The case of the Robotics Academy @ Frederick University: 21st Century Skills Developed through a Non-formal Educational Setting

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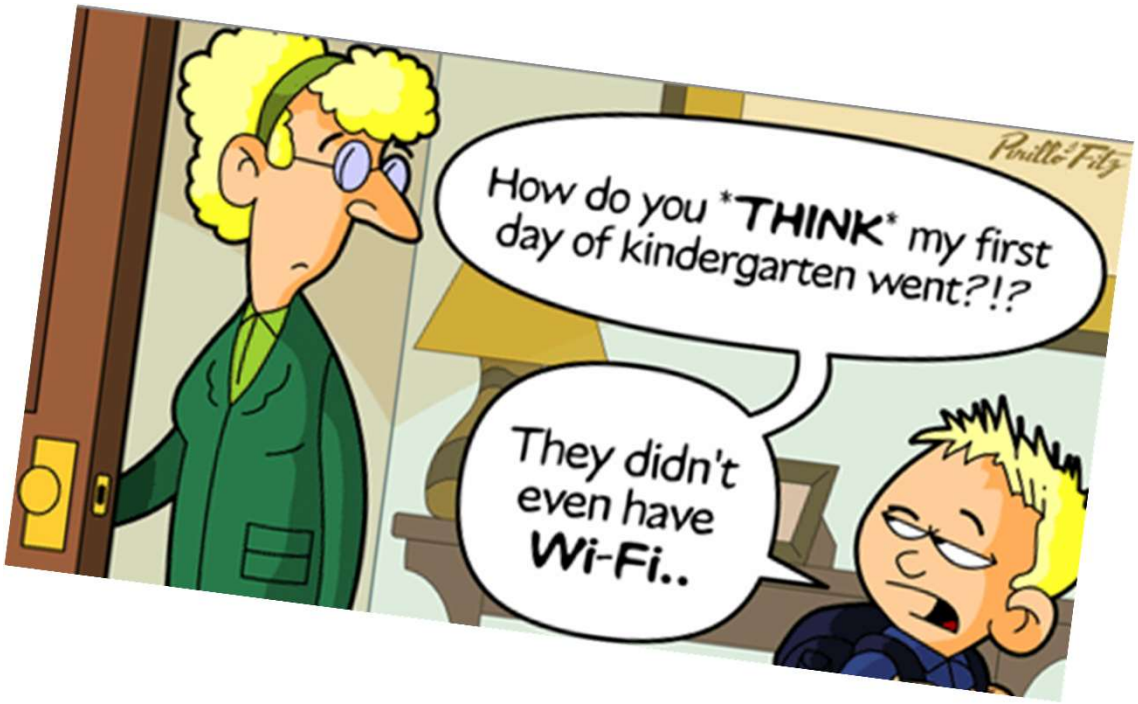
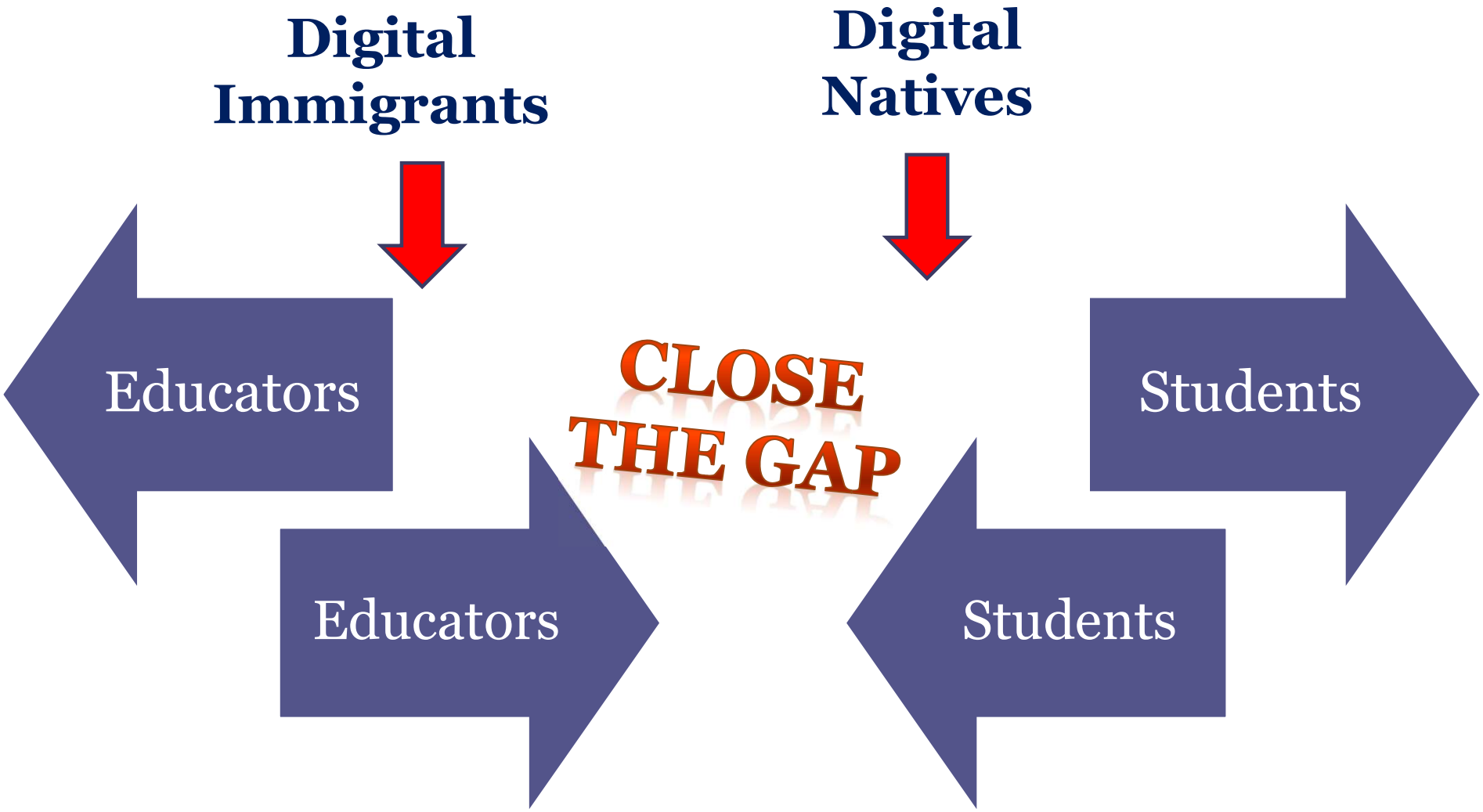
Watch the video!


Geez Grandma! It's not that hard! Go into Settings... select wi-fi... Select it! Tap it with your finger... OMG any finger!! Grrrrrrr


How do you *THINK* my first day of kindergarten went?!?
They didn't even have Wi-Fi..

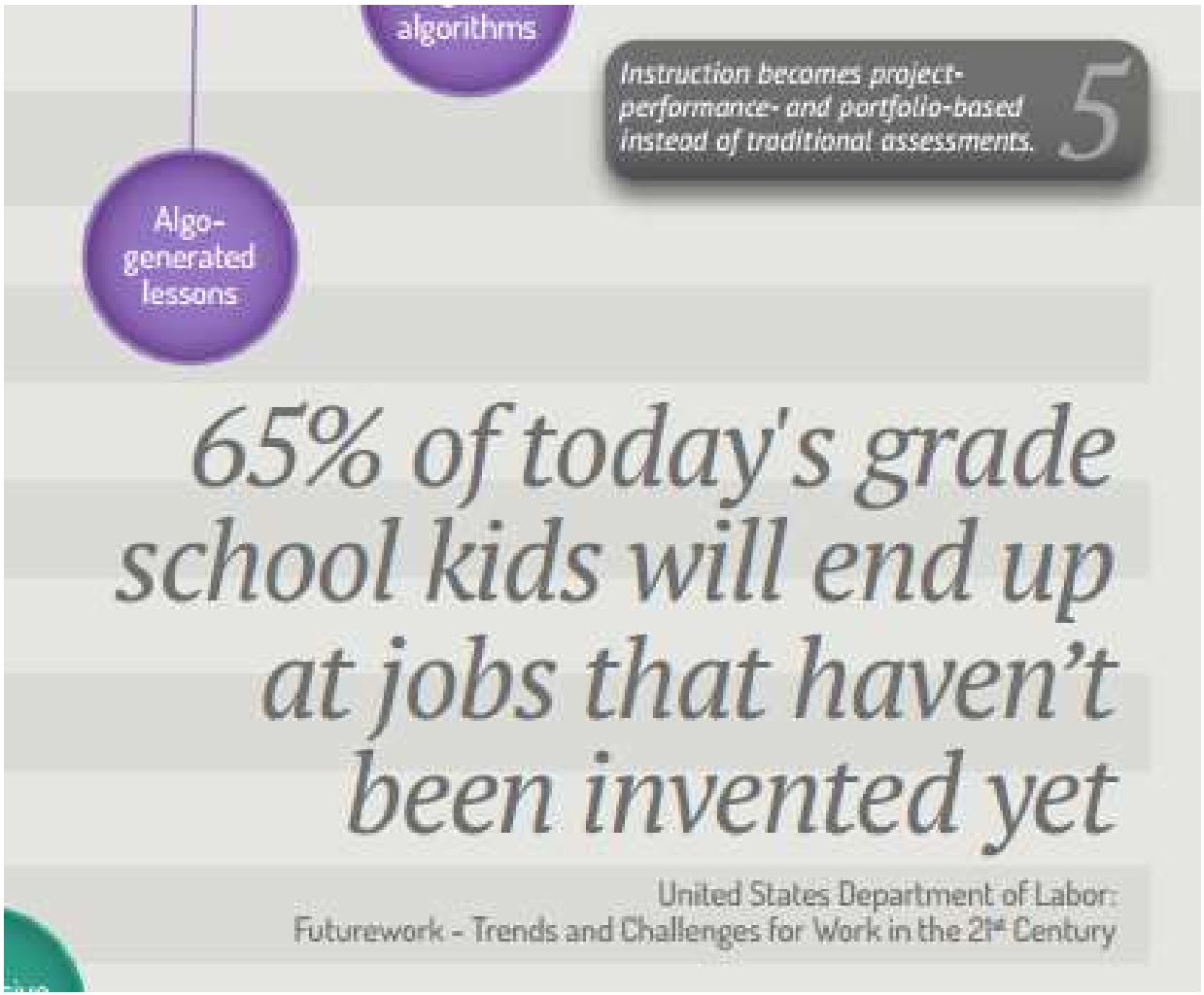
Children 2-5 years old:
the most rapidly developing age group that uses the Internet

Digital Natives



Being part of our students' digital world, it might be more possible to raise their interest, motivate them, transform the classroom environment, and properly prepare them for the society needs and demands.

Future Professions (I)



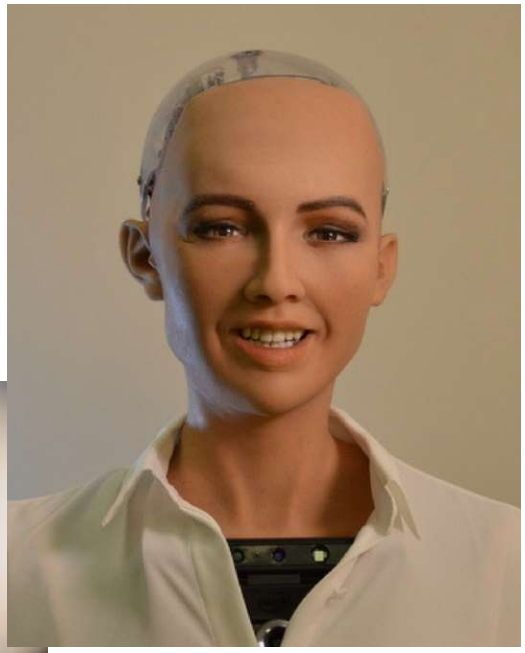
Future Professions (II)

- Productivity Counselor
- Personal Digital Curator
- Microbial Balancer
- Corporate Disorganizer
- Curiosity Tutor
- Alternative Currency Speculator
- Digital Death Manager
- Digital Detox Therapist
- Drone Driver
- Garbage Miner
- Weather Counselor

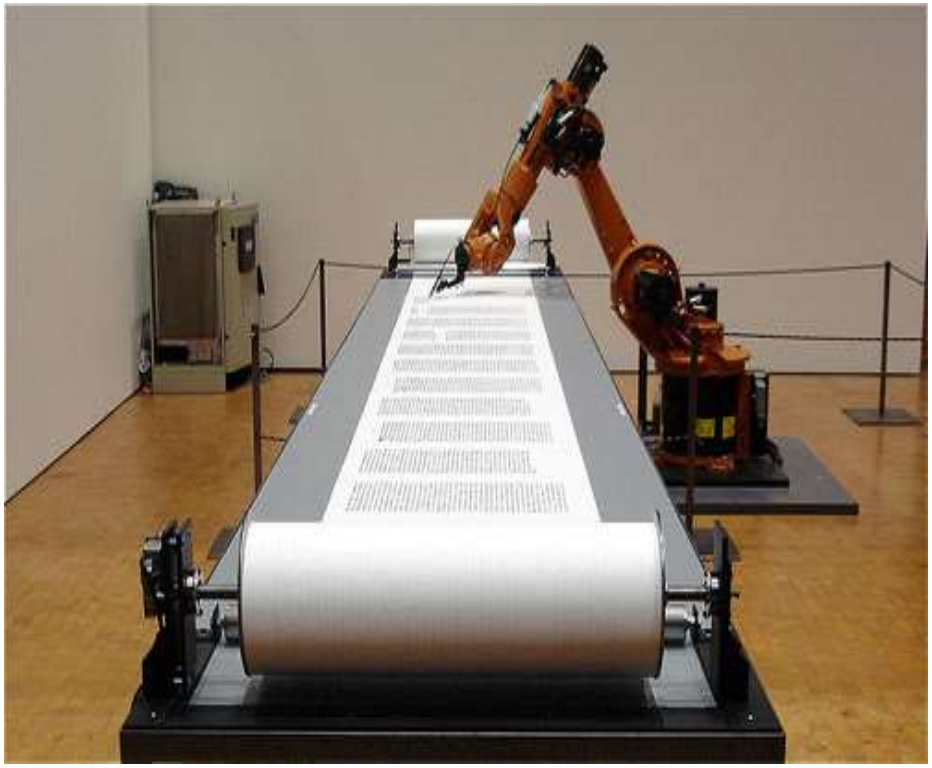
- Is that the future?

[Video 1: Sophia the robot with one of her creators]

[Video 2: Sophia, giving an interview]



Robotics in our daily life activities




MOTOMAN
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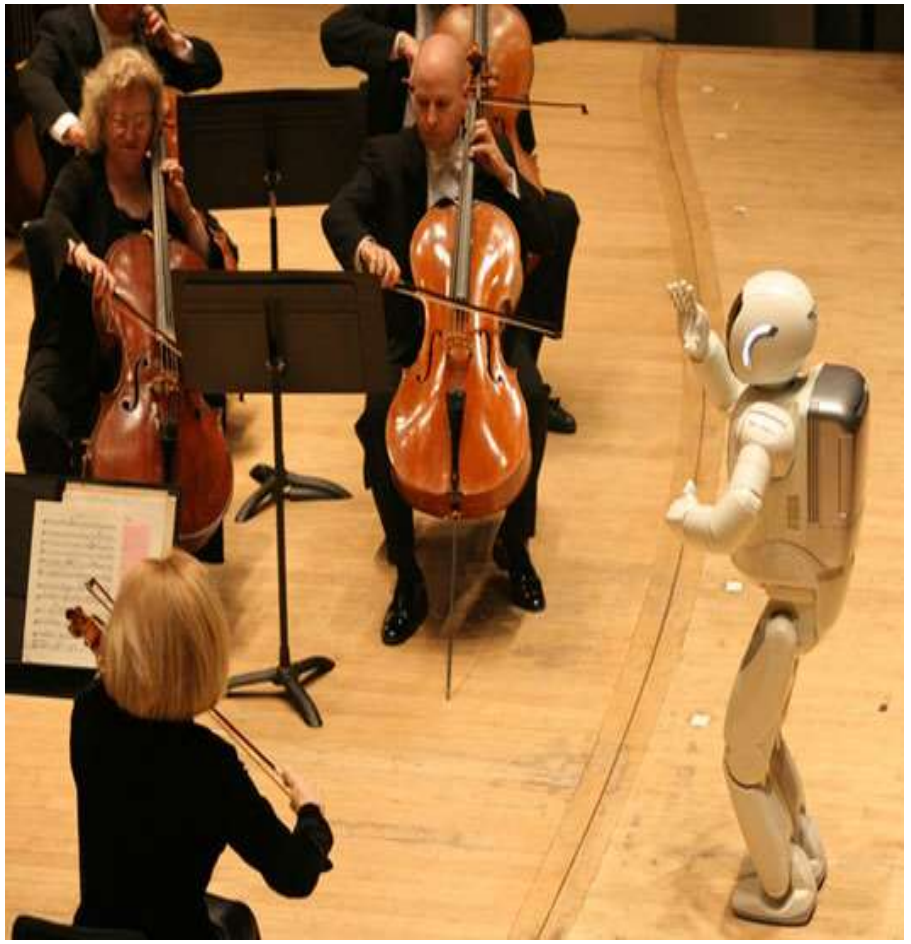

