From Scratch to Rover

An approach to Robotics and programming in early years

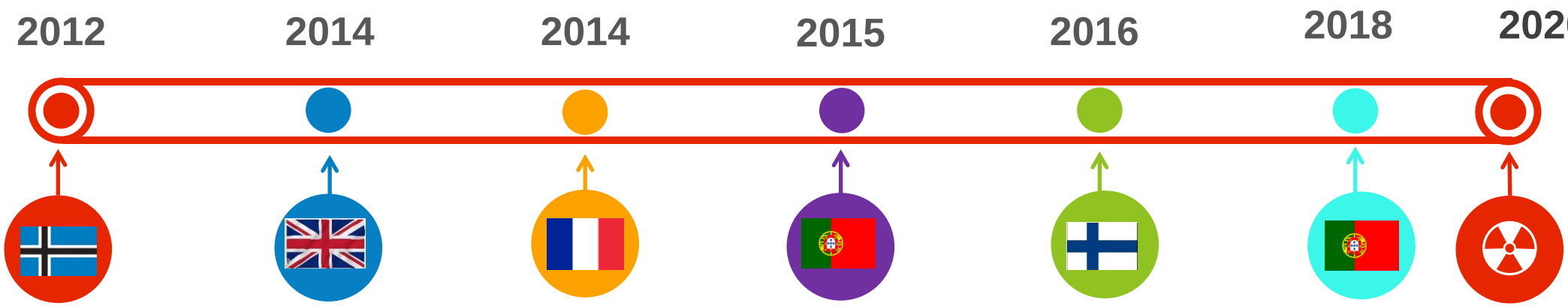
Prof. Luís Jesus e Prof. Sabrina Pereira

Programming and the curriculum

Portuguese Case

Prof. Luís Jesus e Prof. Sabrina Pereira

World Timeline



2012 — Estonia

Introduction of the pilot program for teaching programmation to all students from level 1 to level 12. In optional character, it became available to all public schools in 2013.

2014 — United Kingdom

The public school requires students to learn code from the age of 5 and programming languages from the age of 11.

2014 — France

In primary education, students are given the option of learning the basics of programming and how to create simple applications.

2015 — Portugal

Introduction of the pilot program on key stage (option).

2016 — Finland

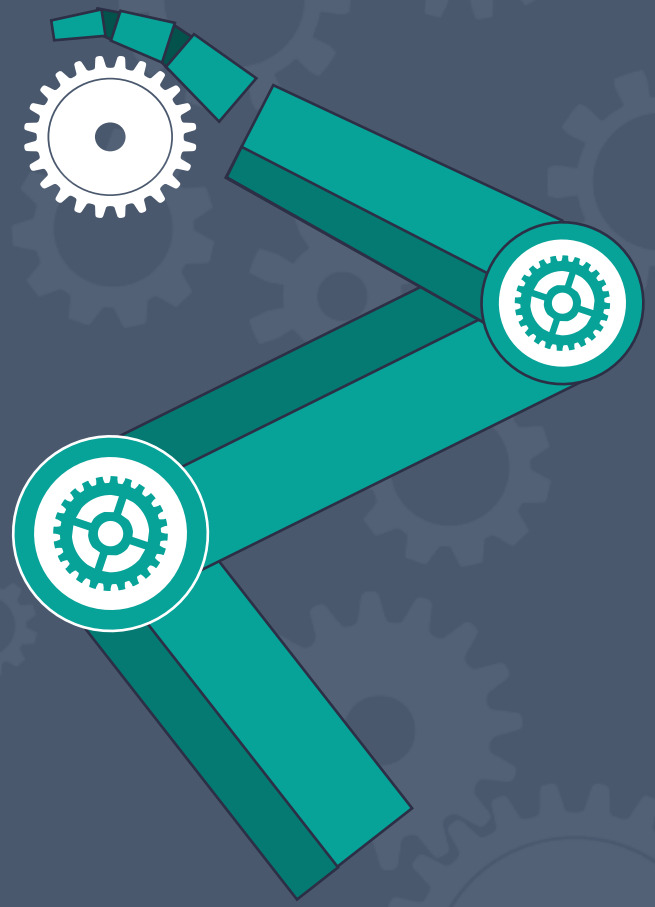
All primary school pupils have to learn programming.
- 1st and 2nd years (basic concepts).
- 3rd to 6th years visual programming.
- 7th to 9th years programming languages.

