Robots
in French STEAM education

Expert meeting
Lyon 13-14 janvier 2020
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No specific place for robotics in the digital policy for education in France

- Digital Plan for Education from 2015 to 2017
  - Focused on standard equipment (digital tablets & PCs) and content resources
  - Still a high degree of territorial inequalities regarding the development of digital technology in French schools.

- No national education policy integrating neither robotics nor STEAM education at the moment in France
  - But a range of local authorities are involved into robotic challenges / contests (equipment & organisation) or make financial efforts to facilitate scientific & artistic experimentation

- There is an institutional support towards educational robotics but no specific development policy, ie no action plan and no specific funding for use of robots at school.

STEAM and interdisciplinarity in the French curriculum

- French curriculum split into two main strands
  - Competencies with "the common core of knowledge and skills": 5 main domains
  - Field of knowledge to be taught, like Maths, French...
- Organisation not supporting interdisciplinarity
  - Competencies of the 21th century ask for an integrated view which is still difficult, the interdisciplinary approach is not durable in the French practices
  - Suppression of interdisciplinary activities that were included into student agenda (2019 high school reform)
- STEAM approach is not strongly structuring the curriculum
  - But it is supported by research and school projects, by Maths competencies: modelling, problem solving...

# Digital technologies and robots in the French curriculum

- 2019 Focus on digital competencies
  - A new field of knowledge in high school: Digital Sciences and Technology, taught by Math teachers and possibly integrated into other classes like literature or art
  - A National Framework for Digital Competencies (age 6 to 16): almost no reference to robots
- Robots have a high potential for interdisciplinarity and STEAM
  - robots in technology classes, sometimes in Maths, in relation with programming in Maths, or Techno or SNT classes
  - but no robots in the Villani-Torossian Plan for Maths
- Nevertheless, a lot of actions are developing on the field!
  - Robots challenges & contests are motivating and popular, they develop in many academies, Robocup 2020 in Bordeaux

Rationale for using robots in French school

For developing cooperation, creativity, problem solving... the competencies of 21th century

- Primary school
  - Introduction to the digital world and to coding activities
    - playful activities
  - Tangible dimension of robots, manipulation and limitation of screens in digital activities
- Middle and high school
  - To learn maths, computer sciences, coding
  - Possibly in relation with knowledge of other domains

