

# Young “engineers” try to help IP3 users!

## Abstract

In this activity the students will watch a news video that states that the “**IP3 Users Association asks for works on the slopes**” because this road has several structural and layout problems that have been the cause of many accidents.

Starting on this problem, at a specific point in IP3, students will study the slope of the roadside, the type of soil and possible disasters related to these conditions and also the reactions of different kind of materials with acidic reagents, establishing the relationship with acid rain and non-filtered water.

After this study, students will decide if it will be opportune to build a slope in the studied road point, and its consequences to a sub problem presented by a local industry near this location.

## 1.1 Schedule: 19 February

## 1.2 Curriculum Frame

Student Profile	Main Learnings
<b>Reasoning and problem solving</b> <b>Scientific, technical and technological knowledge</b>	<b>CN</b> <ul style="list-style-type: none"><li>- Discuss options for the conservation of ecosystems and their contribution to human needs, as well as the importance of science and technology in their conservation.</li><li>- Distinguish Natural Disasters and Anthropogenic disasters and identify the causes of the main catastrophes of anthropic origin, valuing knowledge from other disciplines.</li><li>- Discuss measures that reduce the impacts of natural and man-made disasters on ecosystems, in general, and on the ecosystems of the school's surrounding area, in particular.</li></ul>
	<b>MAT</b> <ul style="list-style-type: none"><li>- Use functions to represent and analyse situations, in mathematical and non-mathematical contexts.</li><li>- Represent and interpret graphically a related function and relate the graphical representation to the algebraic and vice versa.</li><li>- Calculate the slope of a non-vertical line using two points.</li></ul>
	<b>FQ</b> <ul style="list-style-type: none"><li>-Research, in an interdisciplinary way, on the hardness of drinking water in the region where you live, as well as the consequences of using hard water at domestic and industrial level and ways to treat them, communicating the conclusions.</li></ul>

## 1.3 Prerequisites

Function concept.

Linear function.

Practice with GeoGebra, Mindomo, Google Earth, Kahoot, Edmodo

## 1.4 Materials

- Student's guide

- personal computers

  - Interact classroom – 7 PC; the desktop PC of the room, with Mindomo installed and a folder with the pictures that are needed for the task

  - Future classroom – 7 PC with the GeoGebra file (it is necessary the GeoGebra link)

- Ribbons / badges for all students;

- Lab material;

- Student's smartphones

## 1.5 Teacher's Guide

In the next section we present the three parts of this lesson.

### 1.5.1 Introduction – 30' Auditorium

Explain the problem situation using a video (in Google drive);

Presentation of the question - problem;

Explanation to students that this activity will take place over three stations. Each group must be there for 30 minutes.

Introduce students to the following group division and distribute the ribbons / badges to their groups.

Distribute the students' guide to everyone.

Inform students that, after going through all the stations, they can take a 30 -minute break and return to the auditorium to carry out the conclusions of the activity.

#### Groups

**-Blue group** – Miguel; Mariana; Ana; Carolina; Raul; José; Camila + **2 students - Turkey**  
**+ 2 Greece + 2 Baião + 1 Croatia**

**- Green group** – Beatriz + Gonçalo + João + Lara Margarida + Simão + Inês + **2 students**  
**Turkey + 2 Greece + 2 Baião + 2 Croatia**

**- Red group** – Rudi; Érica; Bruna; Tiago Lara Beatriz Lara Filipa, Rodrigo + **2 students - Turkey** +  
**1 Greece + 2 Baião + 2 Croatia**

## 1.5.2 Development

The development of this activity will take place over three stations. In each of them, the students will do a differentiated work pretending to solve the problem under study. After 30 minutes of work at one station, students must move to another station:

**1<sup>st</sup>**

**Blue** – Future classroom, **Green** – “Interagir” classroom and **Red** – Chemistry Lab 10;

**2<sup>nd</sup>**

**Green** – Future classroom, **Red** – “Interagir” classroom and **Blue** – Chemistry Lab 10;

**3<sup>rd</sup>**

**Red** – Future classroom, **Blue** – “Interagir” classroom and **Green** – Chemistry Lab 10;

Now, we continue with the guidelines on the work to be developed at each station.