2018 — Portugal

Implementation of programming and code classes in a compulsory way in basic education.

2020 — European Commission

It wants that 50% of all schools in Europe to join the Digital Education Action Plan by 2020.



Portuguese Timeline

2015 — **Implementation of Pilot Project - Iniciação à Programação**

Robotics took power in Portugal in 2015 with the involvement of more than 70 000 of key stage students.

2018 — **The role of TIC – Program adjustment**

Students should learn notions of code, algrorithm and take programming classes. In the 1º and 2º year of school (option), are energized in the Supplementary Offer, Curriculum Enrichement Activities or School Offer.

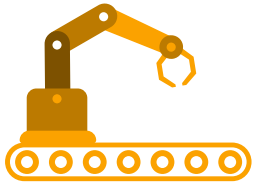
2018 — **Programming and Code mandatory in the 2º e 3º Stage**

The Direção-Geral de Educação (**DGE**) implements (mandatory) the classes of programming and code in the basic education in the school year 2018/2019, within the scope of the Program of Autonomy and Curricular Flexibility (Programa de Autonomia e Flexibilidade Curricular).

2018 — **Teaching with themes focused on future jobs**

The Ministry of Education (**ME**) wants students to acquire the necessary skills to understand, master and create content related to programming, algorithms and information technology.

Theoretical Foundation – Computer science strand



With the introduction of robotics in the Initiation to Programming project in the 1st Cycle of Basic Education, students are expected to be able to:

-Think critically;

- Imagine several solutions to solve the same problem;

-Select and plan the implementation of the chosen solution;

-Build, test results, present them if the solution works or redesign and improve the solution in case of error or need, because if the robot did not perform as expected, the student can adjust it or program it and try again the entire process;

"The integration of robotics (...) makes it possible to approach concepts related to programming and computational thinking tangible, ie out of the space on the computer screen. Learning to create, learn to plan, learn to solve problems, learn to program connecting tangible artefacts, building something with a purpose, also providing articulation with contents of different areas of knowledge, can be implemented using robotics. This option allows a deeper learning of technology, providing moments to "learn by doing" in a tactile way in the relation that the student establishes when relating his ideas with the artifacts, during which the student obtains and visualizes immediate results. "

Taken from “Iniciação à Programação no 1.o Ciclo do Ensino Básico Linhas Orientadoras para a Robótica” - 2 Julho de 2016 – Direção Geral da Educação.