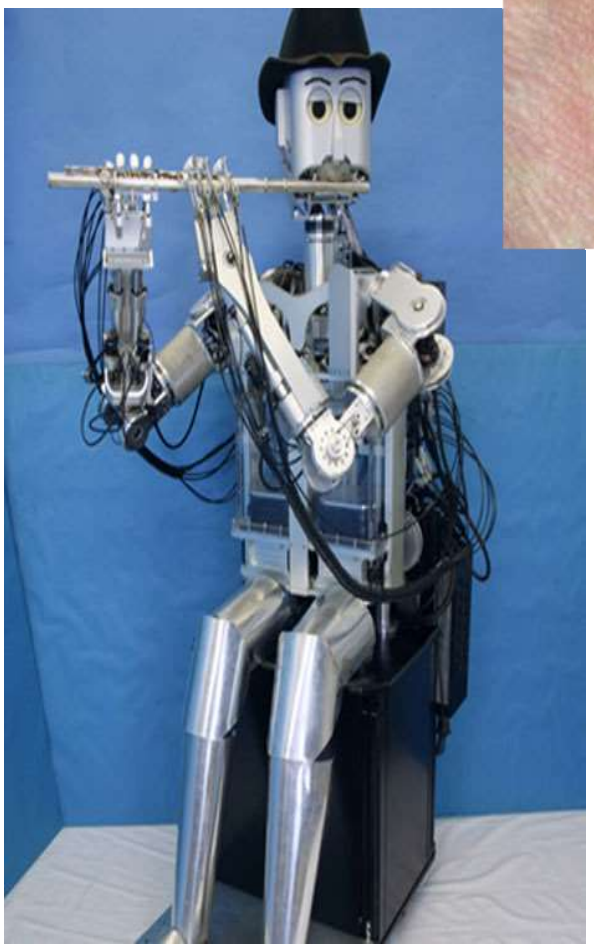

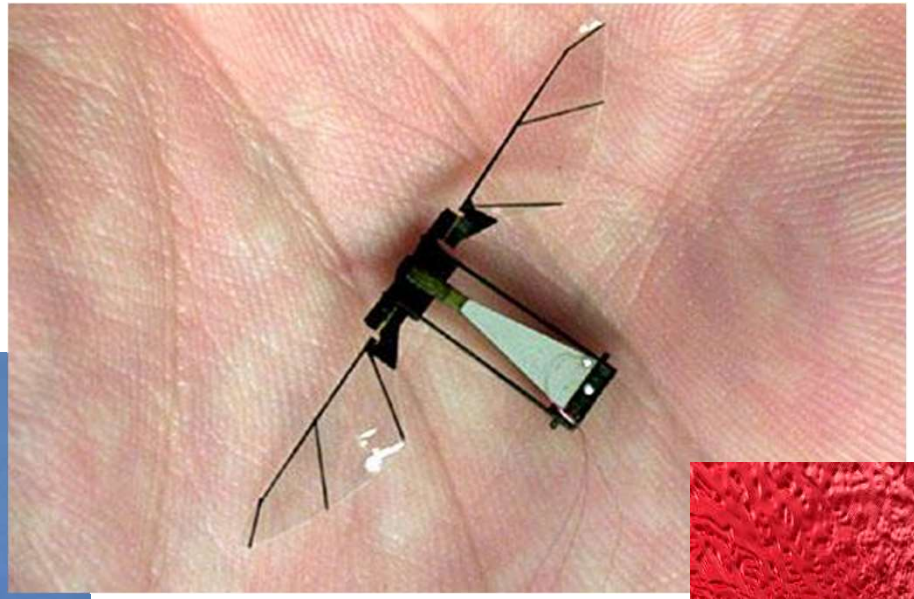

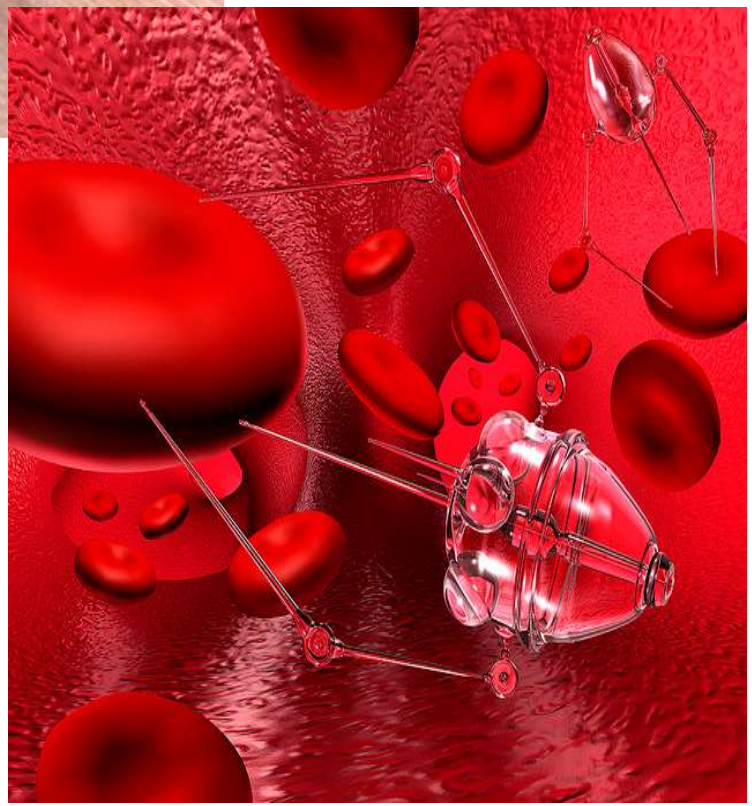

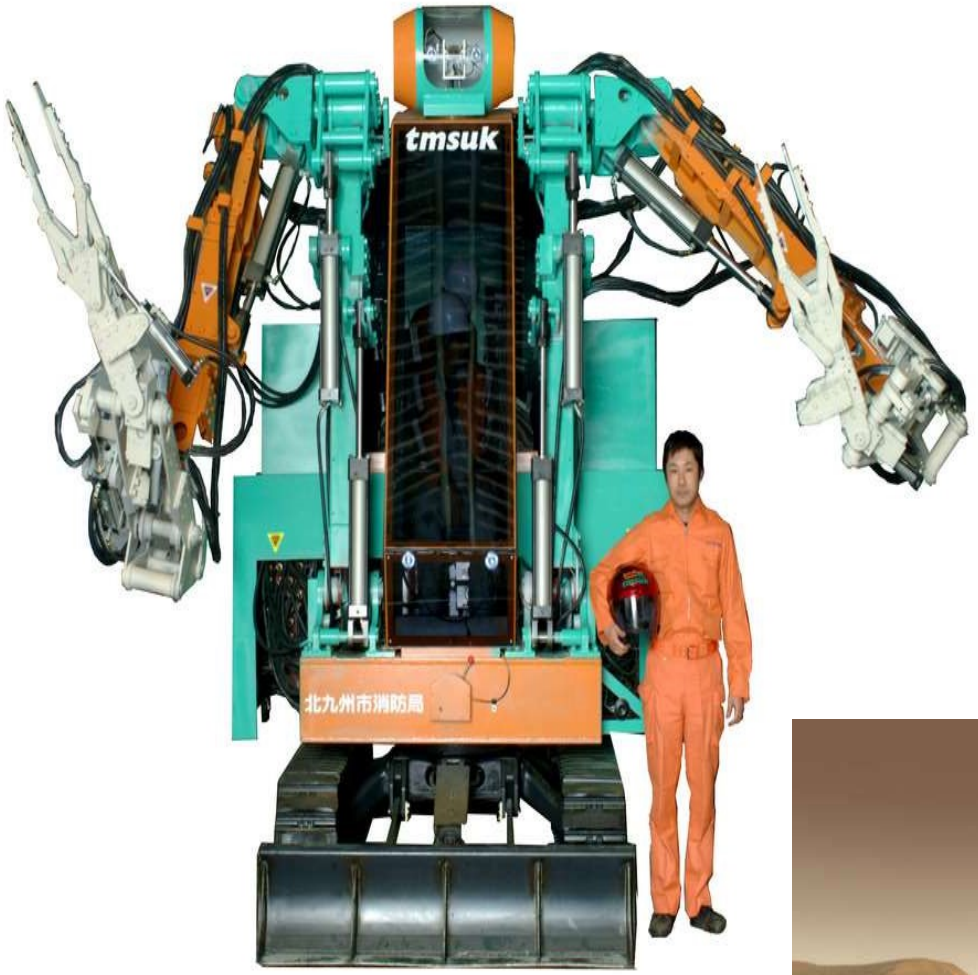
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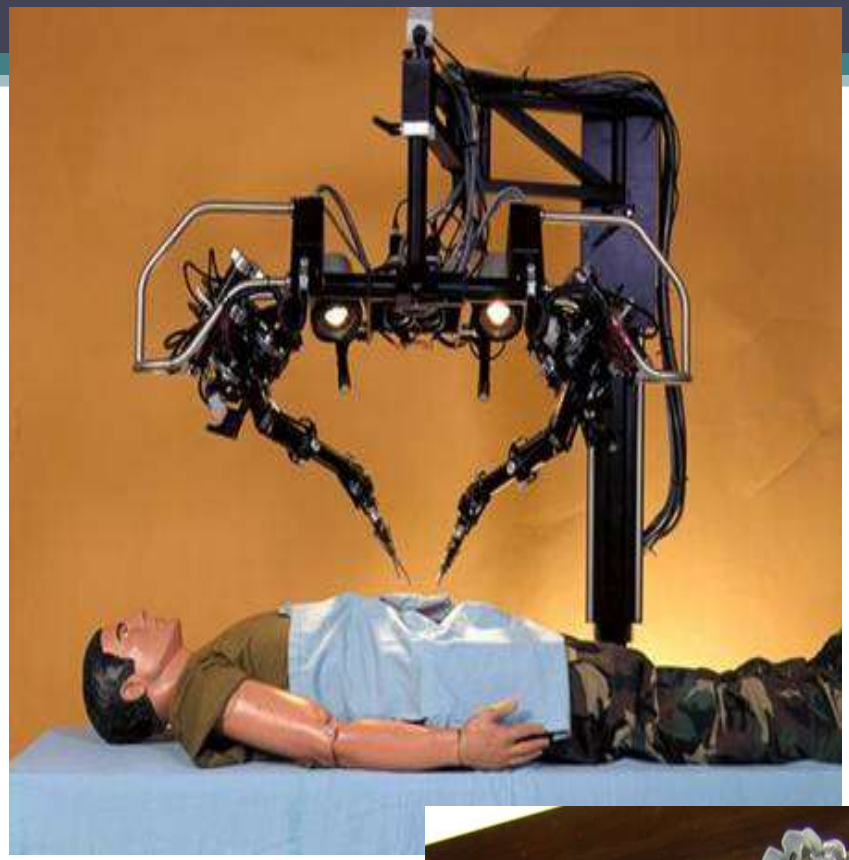
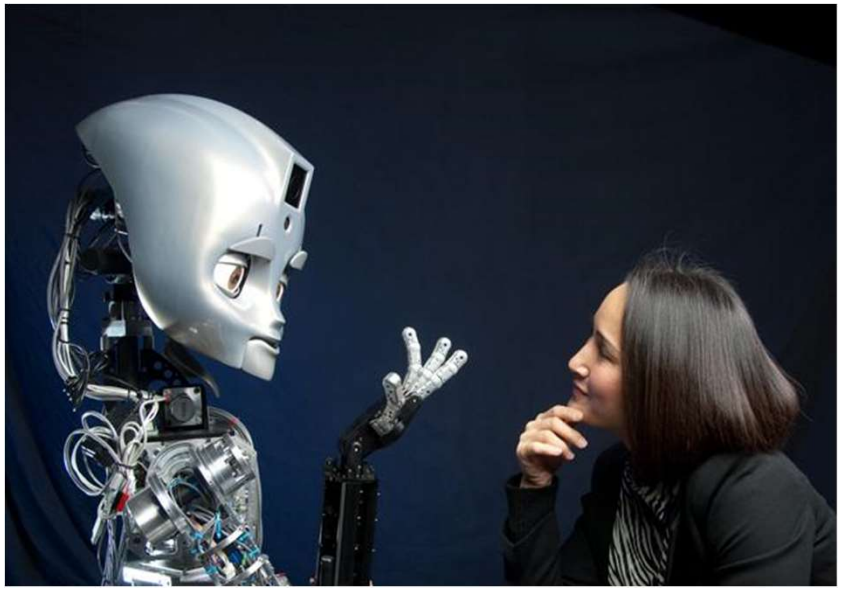
北九州市消防局

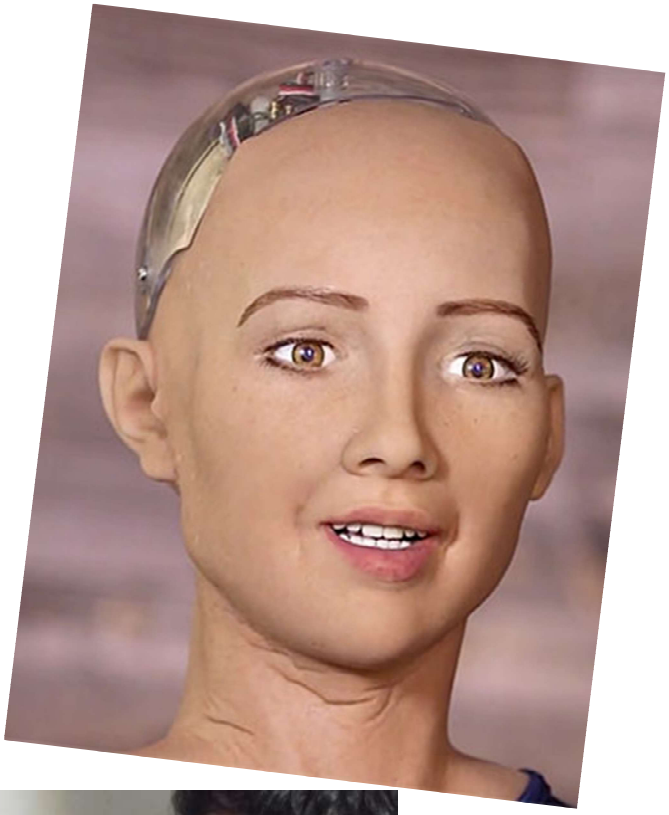

Emirates

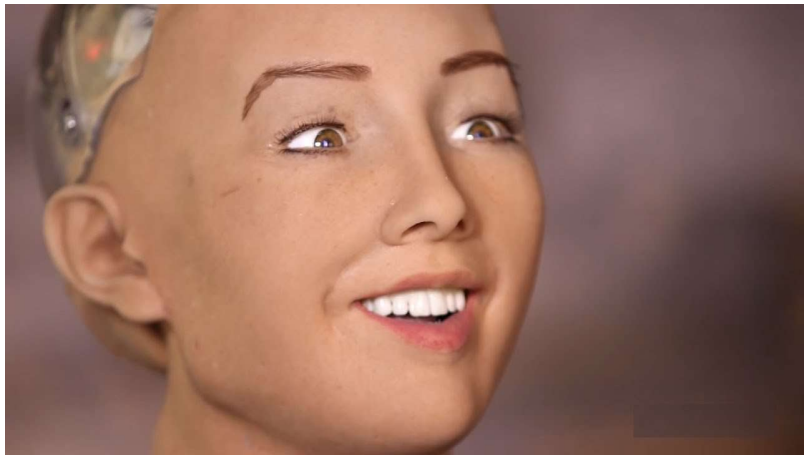

NASA
GM

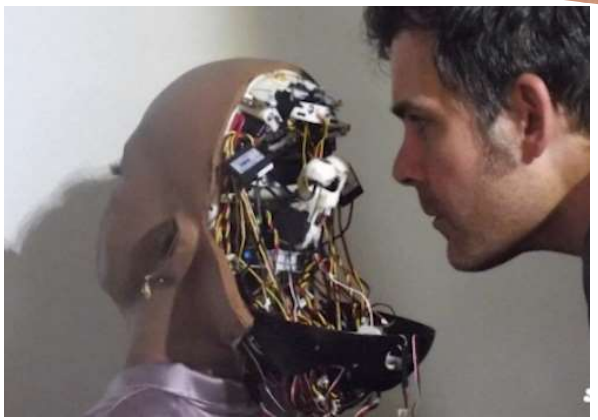

Canada











21st century skills

- The 21st century skills have been outlined and described by various researchers and reports *(e.g. Bybee & Fuchs, 2006; Ananiadou & Claro, 2009; Trilling & Fadel, 2009; Mojika, 2010; Rotherham & Willingham, 2010; Griffin & Care, 2015)*
  - Communication, collaboration, critical thinking, problem solving, knowledge construction, creativity, innovation, self-directed learning, global citizenship and digital literacy.

- The **workforce** needs have changed, the **job tasks** and **type of work** are changing and consequently the required skills are changing.

- Students - as the future citizens of the Information Society need to be equipped with various 21st century skills.

- It is our duty to provide youth with those opportunities and experiences that will adequately prepare them to successfully survive in this competitive, ever-changing Hi-Tech, globalized, and rapid-changing society AND become culturally responsible, active, and competent leaders for themselves, and their communities.