- **A Station – Future classroom (Math) 30’**

Students will be asked to determine the slope at a given location on the side of the road (image 1 - IP3), where there was a collapse and which is next to a factory that intends to use rainwater from the road in its facilities. They will need to remember the images they saw in the video.



**Image 1** – Point of the road near the collapse zone on the road side

Students are asked to think about the importance that the steepness of the slope can have in relation to the danger of collapse of a roadside or cause unevenness of the road and be a danger for drivers.

It is expected that students intuitively confirm that although the type of soil and plant cover is extremely important if the terrain is too steep – if that happens, the probability of a downfall is greater. A correlation will be established.

Ask students if it is possible to draw, for example, a line in the following image and calculate its slope to estimate the slope of the roadside in relation to the road.



**Image 2** – Place near the collapse zone

Explain that it is not possible to calculate the slope in this way and that the use of the image to determine the slope would have to obey certain engineering techniques. However, it is possible to make an estimate if the profile image is available. Check the exercise 1 of the Student's Guide.

Ask students to open the Geogebra file that can be found on their computers.

Ask students to go through all the steps in the guide by themselves - to determine the slope of the line using the two points from the first image; ask them to move one of the points and to calculate the slope again - they must repeat this process and observe that the slope value does not change.

Students must find that the slope of a line, determined by two points, is given by the ratio of the difference between the y's coordinates and the difference of x's coordinates.

Ask students to confirm their assumptions by observing the line equation, provided by the program - GeoGebra - exercise 2 of the student's guide.

Ask students to determine the slope of a line, knowing the coordinates of two points on the line - exercise 3 in the student's guide.

- **B station – “Interagir” Classroom (Science) 30’**

Recall the video about the IP3 overthrow.

Take the example of that catastrophe and give it a more scientific designation: “Landslide”. Make some questions about possible causes of landslides (slope of the terrain, type of rock, chemical, mechanical and biological erosion, absence of vegetation caused by deforestation or fires, torrential rain, removal of land to open new roads, earthquakes ...).

Show images to students in order to conclude that landslides are a kind of “Land Movements”, among others: “Falling blocks” and “Flows of debris”, which occur with some frequency, on Algarve cliffs and Madeira, respectively.

Asking students about whether these geological phenomena are totally natural or whether, eventually, human action potentiates them.

Connect this kind of catastrophe with other related ones: Earthquakes, storms, fires, deforestation - show photographs and related news.

Classify the catastrophes already mentioned, adding with those that are still missing.

Explore the student’s script.

Ask students to open their laptops and start the Mindomo application installed on their desktop.

Ask students to construct a concept map using the terms in the box, in order to obtain a classification of all types of catastrophes.

The concept map should be enriched with images available in a folder, on their desktop.

At the end, discuss the concept map developed by all students.

- **C – Laboratório (FQ) 30’**

Start by presenting the problem (associated with landslides in IP3):

What material would we choose for the construction of a slope (a wall to hold the soil)?

Presents images and videos about the circulation of water in nature, referring to the fact that there is no pure water in nature - it is more or less rich in substances that it dissolves from the medium it passes through.

Explain rainwater acidification (natural and human intervention)

Question:

What does this (acidified) water cause in different materials?

Perform an experimental activity to show what happens to different possible materials for the construction of a slope in contact with acidic water; use a camera so that students can better watch the demonstration of the experimental activity.

Note that water passing through certain materials reacts with them and dissolves certain components in order to refer to the hardness of the water.

Show, experimentally, the difference between hard water and soft water in terms of foaming.

Show images about the effect of hard water on heat exchangers and other materials.

After all the activities, students have a 30' pause, until 11:30.

### 1.5.3. Conclusion – 30' Auditorium

Back to the auditorium, students must have a few time to discuss their solutions for the initial problem. They must have a solution, write their answer and share it using the Google Form, which they have in their tablets, and choose a spokesman to present their solutions.

With the projection of the Google Form report, all students will debate the answers of each group, and choose the better one.

At the end, students should verify their knowledge by answering a Kahoot questionnaire.