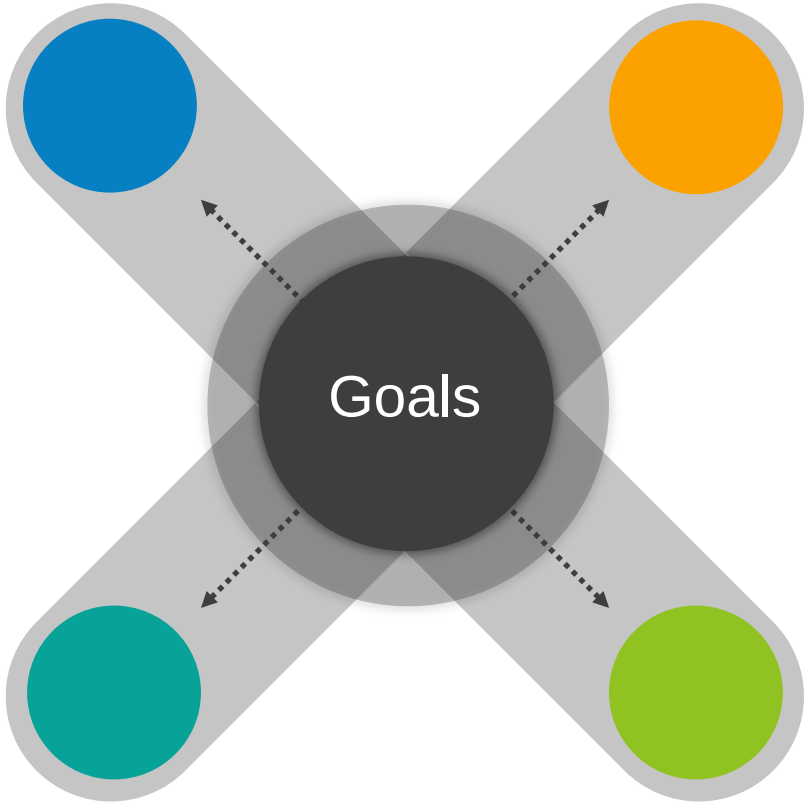
Some specific goals to achieve

Address scientific concepts by linking them with practice

- To explore concepts related to the different areas of knowledge, namely, computer science, (...), mathematics, (...);
- Develop concepts related to proportionality;
- To promote the articulation with contents approached in the curricular areas and in the transversal areas;
- Apply the concepts addressed in concrete and / or contextualized problems.

Provide challenges to develop creativity

- Stimulate creativity in the scope of intersecting knowledge from different areas.



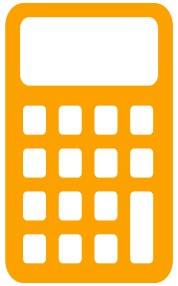
Use problems that foster the development of logical reasoning

- Encourage problem solving strategies based on needs identified in the projects.

Development of values, attitudes and strategies of resilience

- Promote collaborative work and mutual aid;
- Identify and deal with the error / fault;
- Redesign the projects correcting the identified flaws;
- Improve and perfect the work developed.

Theoretical Foundation – Mathematical strand



With the introduction of mathematics in the 1st and 2nd year of the Primary Education, students are expected to be able to:

- Count up to 100 (1st year) and up to 1000 (2nd year);
- Carry out progressive and regressive counts (...) and record the number sequences obtained;
- Design and implement strategies in problem solving (...) and evaluate the plausibility of results;
- Develop interest in Mathematics and to value its role in the development of other sciences and domains of human and social activity;
- Identify, interpret and describe spatial relationships, being situated in space in relation to others and to objects. (...)

"By using varied settings and contexts, including the use of diversified materials and technology, students must solve tasks that require problem solving, reasoning and communication, so that they are able to: (...).

- Learning conditions must be created so that students, in individual and group experiences, have the opportunity to:

- Exploring, analyzing and interpreting situations of varied contexts that favor and support a meaningful mathematical learning (of concepts, properties, operations and mathematical procedures).

- Perform tasks of a diversified nature (projects, explorations, investigations, problem solving and other learning tasks) "(…)

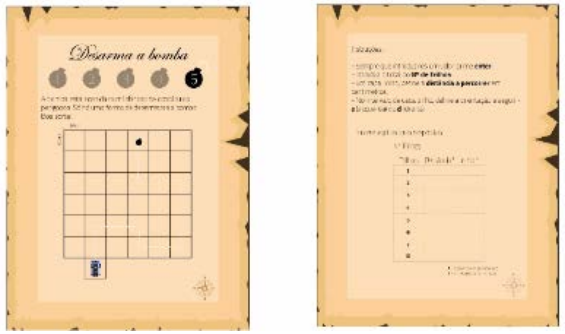
Taken from “Aprendizagens essenciais | articulação com o perfil dos alunos” – 1º ano | 1º Ciclo do Ensino Básico – Matemática. (ME)

The ideia was born…

In this video, we will approach the whole process that led to the realization of this project, from the initial proposal, adaptation to the reality chosen and all the challenges that came up along the way.

Problem Solving

Map



Cards

TI-Innovator Rover

Obstacles/Travel aids

PROBLEM SITUATION

Can you program the Rover so you can find the way to disarm the bomb?

GOALS

Identify the path provided and translate it into rails, distances and direction changes (left / right) and disarm the BOMB.

MATERIALS

- Map / Obstacles / travel aids
- Cards with different routes
- TI Innovator Rover e TI-Nspire CX