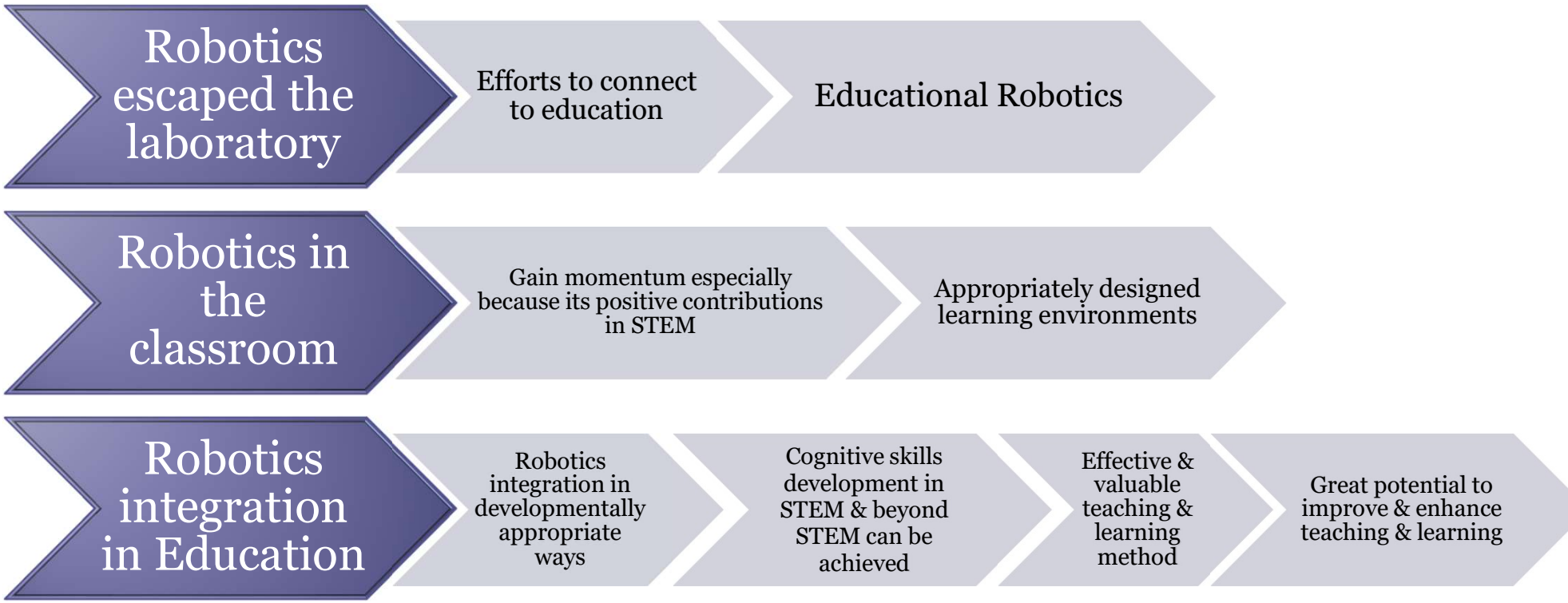
- "Information society"
  - New forms of work, communication and economic growth have emerged
- ICT is an important aspect of employability

- Technology plays a crucial role in assimilation of these skills.
- **Robotics** provide challenges and opportunities to the learners to develop **innovative ideas**, disruptive thinking and higher order learning skills.

- **What is the context, the environment and the tools through which these skills can be developed?**
- **How technology can contribute to the development of students' creativity skills that are considered important characteristics for today's globalized, interconnected world?**

- ***The Educational Robotics Curriculum developed by the Robotics Academy aims to embrace all the above under its innovative umbrella.***

Robotics in Education



ROBOTICS INTEGRATION IN EDUCATION – 2 PHILOSOPHIES

Robotics as a subject matter	Robotics as cognitive – learning tool
To learn ***about*** Robotics	To learn ***with*** Robotics
Learn how to use robotics package & programming software	Within a specific educational context to achieve learning objectives
As an autonomous entity	Deliver & teach concepts within various subject matters
Limited educational potential & value	Selected teaching cases, exploits its full potential, upgrades & enhances the teaching & learning process and promotes school transformation

Robotics integration in the teaching and learning practice is defined as the use of robotics **by students** as a tool that enhances their learning experience and supports the achievement of **specific cognitive learning goals**

ROBOTICS INTEGRATION AS COGNITIVE-LEARNING TOOL

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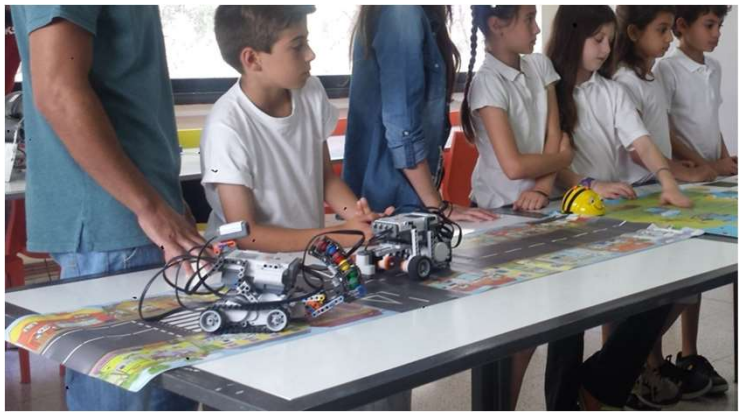
Learning ***with*** Robotics

Constructivism, Constructionism, Learning by doing, *"Learning by constructing", Interactive thinking objects*

Development of higher order thinking skills

Development of 21st century skills

Educational Robotics Curriculum



Up today experience…

Robotics Academy – Frederick University: “a Journey of Knowledge, Innovation and Creativity “

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Robotics Academy- Frederick University (I)

The Robotics Academy was established in order to **promote robotics to the educational system and society.**

Educational and Research Unit

Promotes and conduct research in the area of robotics but primarily in the area of robotics education.

- It researches how to best integrate robotics in the educational system as:
  - a subject-matter,
  - a cognitive-learning tool within the teaching and learning process.

  - Research also focusses on…but not limited to:
    - Design learning environments, educational material development, skills and knowledge development, instructional approaches to robotics education

Robotics Academy
Frederick University (II)

- Professional Development Robotics courses to **educators** (all grades)
  - Develop knowledge and skills on robotics packages (building and programming the robots)
  - Philosophy of robotics integration as a teaching and learning tool
    - How to integrate robotics in their teaching and learning practice

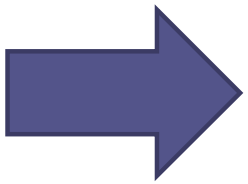
- Robotics courses to **students** (All grades)
  - Develop Knowledge and skills on robotics packages (building and programming the robots)

- **Hobbyists & Anyone interested in robotics**
  - Develop knowledge and skills on robotics packages (building and programming the robots)

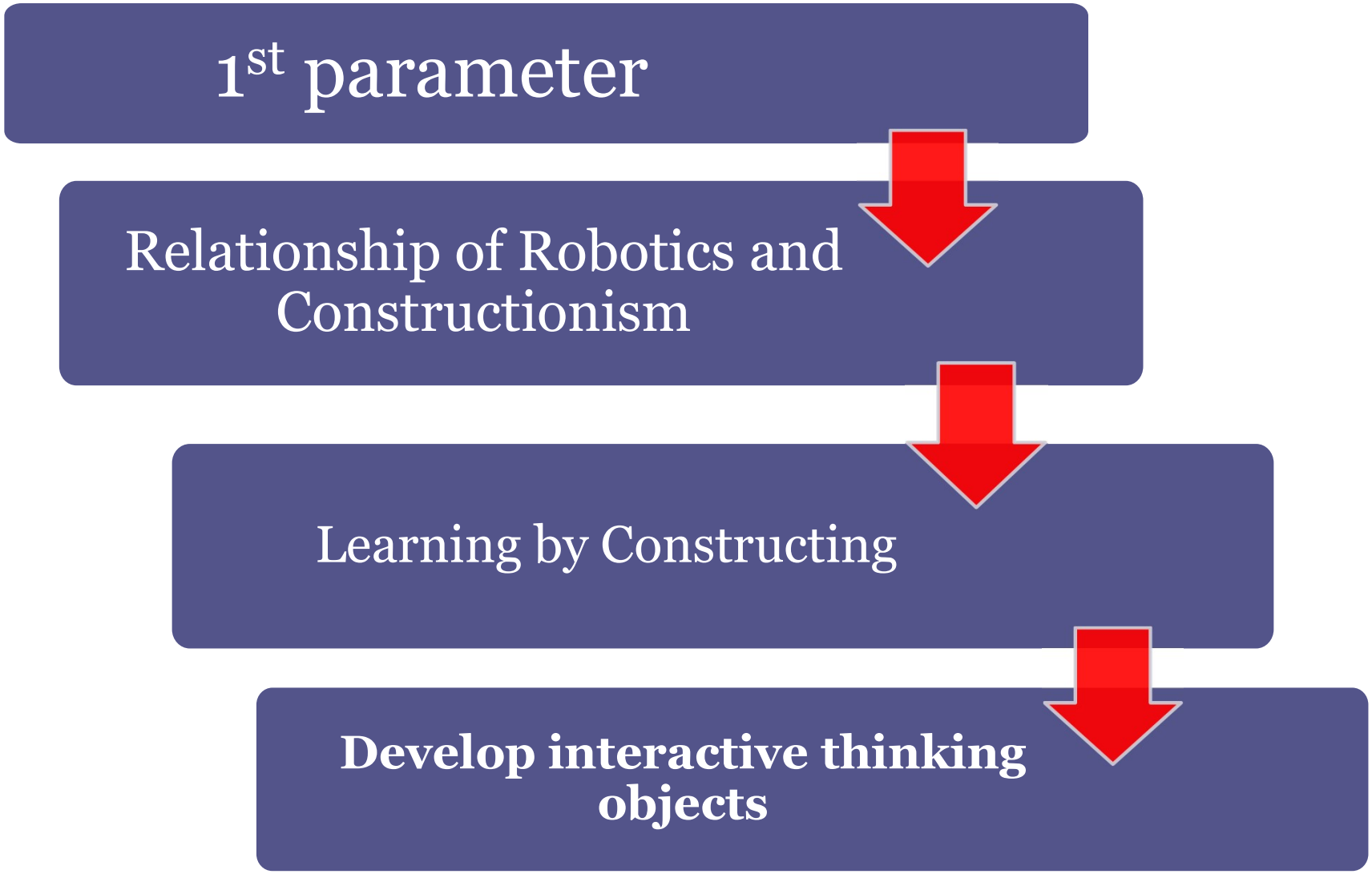
Robotics Academy - Educational Robotics

The Philosophy & the Pedagogical Framework

Parameter 1: Learning by Playing: Building and Programming Robots



Parameter 2: Robots- Partners in Learning: Examine, Explore and Discover through Construction and Programming



(Bers et al., 2013; Eteokleous, 2016; Kazakoff, & Bers, 2012, Kazakoff, & Bers, 2014; Puntambekar & Kolodner, 2005; Sullivan & Moriarty, 2009; Sullivan & Bers, 2015)

2nd Parameter
Robotics as Cognitive-Learning Tool

- Robotics integration as a cognitive-learning tools in the teaching and learning practice can be defined as:
  - The ***exploitation*** of ***robotics by students*** as tool that enhances their learning experience, promotes and supports the achievement of ***specific learning objectives***.

Educational Robotics Curriculum

The educational robotics curriculum employs various educational robotics packages and visual programing platforms. The participants are engaged in ***hands-on, technology-based and unplugged activities related to robotics, based on the grounds of gamification, project, problem and inquiry based learning.***

It includes **presentations, educational games, documentary, rich audiovisual material, hands-on activities, interactive activities (building & developing robots), technology-based (educational software & simulations) and unplugged activities.**

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Various Educational Robotics Packages

- Bee-Bot
- Blue- Bot
- Robot – Mouse
- Kibo Robotics Kit
- Lego Mindstorms NXT
- Lego Mindstorms EV3
- Lego WeDo 1.0
- Lego WeDo 2.0
- *Botley Robotics Kit*
- *Kids first coding*
- *Botley*
- *Artie*
- *Coding critters*
- *Little Bits*
- *Grove*
- *Edison Robot EdCreate Constructors Kit*
- *Educational drones*
- *Arduino based educational projects*
- Engino
- mbot
- Meet Edison
- Rasbery Pi
- VEX
- Recyclable robots

Curriculum & Educational Robotics Packages Used

- The educational robotics interventions was based on the pre-existing developed robotics curriculum.
- Intervention included technology-based and unplugged activities based on the following educational robotics packages and associated robotics platforms.

Bee-Bot

Lego WeDo I

Robot Mouse

Engino

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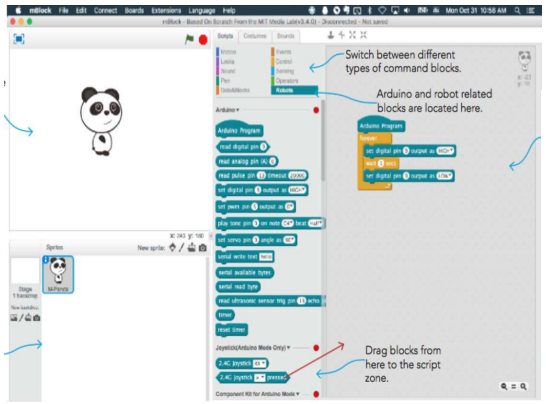
Curriculum & Educational Robotics Packages Used