Who drives & who funds educational robotics in France ?
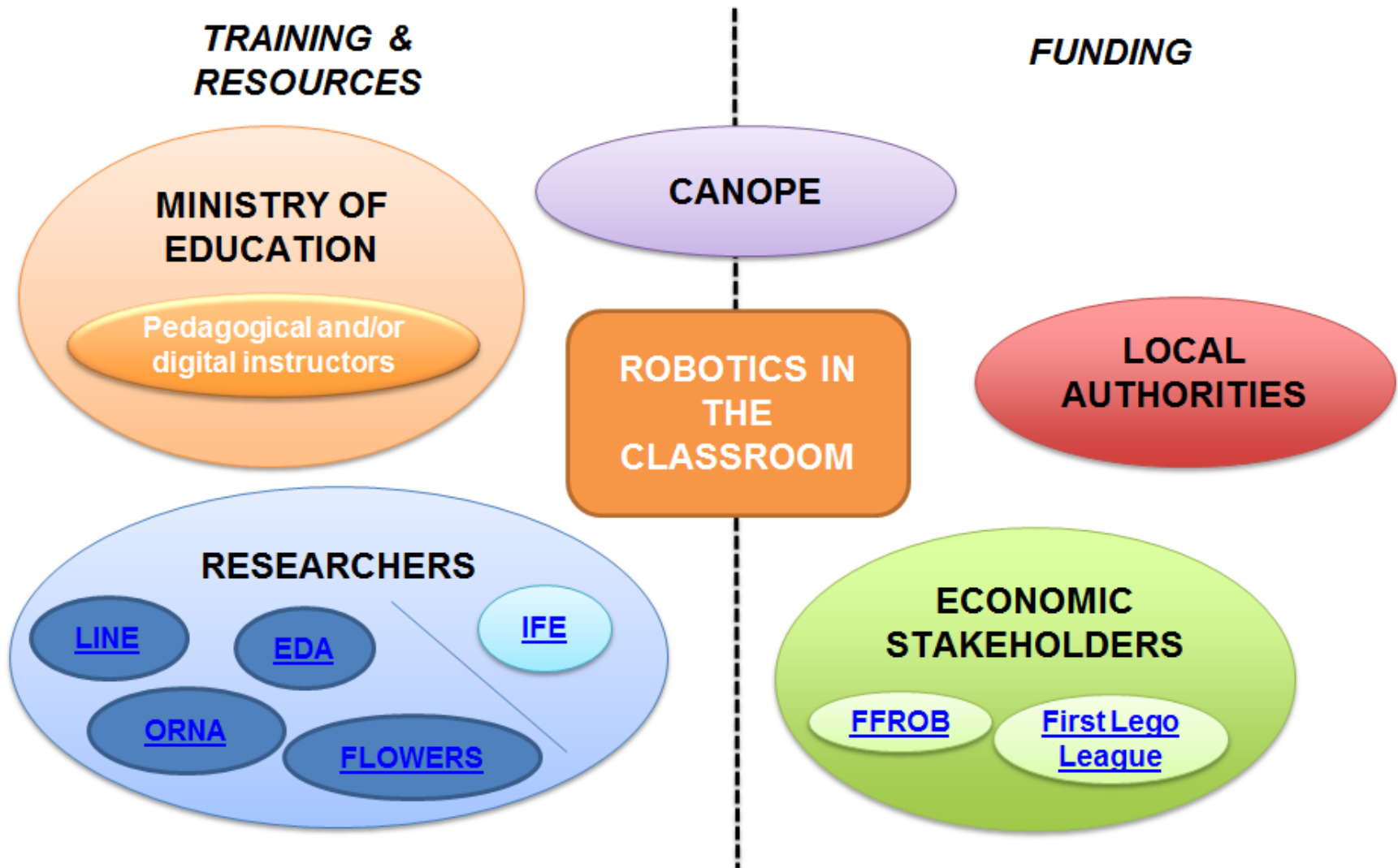
Some relevant examples of french educational robotic project integrating both field practices & research…
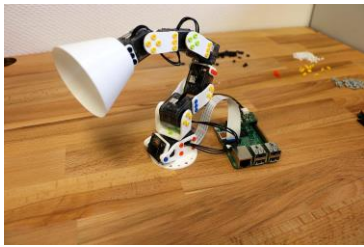
1. [Poppy education](#)

- Poppy education : "Robots are powerful tools to learn et to be creative"
  - derived from Poppy project
  - in answer to teachers & education stakeholders expectations & needs

- Collaborative works between 2014 & 2017 gathering several hundreds of researchers, teachers, trainers, makers, artists… from all over France and even french speaking countries

- Production & testing in an iterative way of :
  - Open source robotic kits (hardware) to buy or to print (3D)
  - Software developments & improvements
  - Pedagogical activities & resources (scenarios, guidelines, memos…).

2. OCINAEE project & LéA CiMéLyon
A robot as a tangible and digital connected object to learn mathematics

Different roles for the robot in games to learn primary school mathematics

A pawn on the board

To indicate progress of the game and which player is in a winning position

A provider of feedback

A mobile object, whose position or trajectory is a possible metaphor of mathematical concepts: blinking eyes and victory dance

A companion

A guide who provides instructions, advices and encouragements
A mascot for motivation

The stake of the game

Controlling the behavior of the robot can be the aim of the game

# Tangible and digital, set of questions and results

- **About design**
  - How to choose between tangible or digital interface for a possible action of the user on the system and for feedback: either though cards and a tangible phenomena like a robot move, or on a tablet or smartphone screen?
  - Design choices, like information and objects distribution, foster collaboration among students

- **About learning**
  - Students develop different solving strategies and thus different conceptions when interacting with the tangible or with the digital devices.
  - Students have difficulties to interpret mathematically the tangible feedback produced by a robot moves (Mandin *et al.* 2017).
  - How students' writings evolve towards mathematical symbolic expressions?