Exploring the Activity

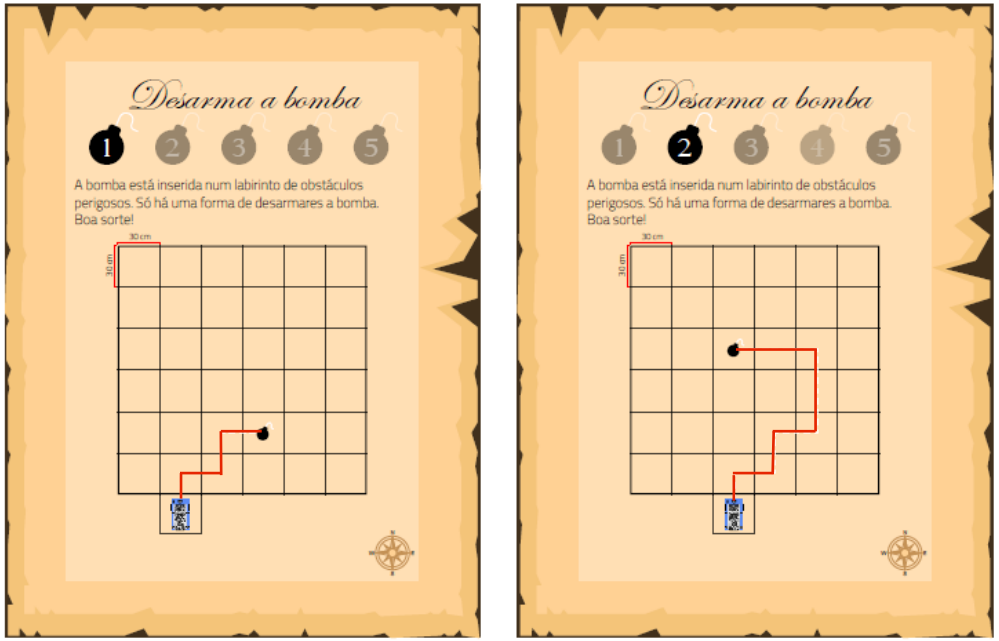
Each group of students will be provided:

A card with a path leading to the pump.

Card characteristics:

The card contains a map that is a scale r epresentation of the map that lies on the ground.

The map is divided into 30 cm square plo ts, which will assist the students in perfor ming the calculations of the determinatio n of the distance of each rail.



The winning team succeeds if it:

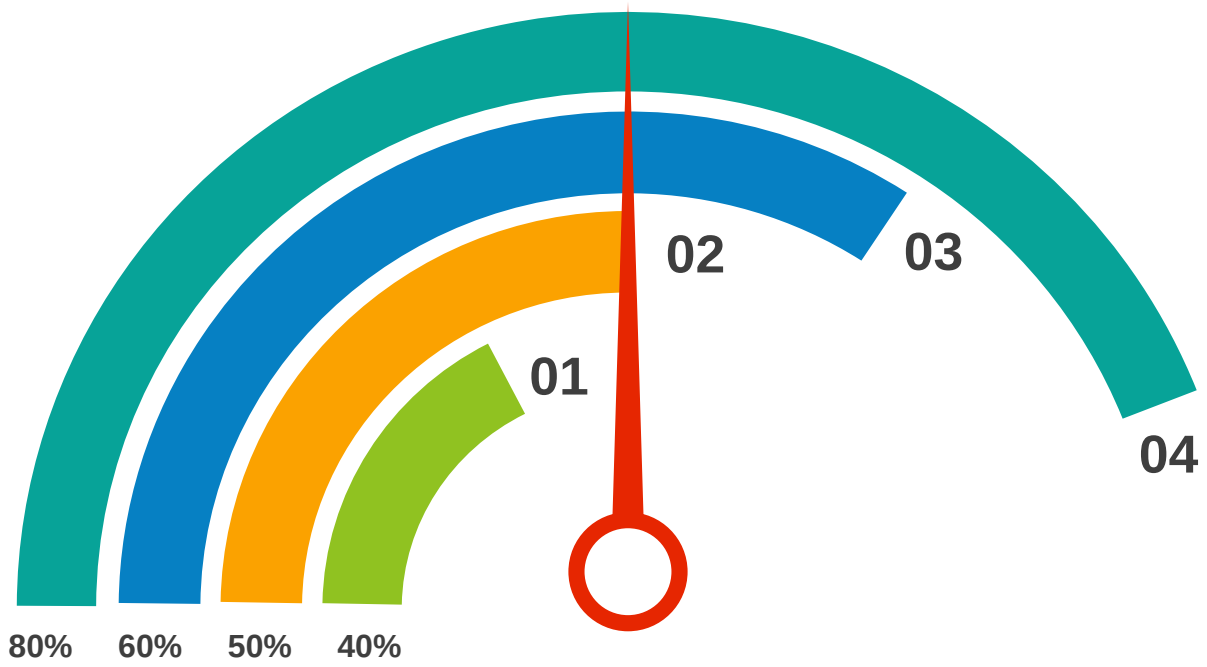
- Identifies the number of rails;
- Calculate the distance of each rail;
- Identifies the change of direction ass ociated with the rail (left or right);
- Place this information correctly in the Rover, so that, when started, it travels the previously defined path and reache s the pump, disarming it.