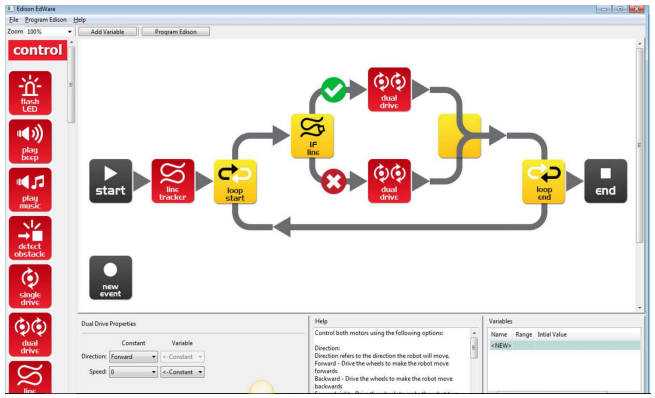
mBot

Blue Bot

Botley

Lego WeDo II

Curriculum & Educational Robotics Packages Used



Meet Edison

Pro-Bot

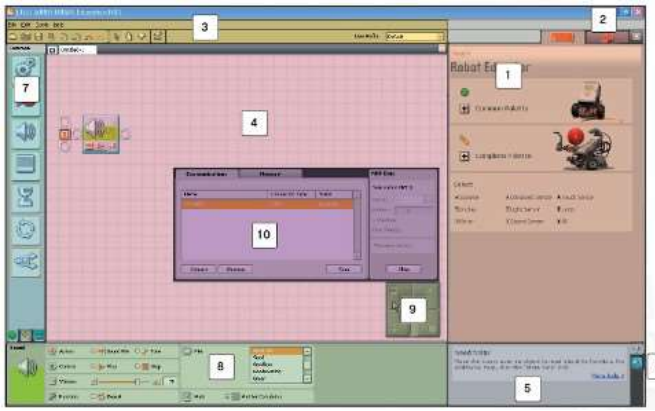
Kibo Robotics kit

Raspberry Pi

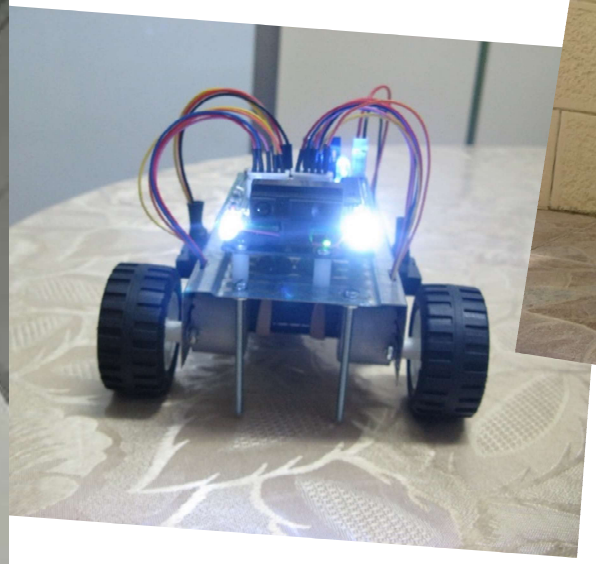
Lego Mindstorms Ev3

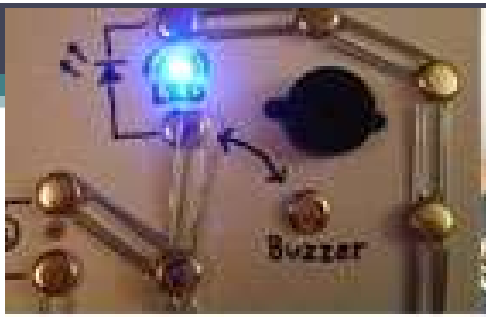
VEX

Lego Mindstorms NXT

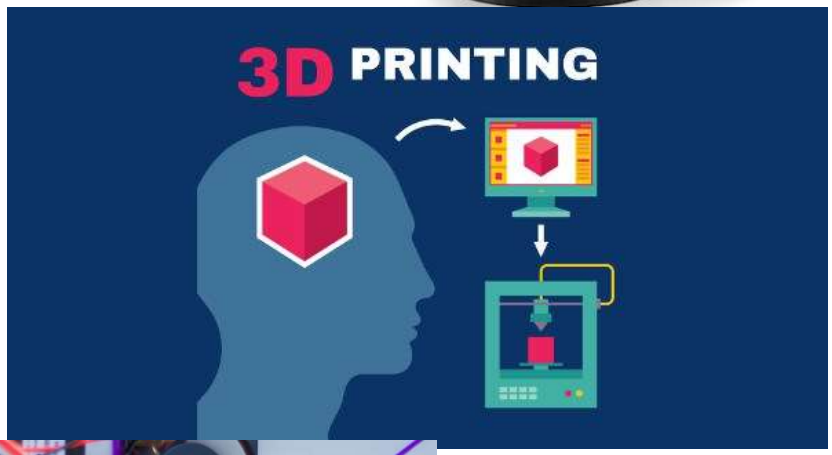


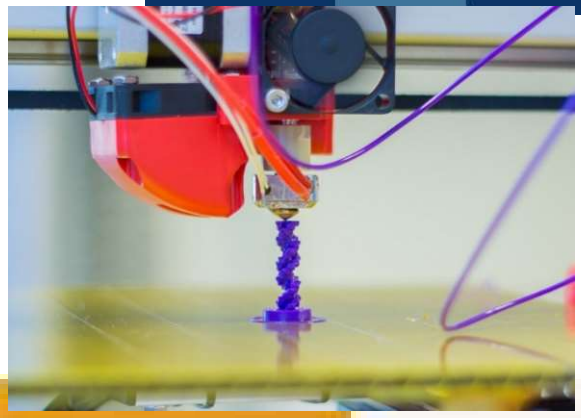
- Recyclable robots




Buzzer


The
ArtBot


3D PRINTING



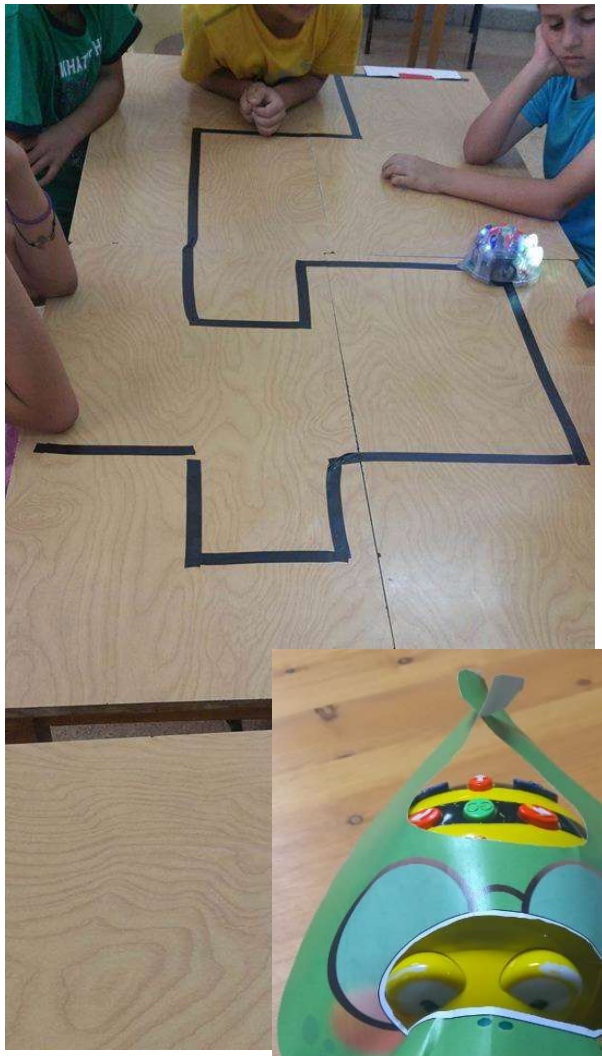
…to conclude

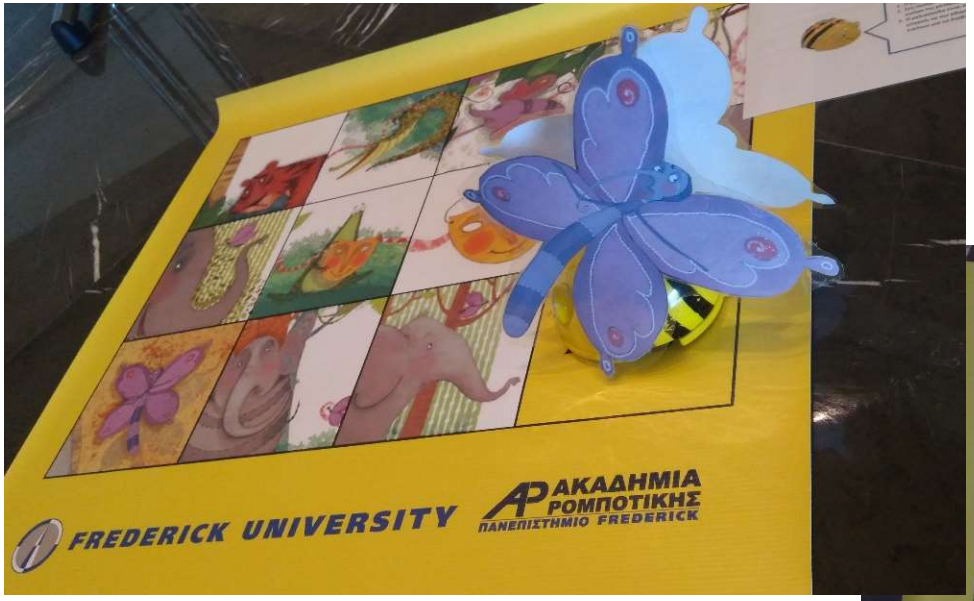
- The results suggest that:
  - Educational robotics positively influence the development of 21st century skills:
    - **Critical Thinking, Creativity-Innovation and Collaboration.**
  - Possible to employ robotics within the educational practice within a well-designed learning environment
    - In this case - the pioneer educational robotics curriculum developed by the Robotics Academy.
    - Students experience various hands-on, technology-based as well as unplugged activities.

- Great potential of integrating robotics as a cognitive-learning tool

- Underlies the value of integrating robotics as an innovative form of teaching and learning to be applied in schools, in order to promote the development of the skills needed for future citizens.

- ***For students to become active citizens and promote local and national innovation and development; they should be provided with those opportunities and experiences that will adequately prepare them for the unknown.***

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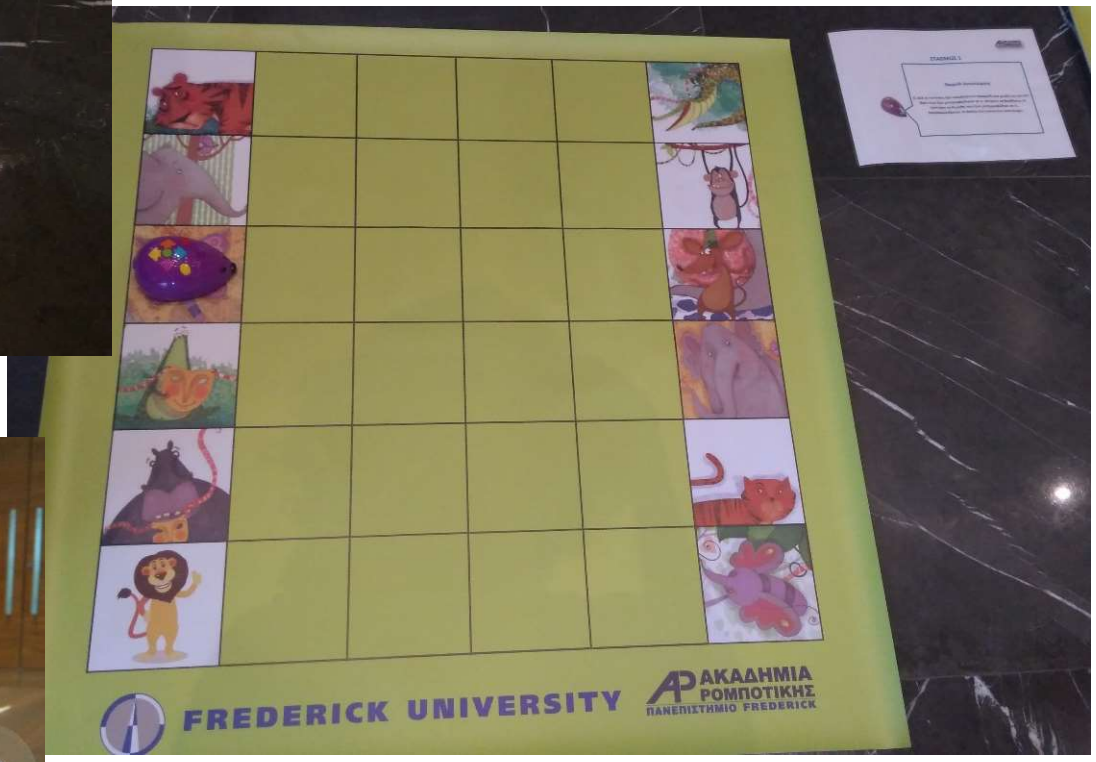
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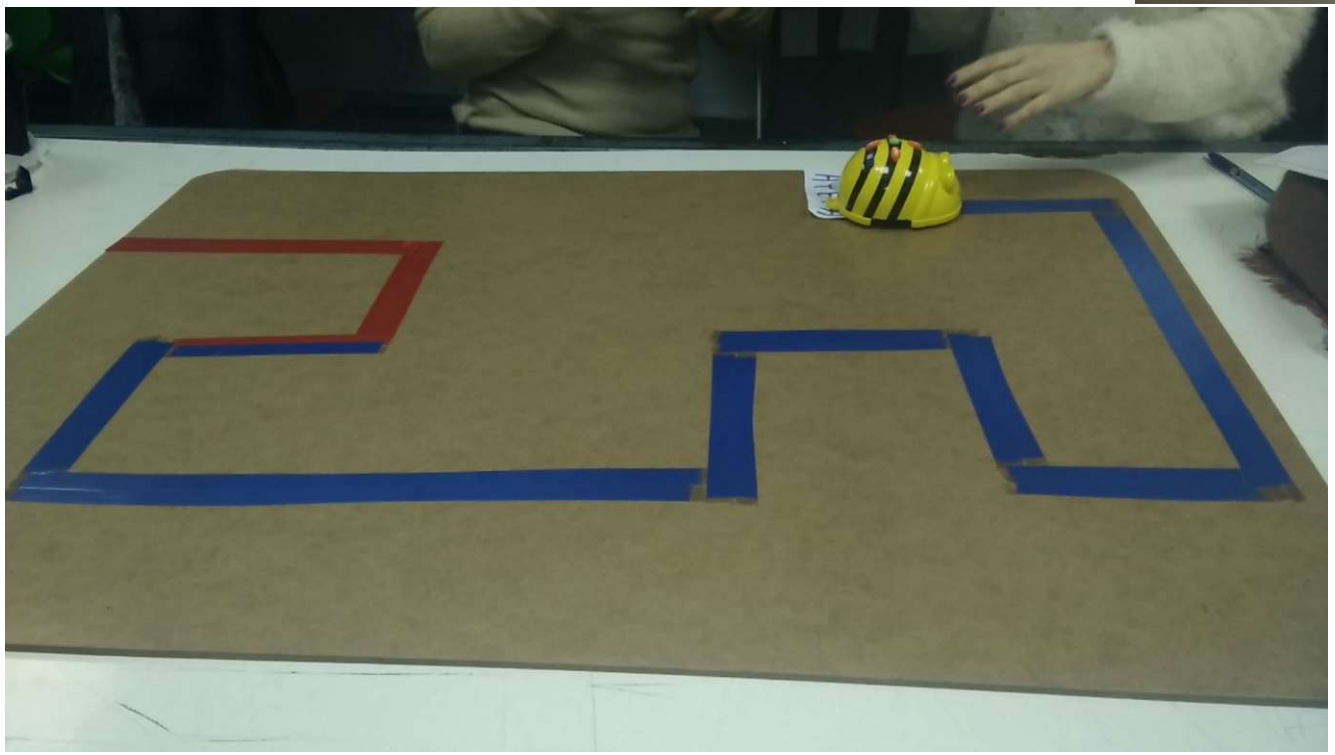

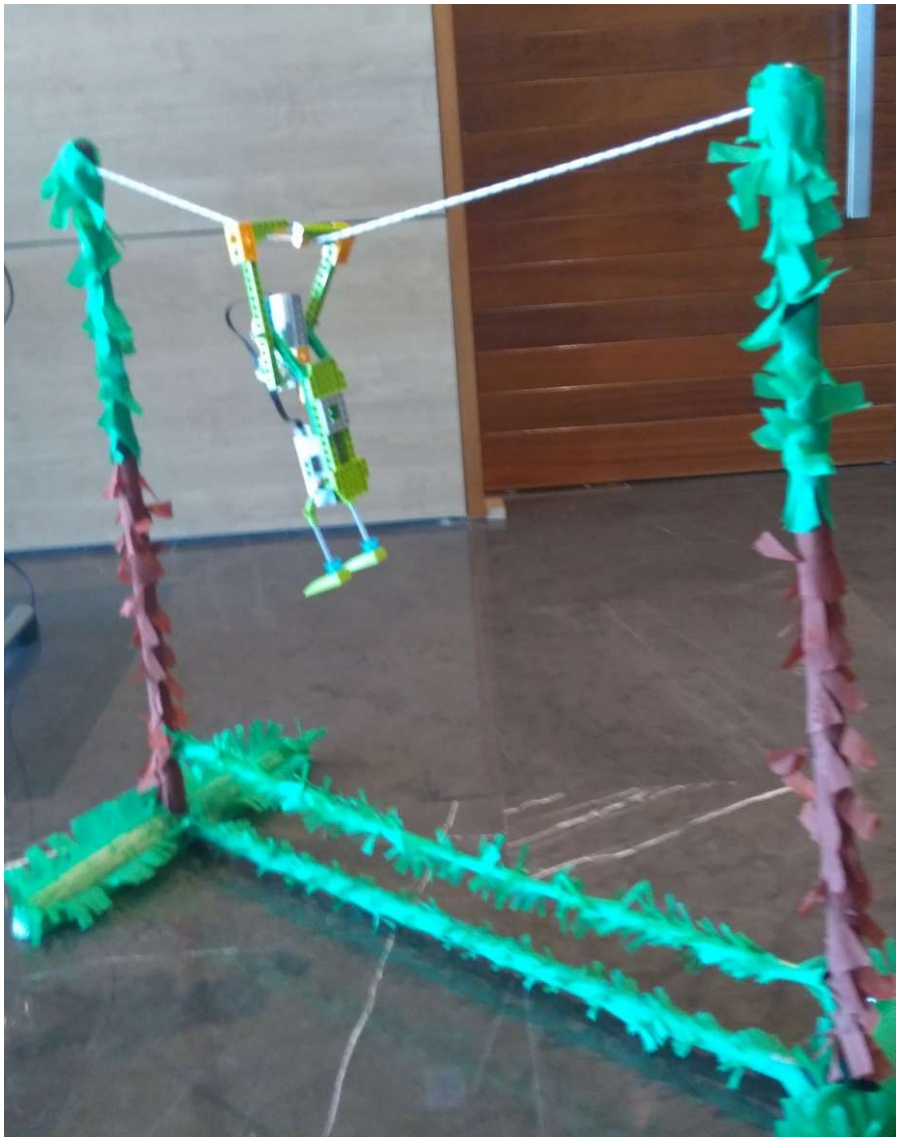

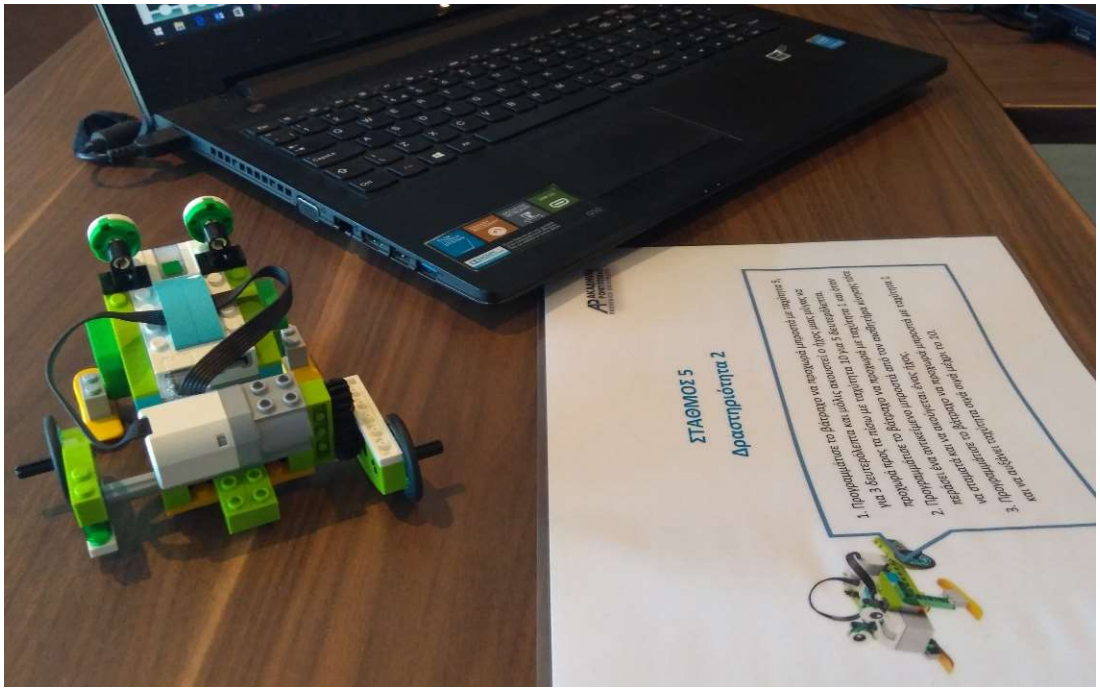
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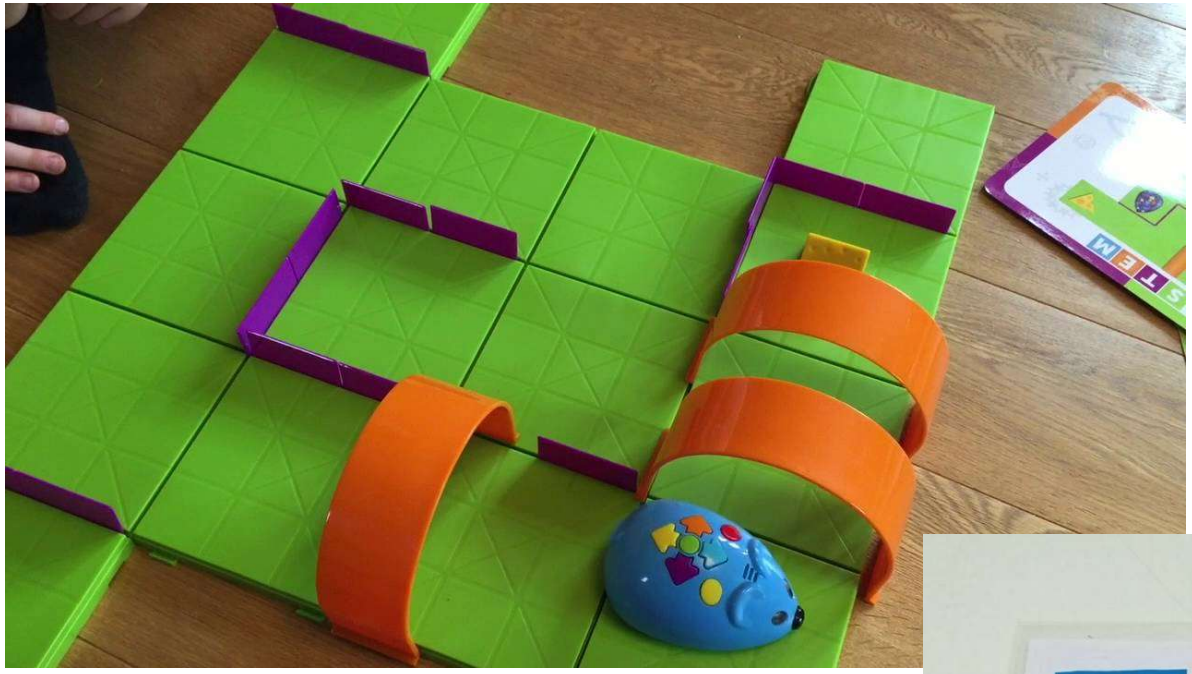


