and teamwork.

The students of the 9th grade always presented great difficulties in the discipline of mathematics and therefore little motivation for it. With the work for ERASMUS+ initially, they also weren't very interested in participating in it. However, as the project unfolded, the students gained interest and ended up presenting very interesting works.