TI-Nspire Code


```
Define desarmarbomba()=
Prgm
:Local segmentos
:Local ms
:Local angles
:Local turns
:Local cm
:Local direction
:Local degrees
:Local pop
:Local switch
:ms:={}
:turns:={}
:Request "Quantos trilhos?",segmentos
:For z,1,segmentos
:Disp "Trilho",z
:If z=segmentos Then
:Request "Distância (cm): ",cm
:DelVar cm
:((cm)/(100))→ms[z]
:Else
:Request "Distância (cm): ",cm
:RequestStr "Esquerda or direita (e/d): ",direction
:((cm)/(100))→ms[z]
:direction→turns[z]
:If direction="e" Then
:0→turns[z]
:EndIf
:If direction="d" Then
:1→turns[z]
```


```
:  DelVar direction
:EndIf
:EndFor
:Text "Prima Enter para Iniciar"
:Send "CONNECT RV"
:Wait 0.1
:0→pop
:Send "READ RV SWITCH"
:Get switch
:If switch=0 Then
:Text "Ligue o Rover!"
:1→pop
:EndIf
:While switch=0
:Send "READ RV SWITCH"
:Get switch
:EndWhile
:If pop=1 Then
:Text "Prima Enter para Iniciar"
:EndIf
:For x,1,segmentos
:If x=segmentos Then
:Send "RV FORWARD eval(ms[x]) M"
:Else
:Send "RV FORWARD eval(ms[x]) M"
:If turns[x]=0 Then
:Send "RV LEFT"
:Else
:Send "RV RIGHT"
:EndIf
:EndIf
:EndFor
:EndPrgm
```

Implementation Fases



01 **Fase 1**
Feasibility test of materials chosen by teachers.

02 **Fase 2**
Rover program viability test with the device installed.

03 **Fase 3**
Test of procedure by the students, with elaboration of map in the Whiteboard and resolution of the problem without apparatus.

04 **Fase 4**
Presentation to the students of the procedure for entering the calculated data in the Rover.

Execution!

- [x] Materials Producing.
- [x] Scenery Assembly.
- [x] The students perform the activity.
- [x] Students Review.

Final Considerations

Rationale of mathematical concepts

Previously acquired mathematical knowledge was established.

Learning human skills

Collaborative work and self-help were promoted. They trained how to identify and deal with the error / failure.

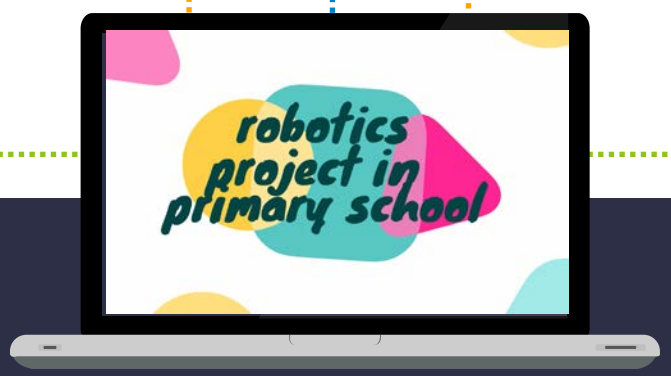
Acquiring logical thinking

The logic was developed with the use of robots and in the applications to control the mechanisms.

Primary school adaptation

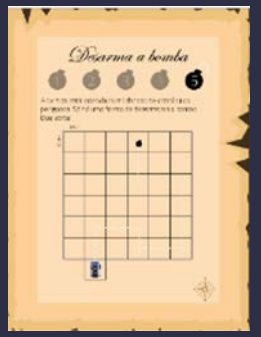
The use of Rover's capabilities is possible for primary school.

Rationale of mathematical concepts



Laerning by doing

A "hand in hand" approach was used to develop the skills needed today.



Thank You!

For any questions, please contact
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