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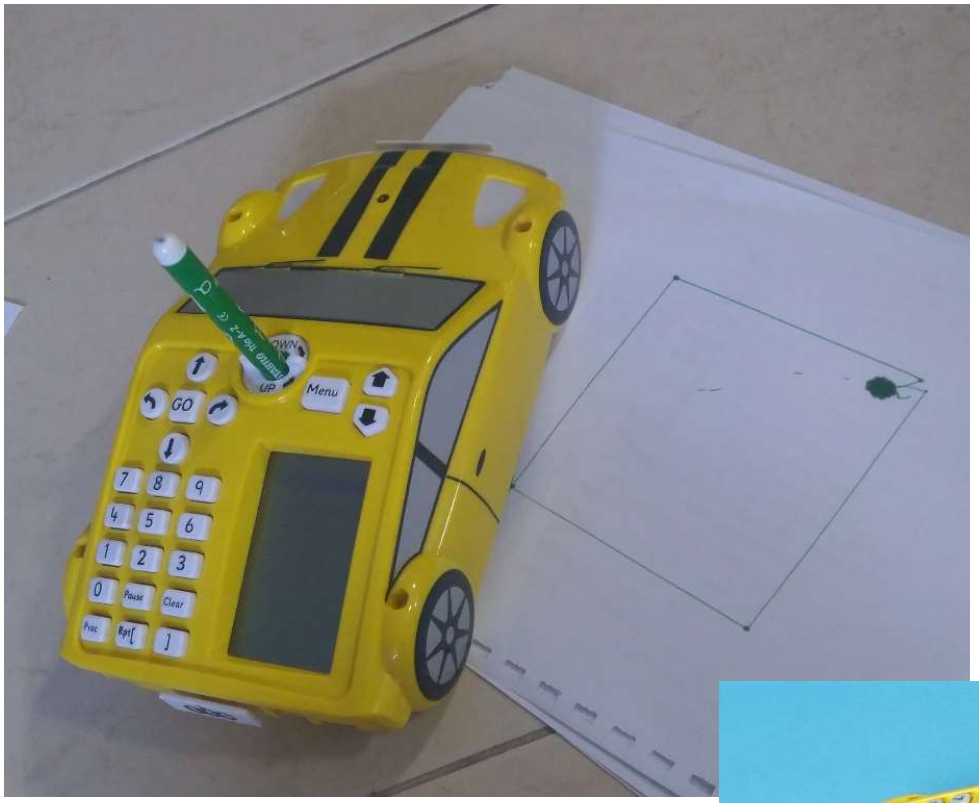
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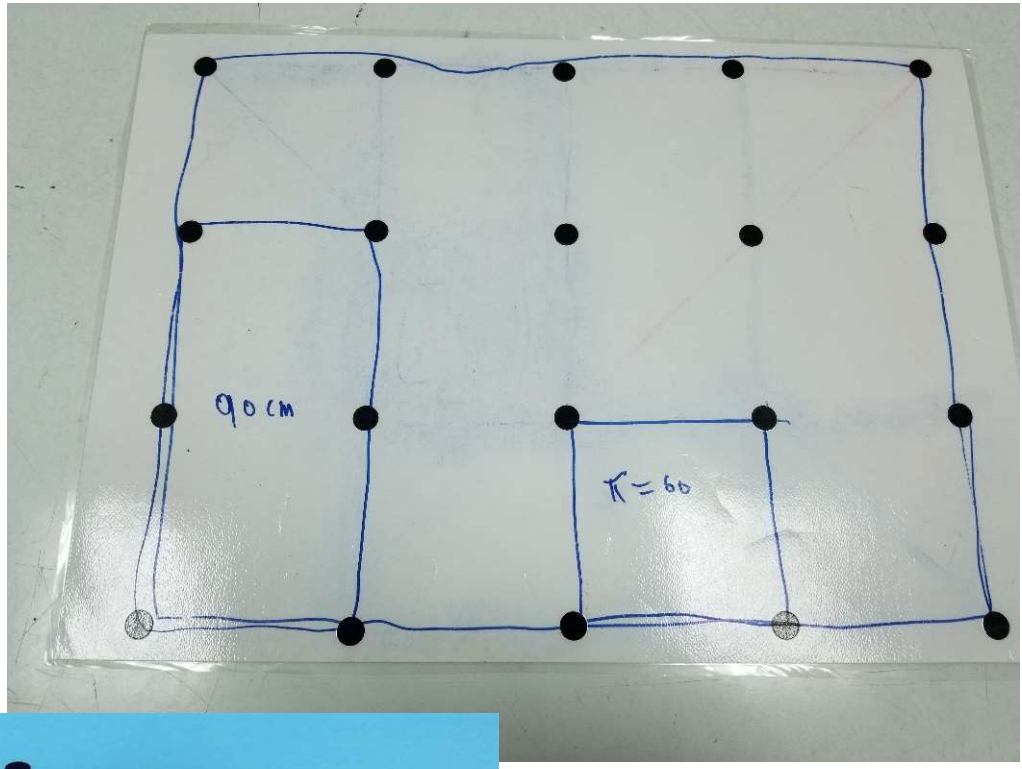
0 Pause Clear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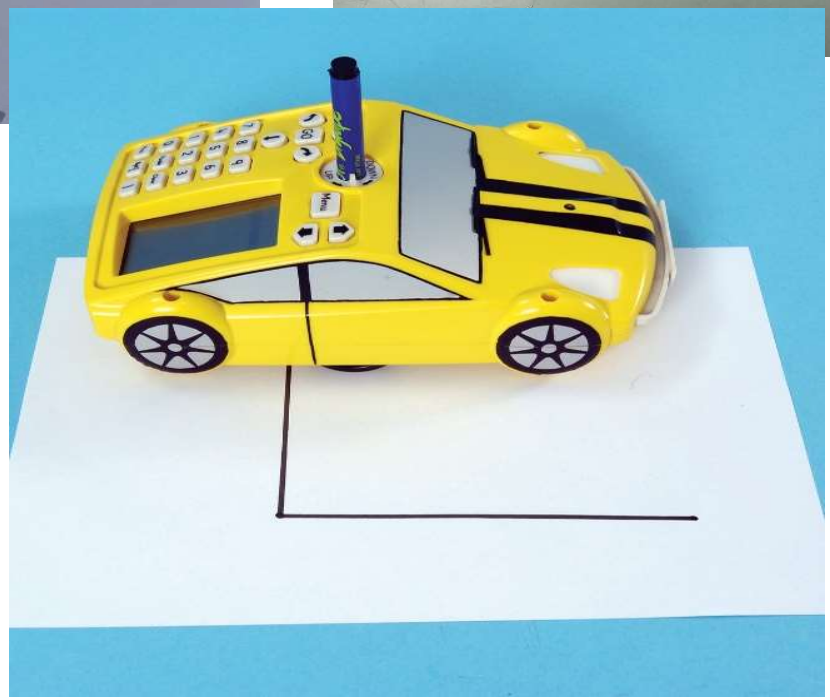
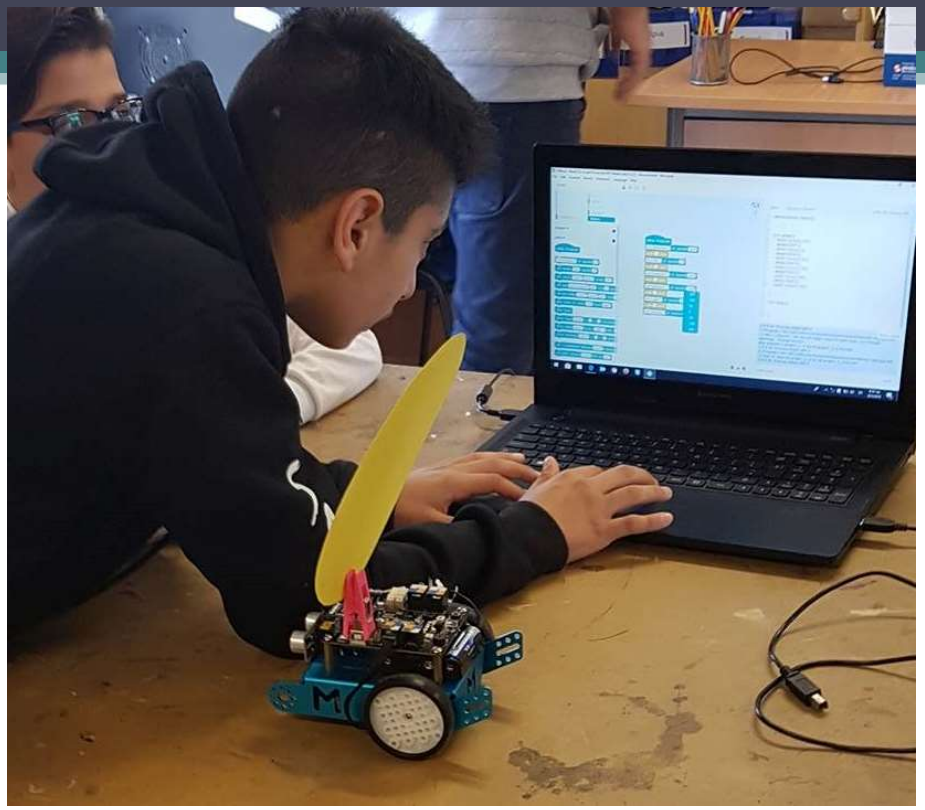
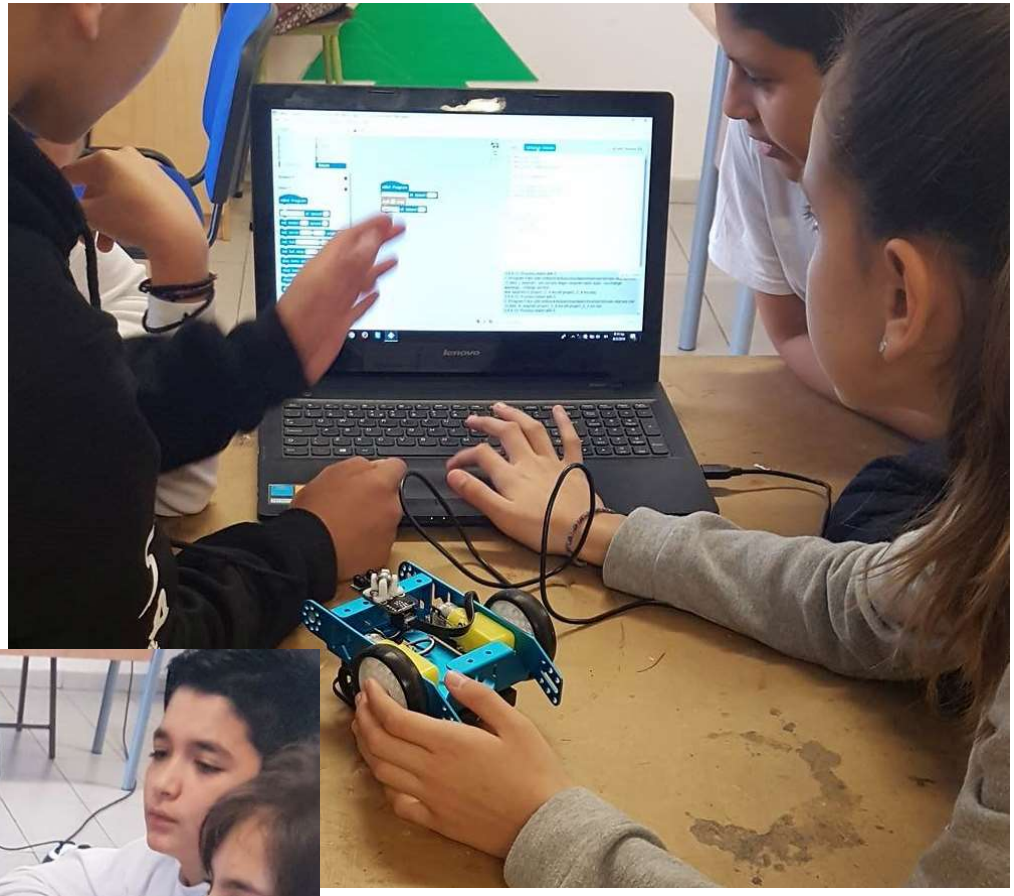
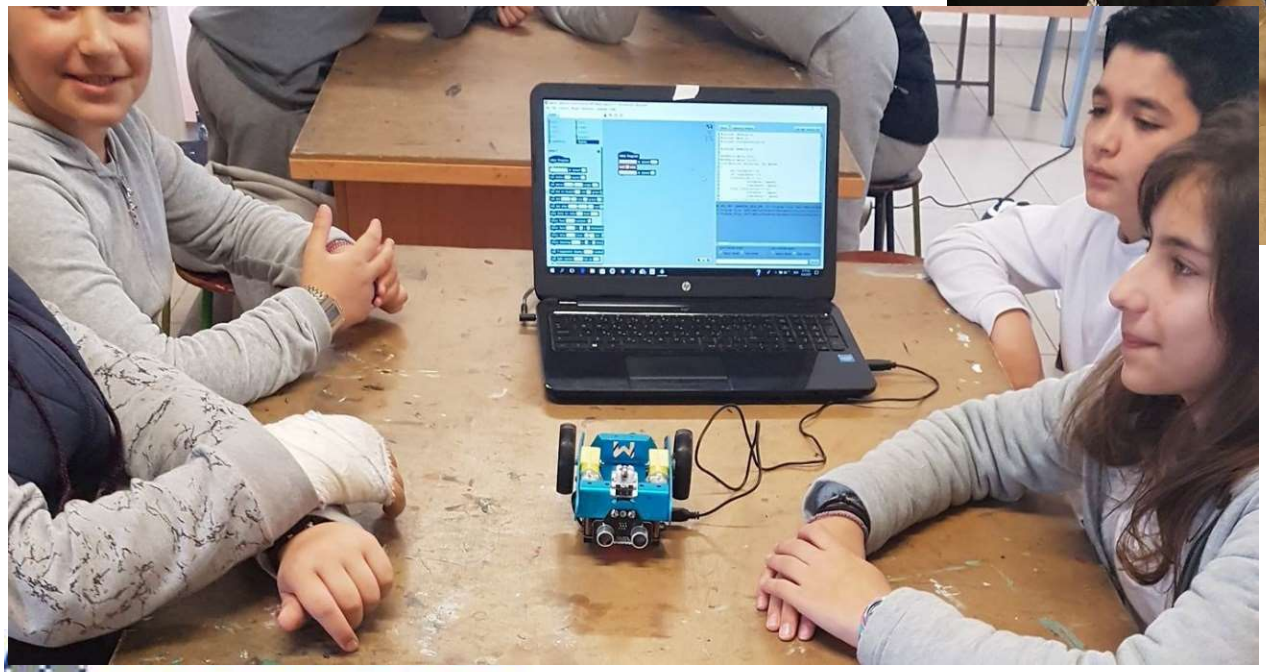
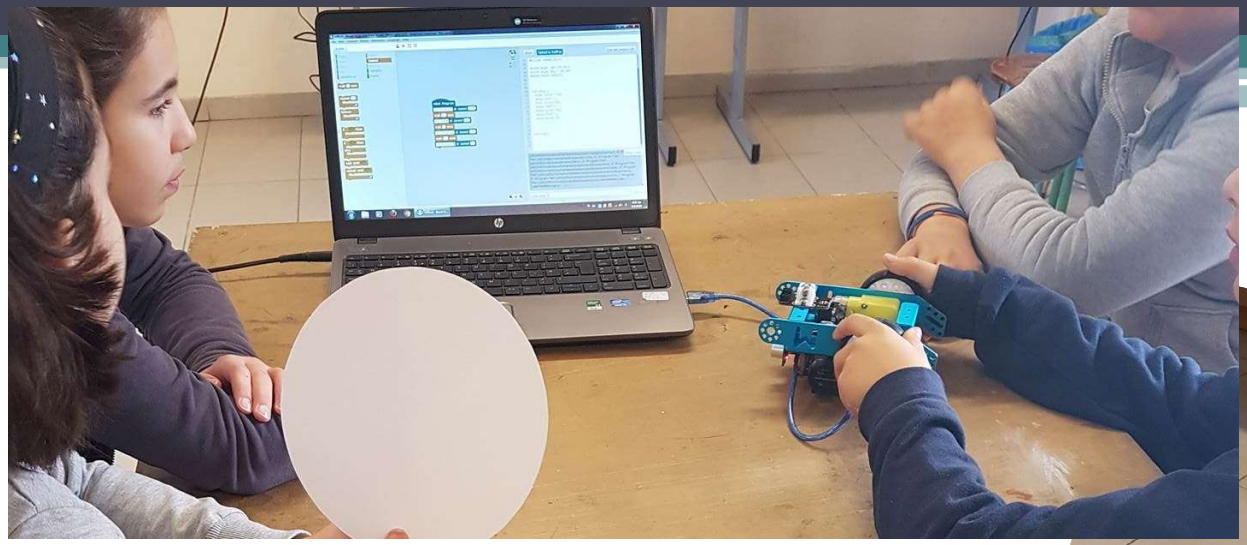
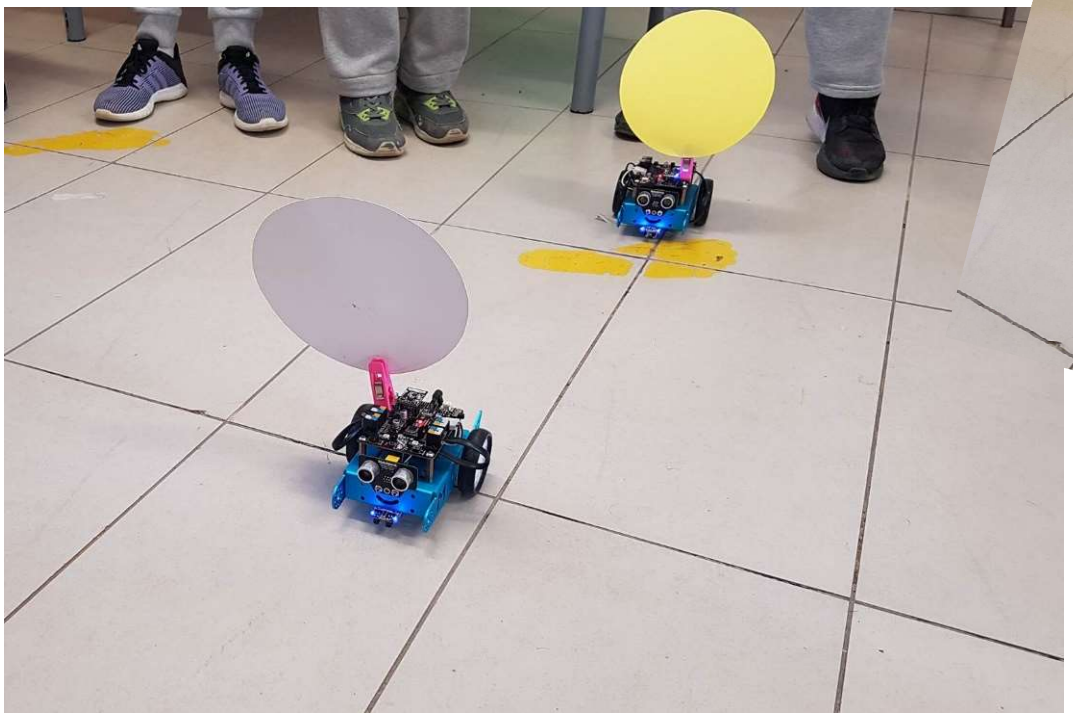