- **About teaching**
  - Necessity collective discussions after use to obtain learning
  - Can teachers use these games to teach curriculum mathematics, like place value system? Yes, example of Chiffroscope for place value (Croquelois *et al.* to be published)
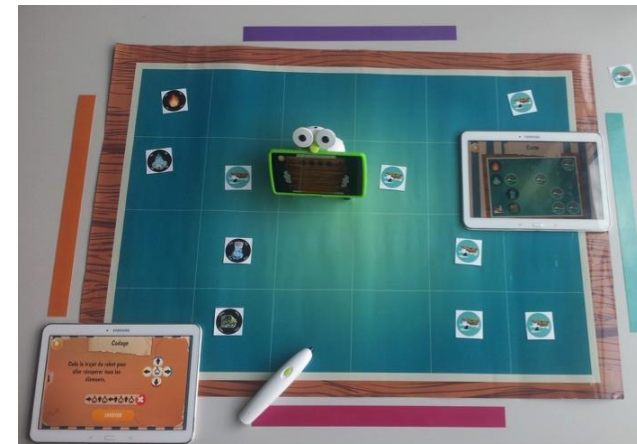
Programmation du Robot à l'Ecole Primaire

Robot Programming at School

2018-2021

3. PREP Project

Rawad Chaker

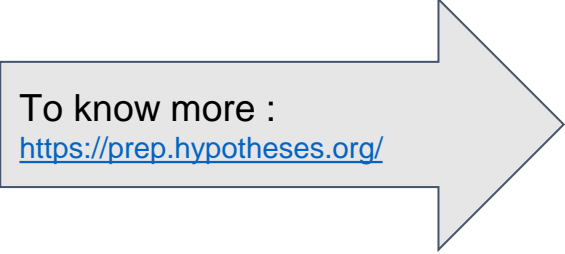Laboratoire ECP

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La Région
Auvergne-Rhône-Alpes

PREP Project

- Financed by Auvergne-Rhône-Alpes Regional council (50k €)

- +1000 children and +40 teachers involved ; 8 elementary schools (Lyon and Villeurbanne)

- Strong involvement of local institutions (Villeurbanne municipality, Rectorat)

- Aims at:
    - Development of coding skills for school children (6-10 years old)
    - Computational tinking
    - STEAM
    - Teachers training
    - Development of a "Learning territory" (to the benefit of Villeurbanne's poor areas).

Main results (as to january 2020)

- Computational thinking (standardized test)
  - Boys = Girls
  - High SES* > low SES
  - French language skills correlated with computational thinking
  - Girls performances in Maths and French are less influenced by SES background
  - Boys performances are more sensitive to SES background
  - High SES students : better self-assessment of computational thinking test results
  - Low SES students : overassessment of computational thinking test results

- A very large success :
  - 3 schools and 20 teachers in september 2018
  - 7 schools and +40 september 2019
  - All volunteers

To know more :
https://prep.hypotheses.org/

La Région Auvergne-Rhône-Alpes

* socio-economic status

4. [#CréaMaker](#) / Margarida Romero

- From "traditional" pedagogical robotics to techno-creative activities
  - Evolution from "teaching with robots"
  - to using robots as a mean to develop creativity, problem solving & computational thinking.

- #CreMaker research project ⇒ how do "makers" project combine DIY practices, coding & educational robotics in order to engage trainees into a both an individual and collective creative process.

Consequences

- Evolution of the pedagogical space and the classroom spatial organisation

- Evolution of teachers' attitude: coach and project supervisor instead of knowledge provider

- Issues about teachers' professional development and teachers' support:

  - robots are not replacing teachers in pedagogical activities, but teachers are looking for students autonomy, teachers looking for a new posture