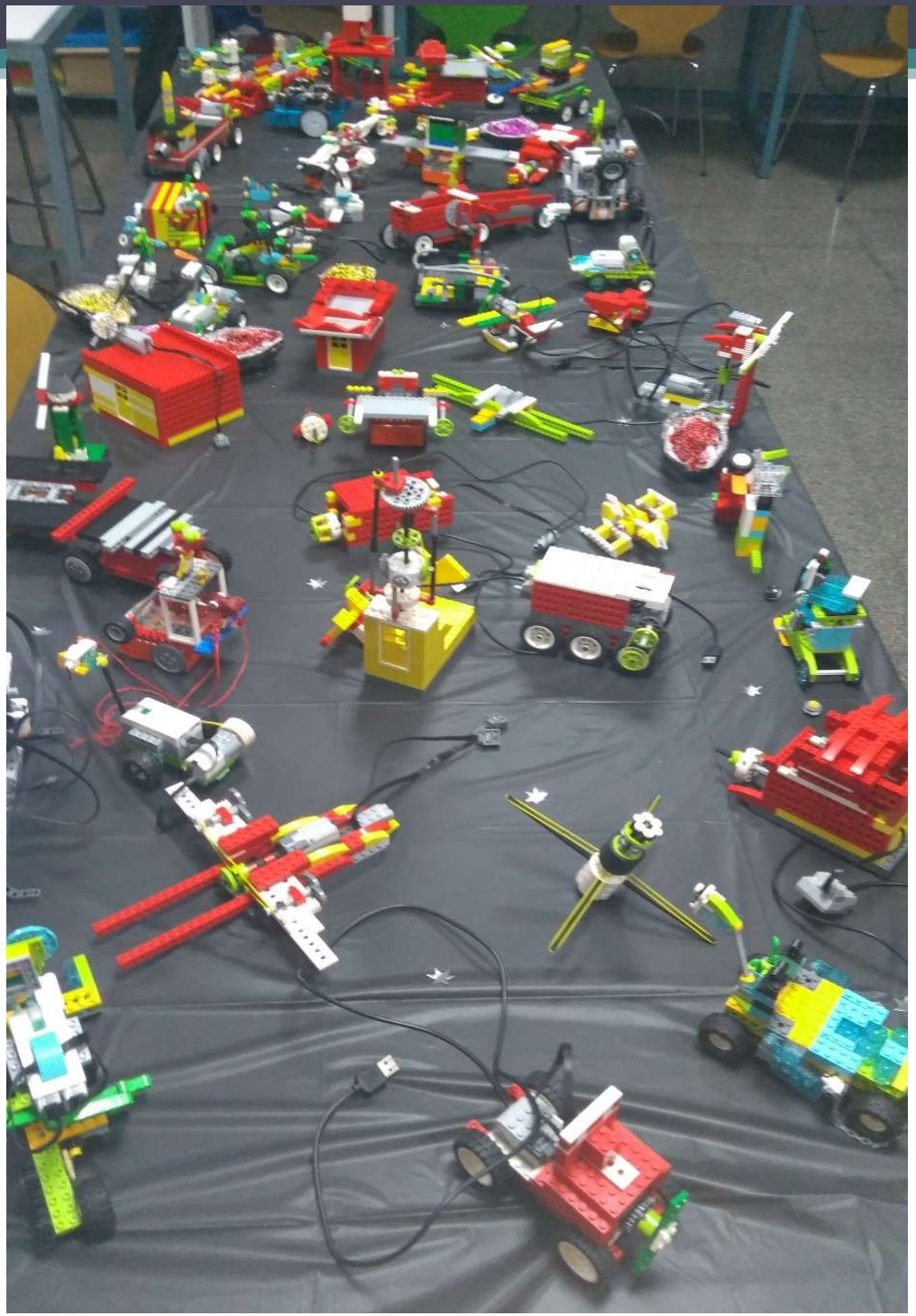






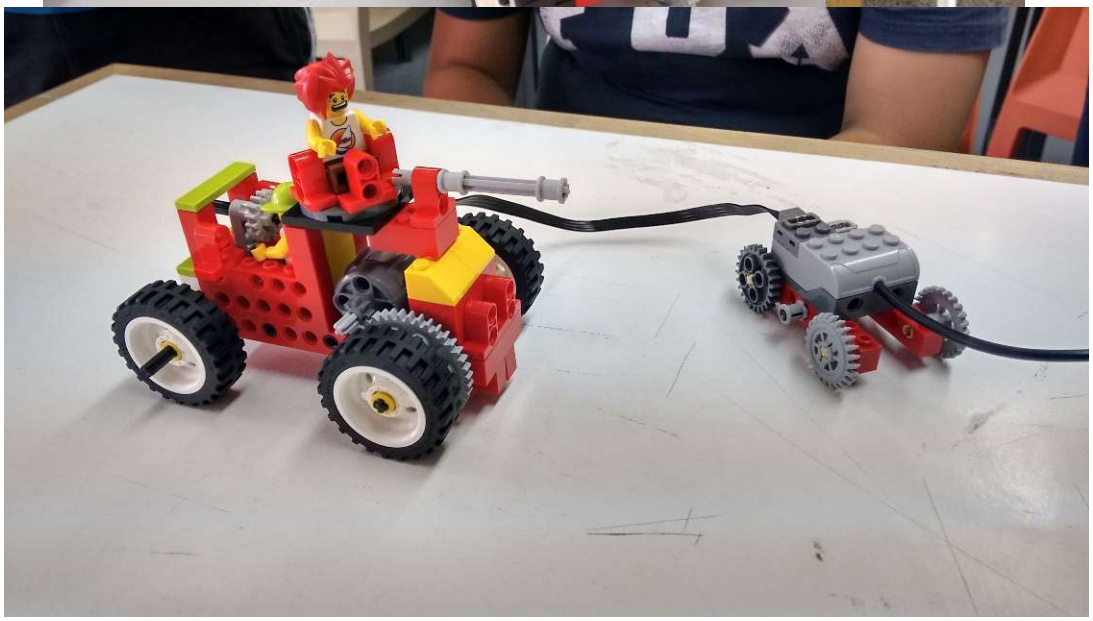


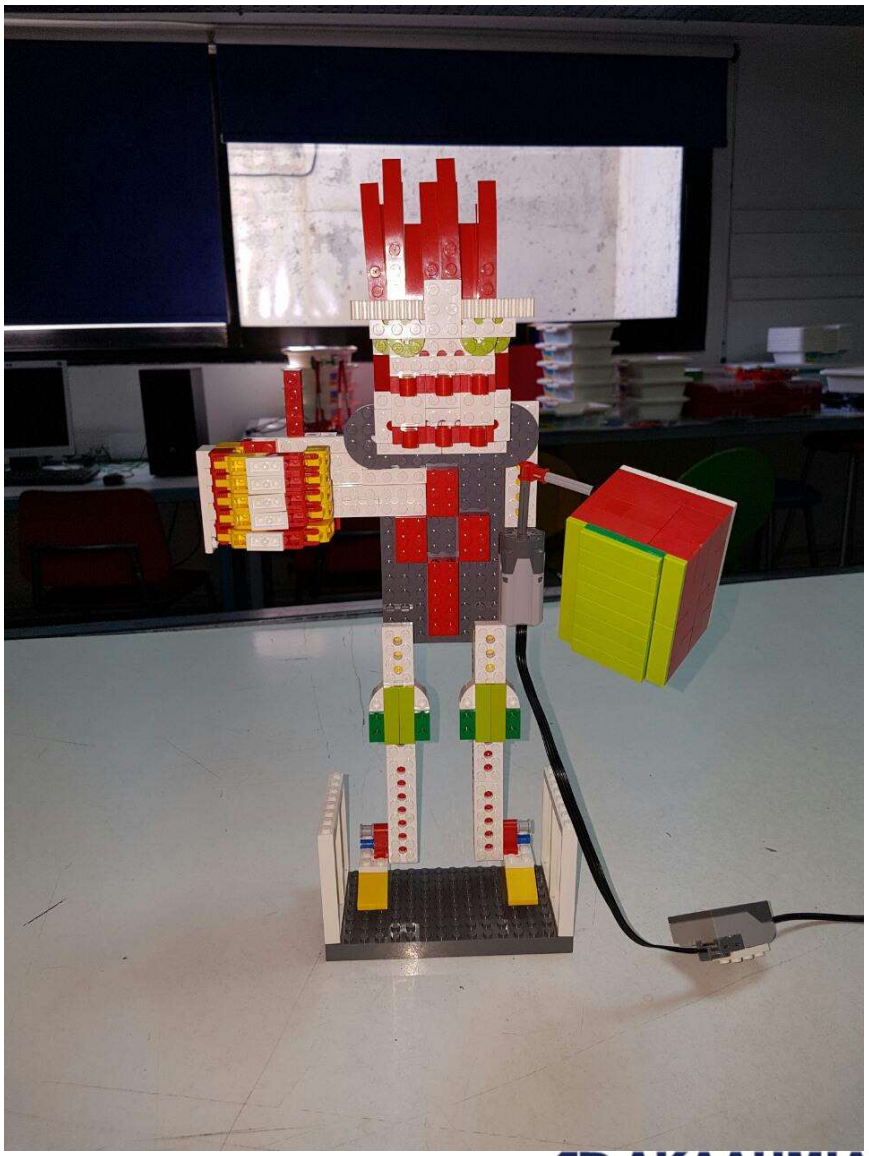




Students self-developed robotics models

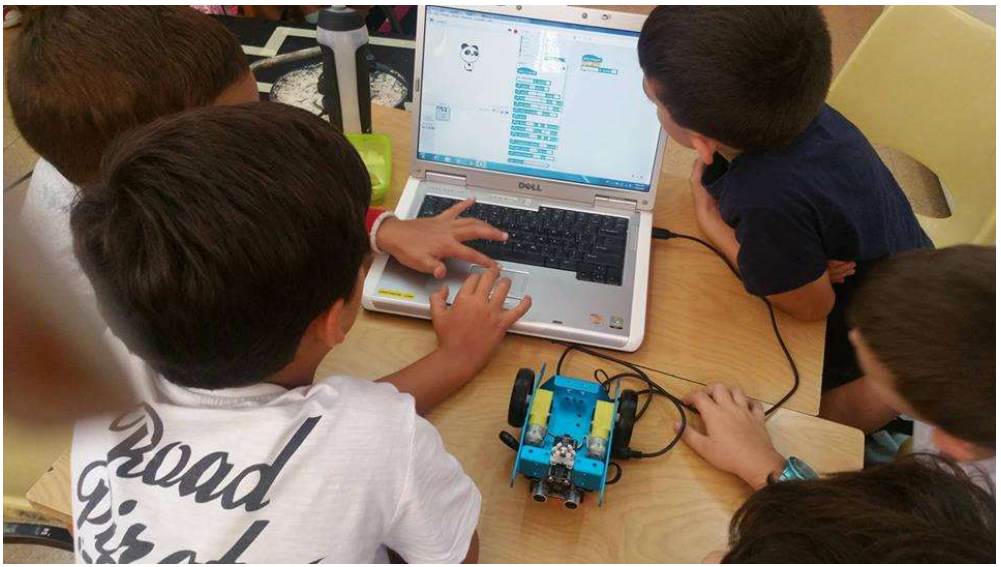
Students self-developed robotics models

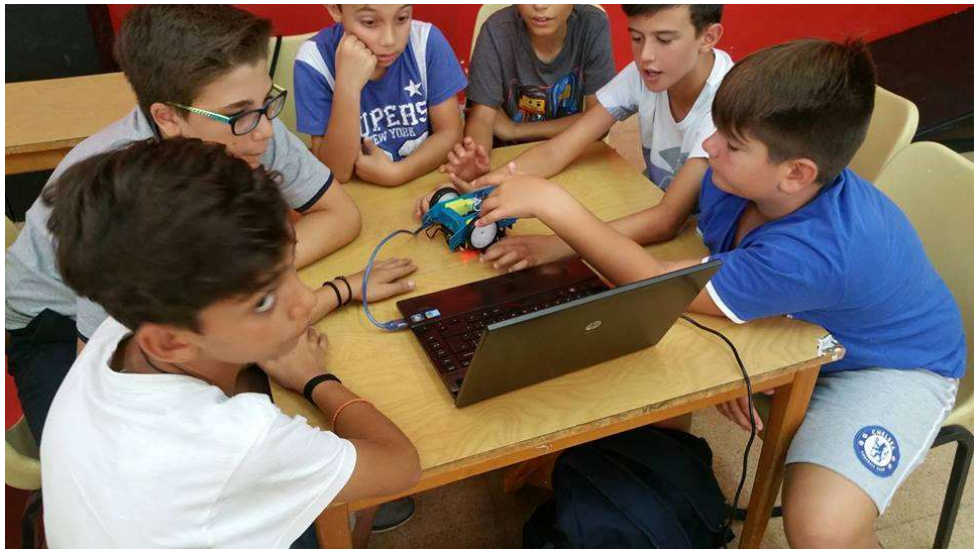


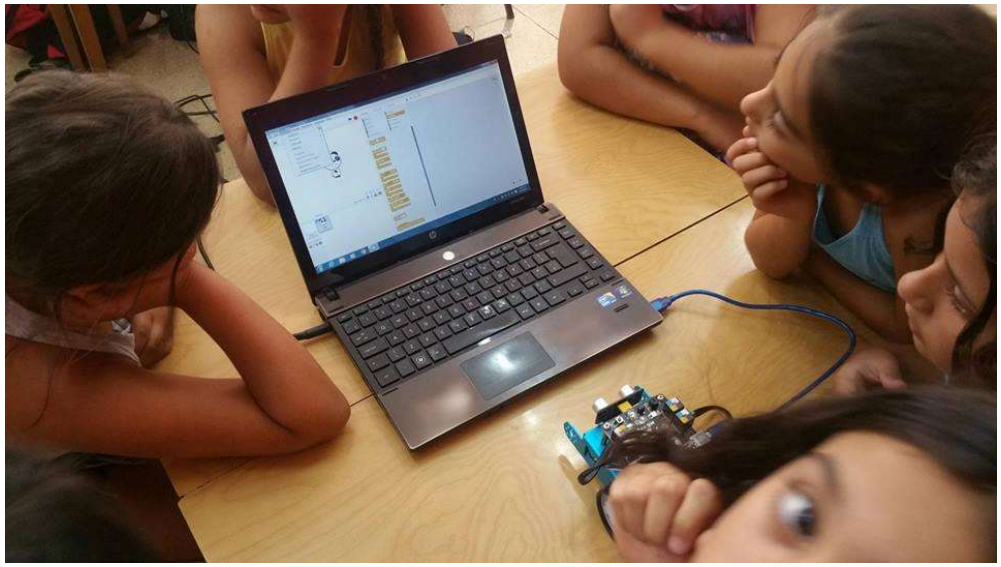


Students self-developed robotics models

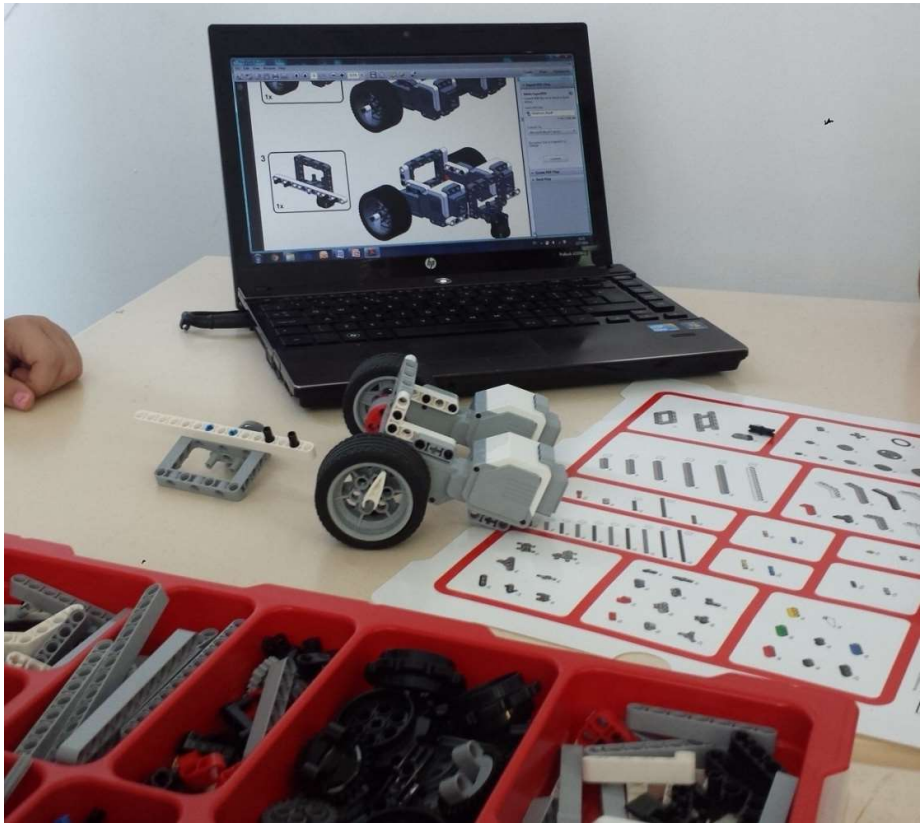
Programming the Mbot

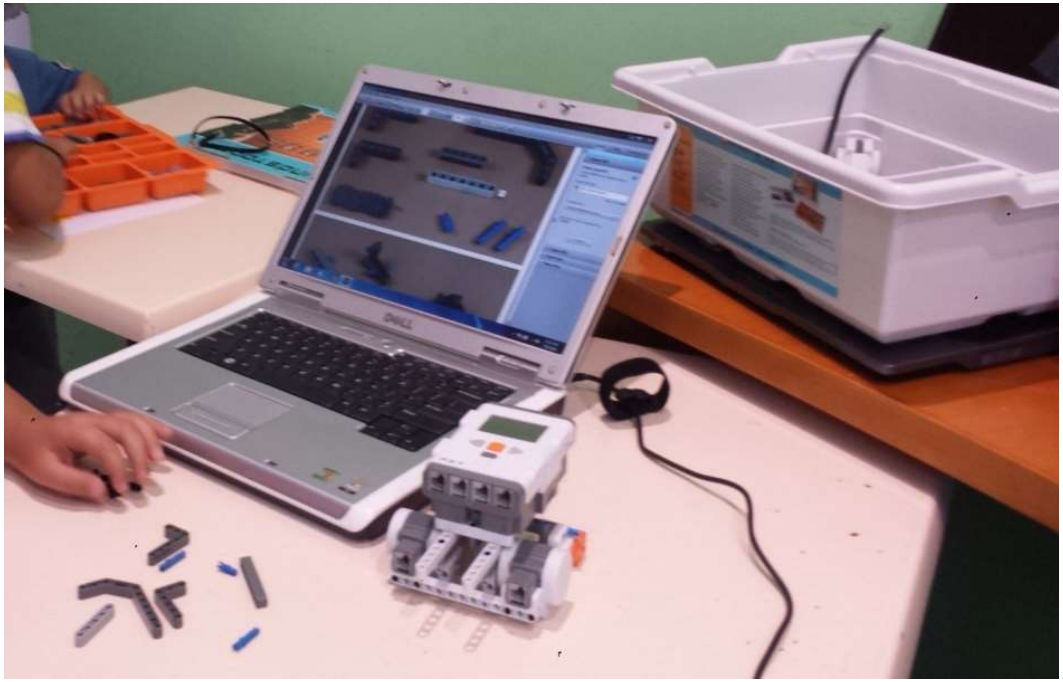


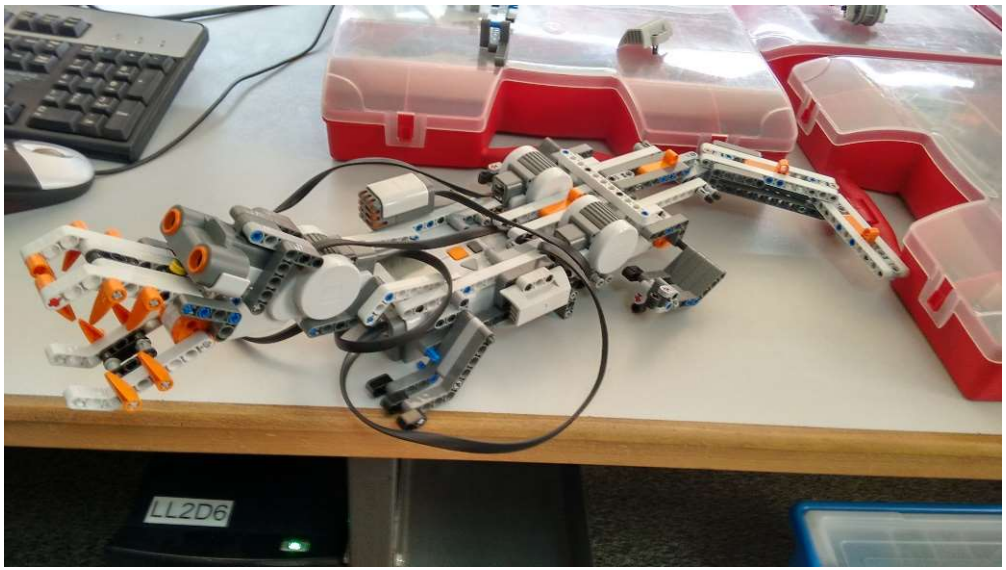




NXT MINDSTORMS & NXT MINDSTORMS EV3



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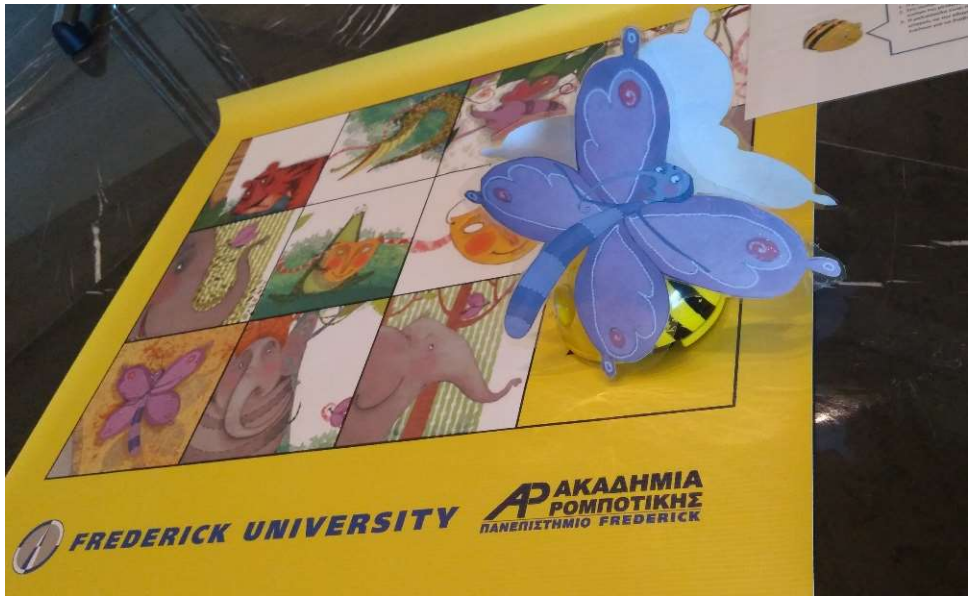
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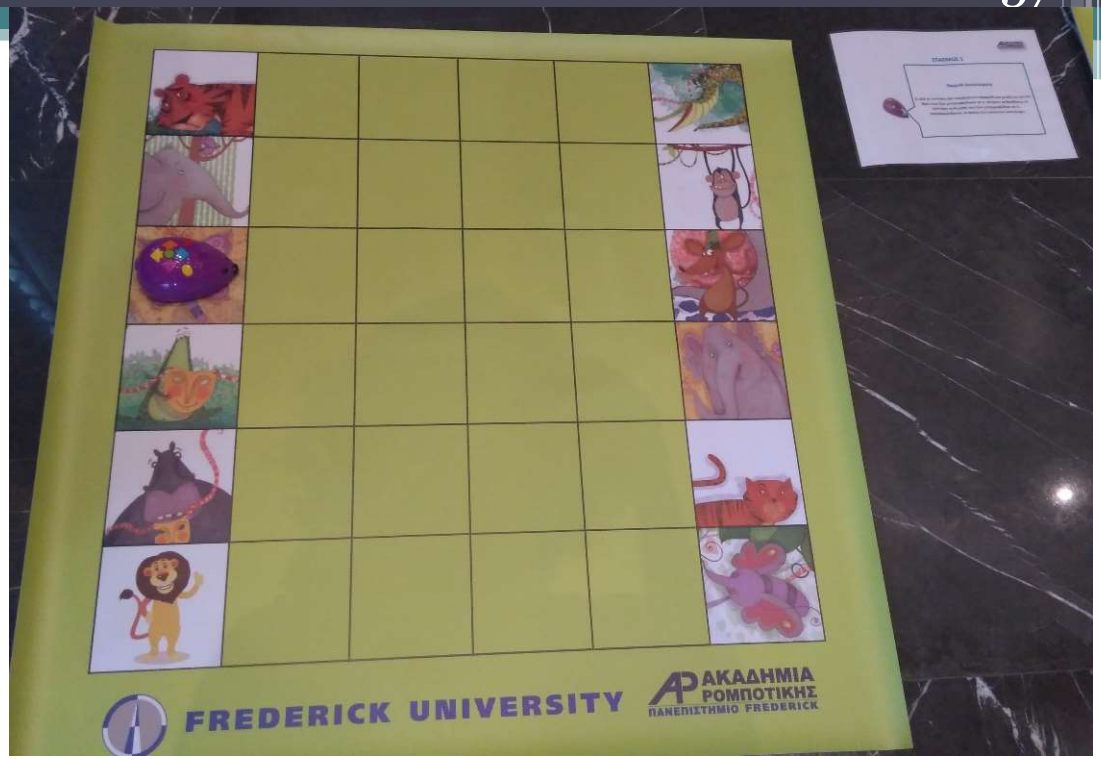
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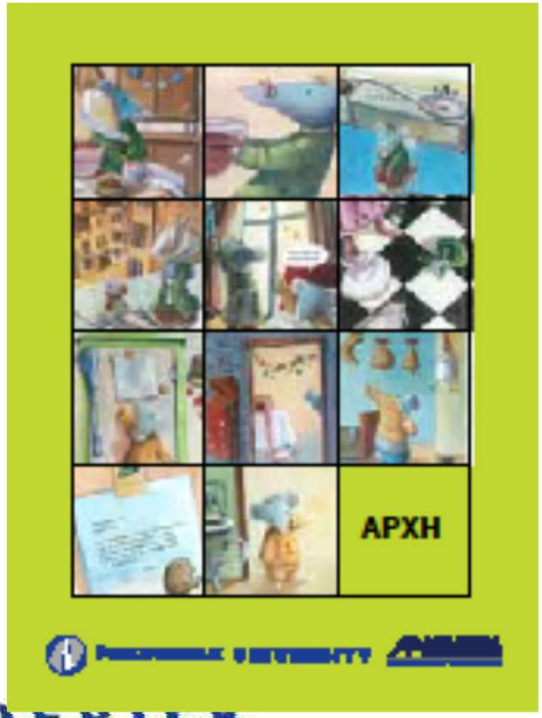
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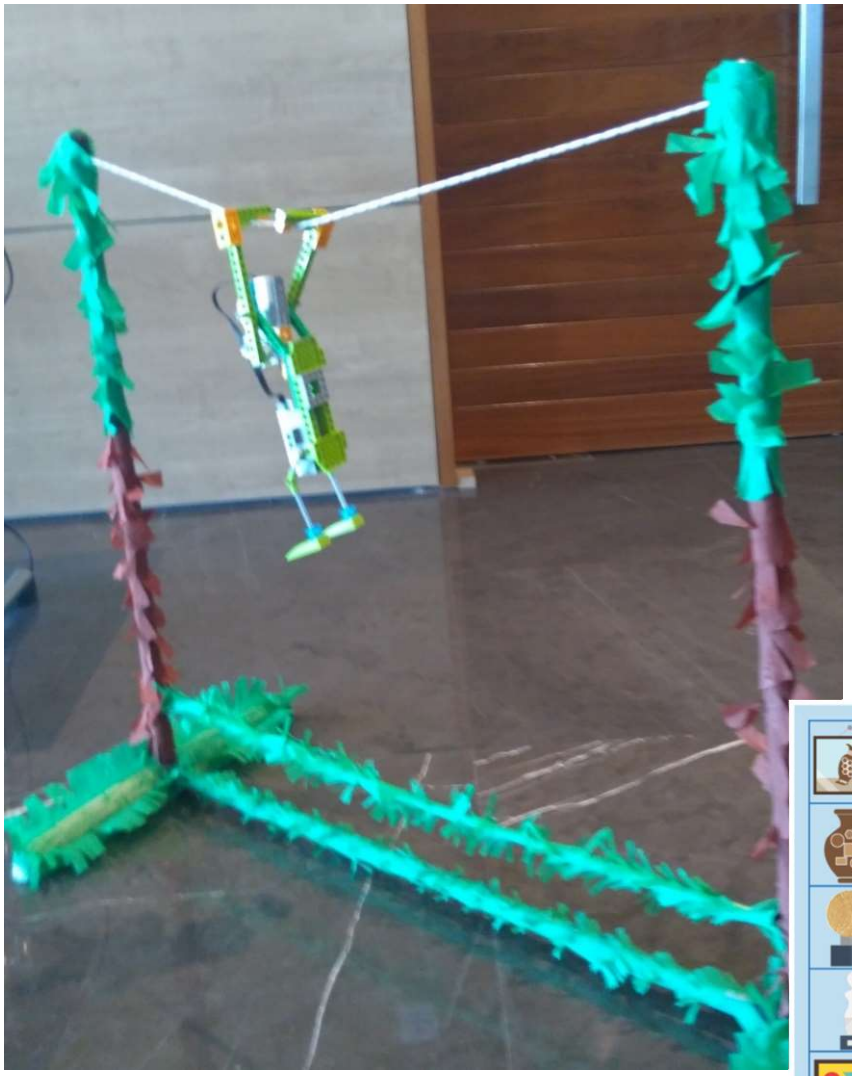

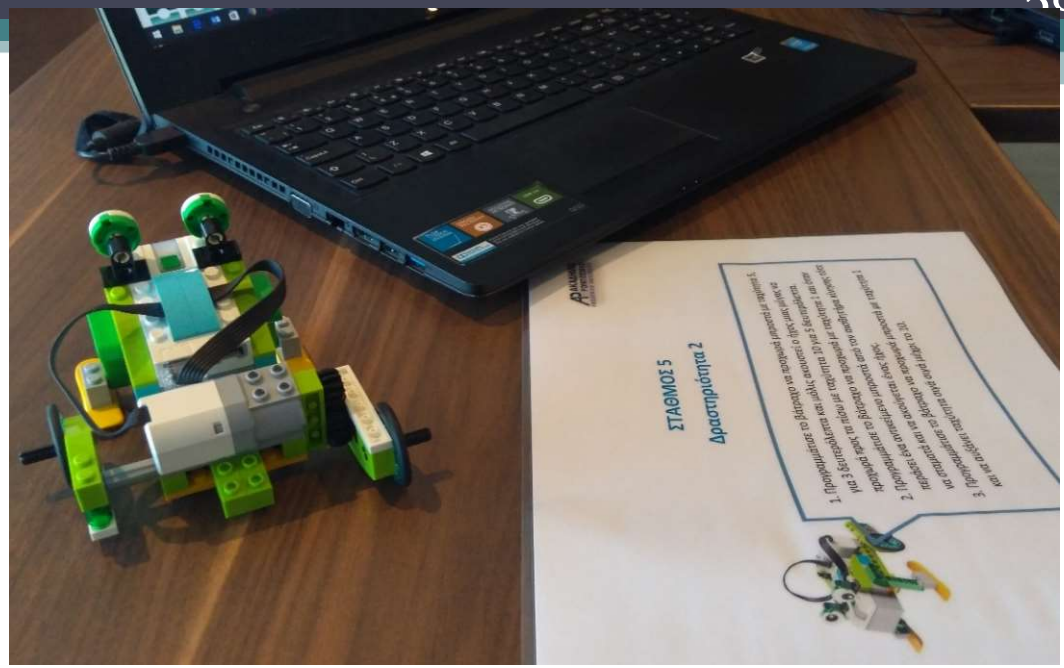
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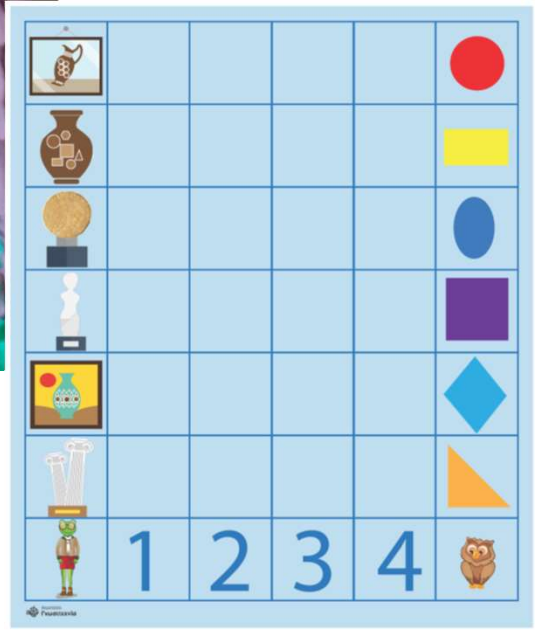
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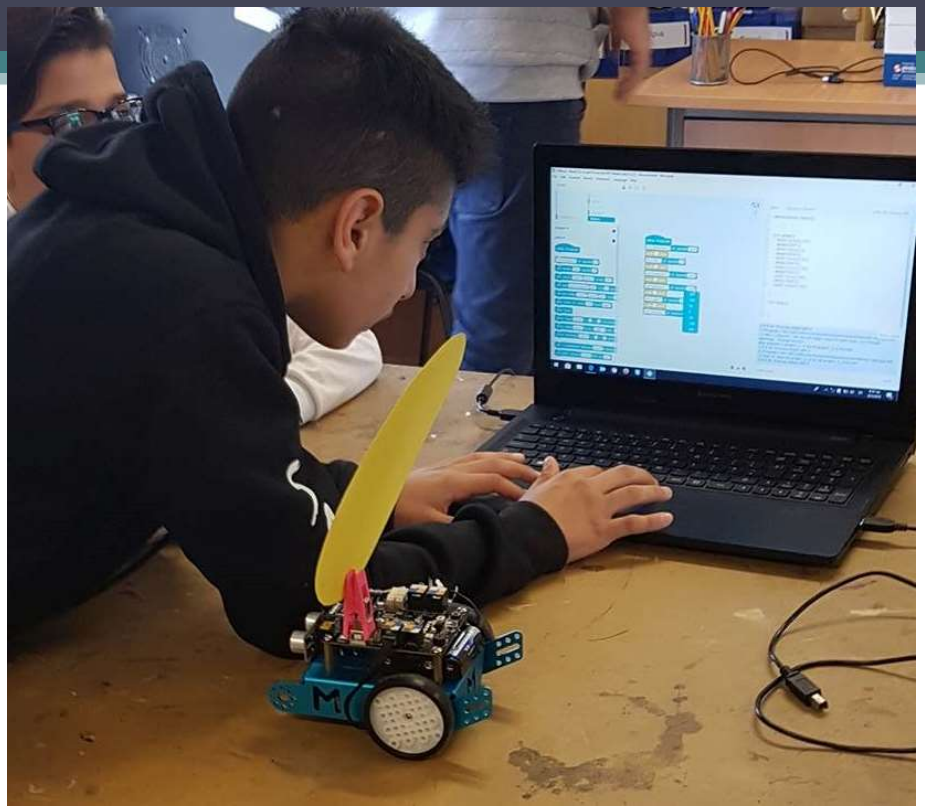
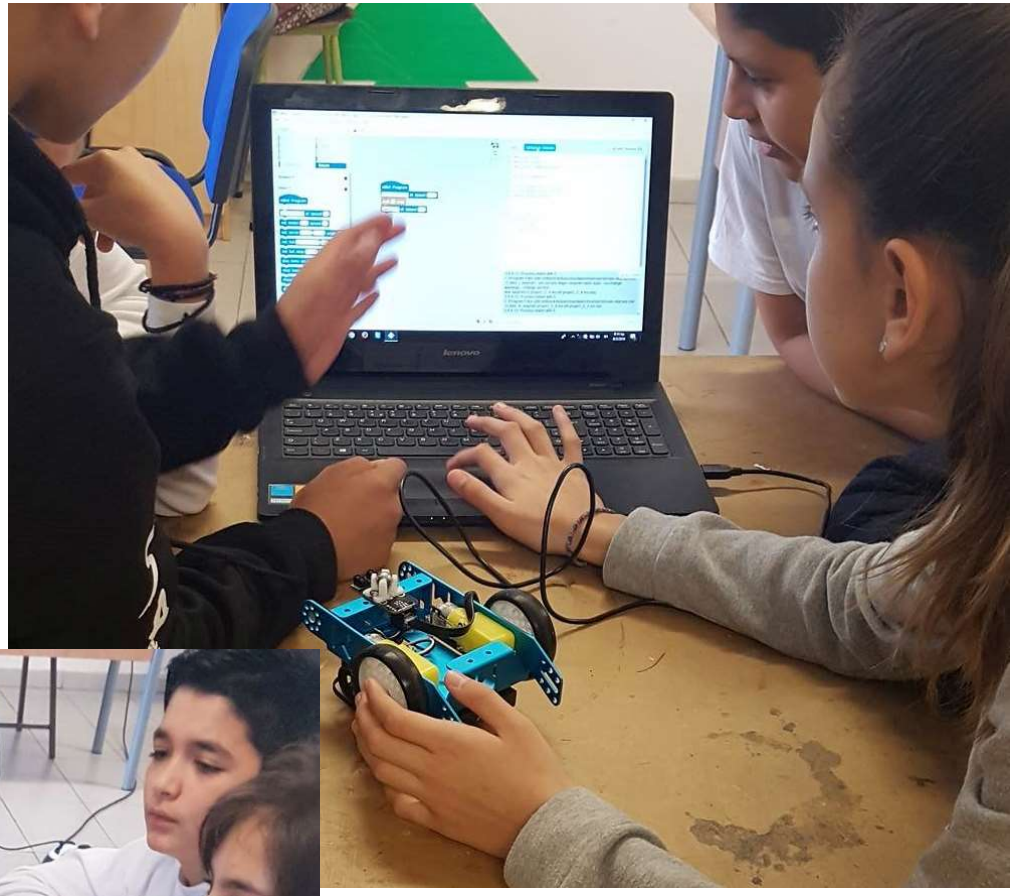
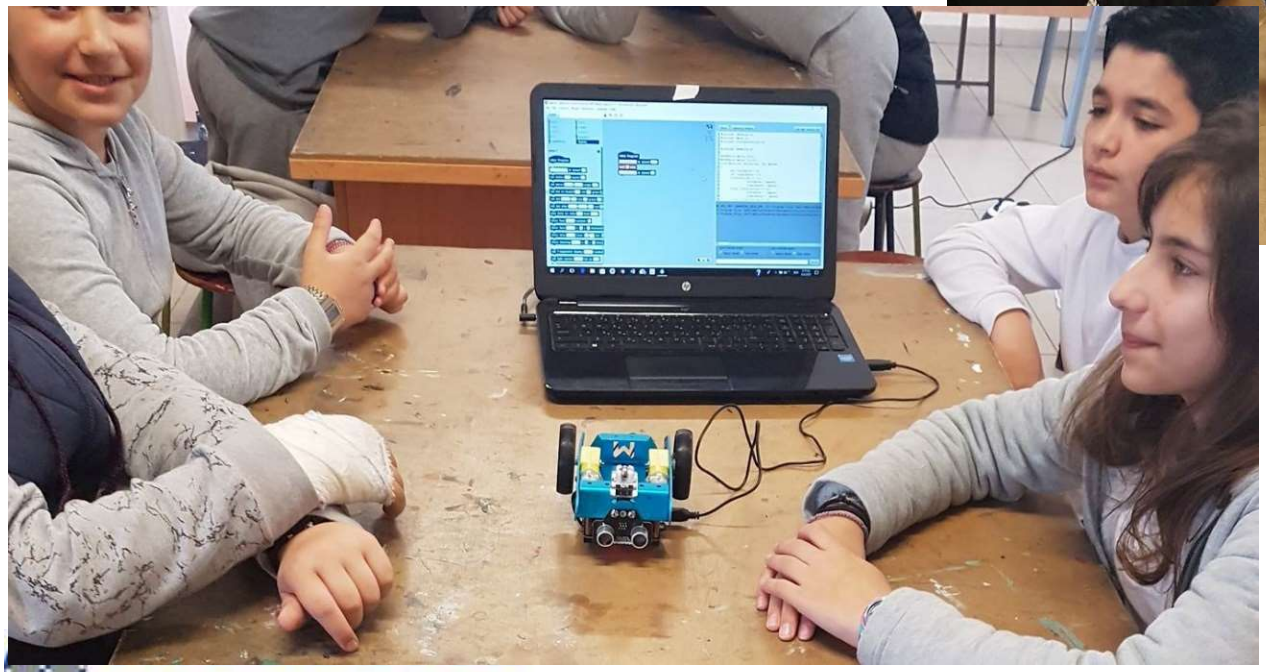
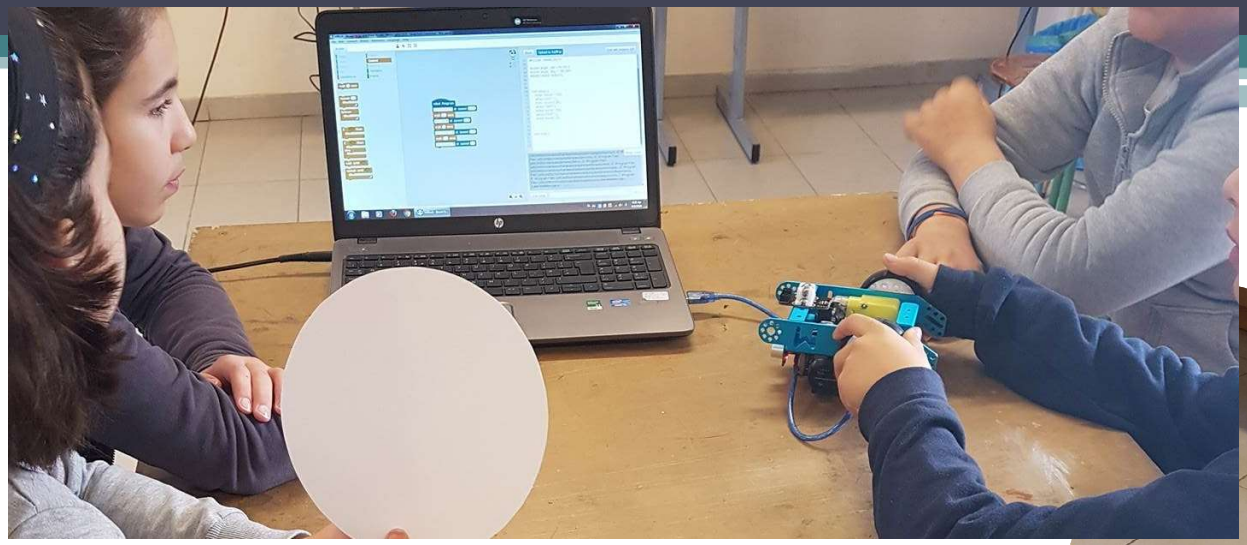
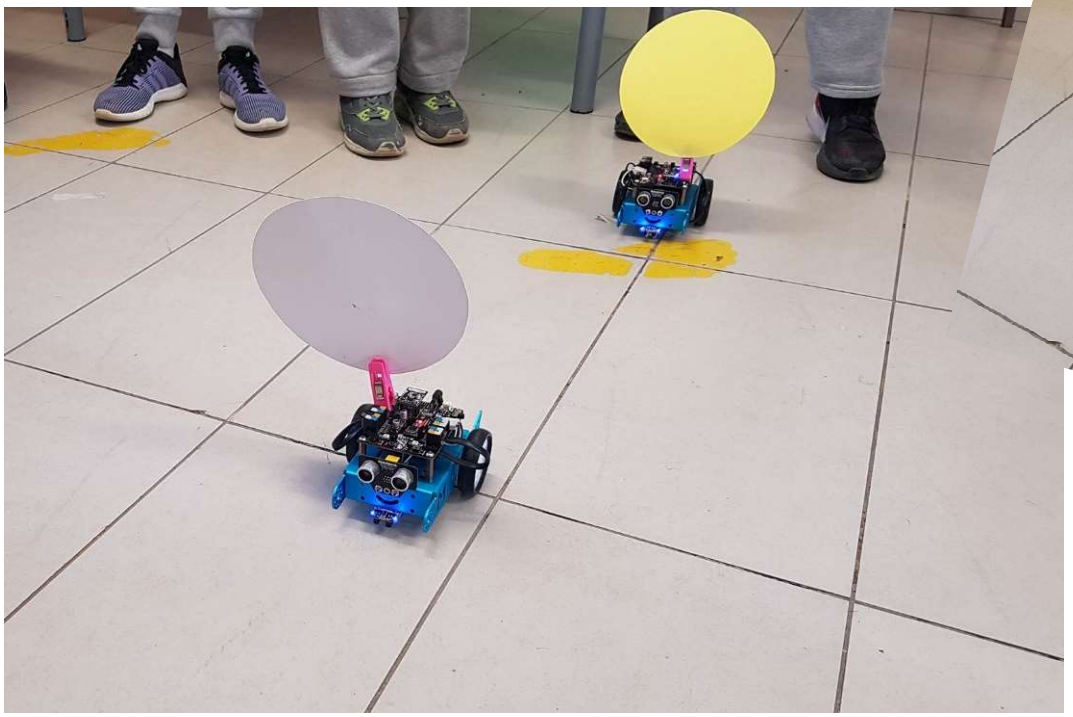
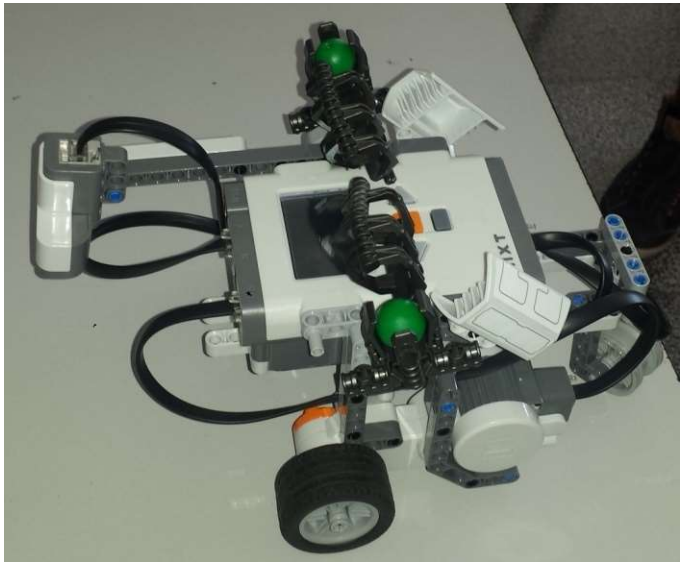










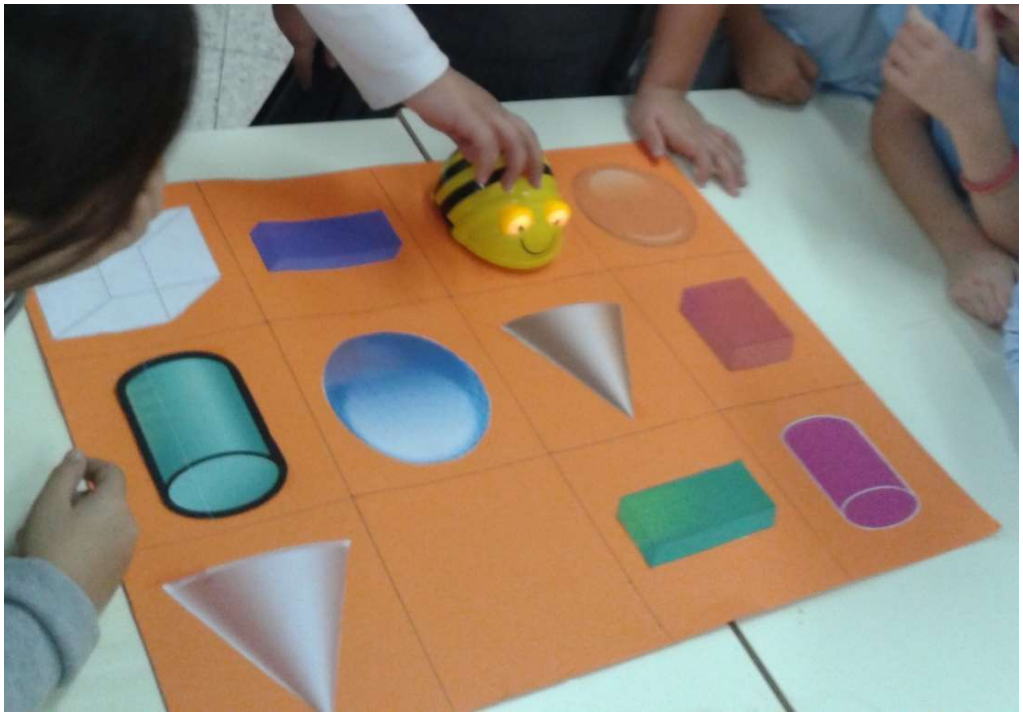


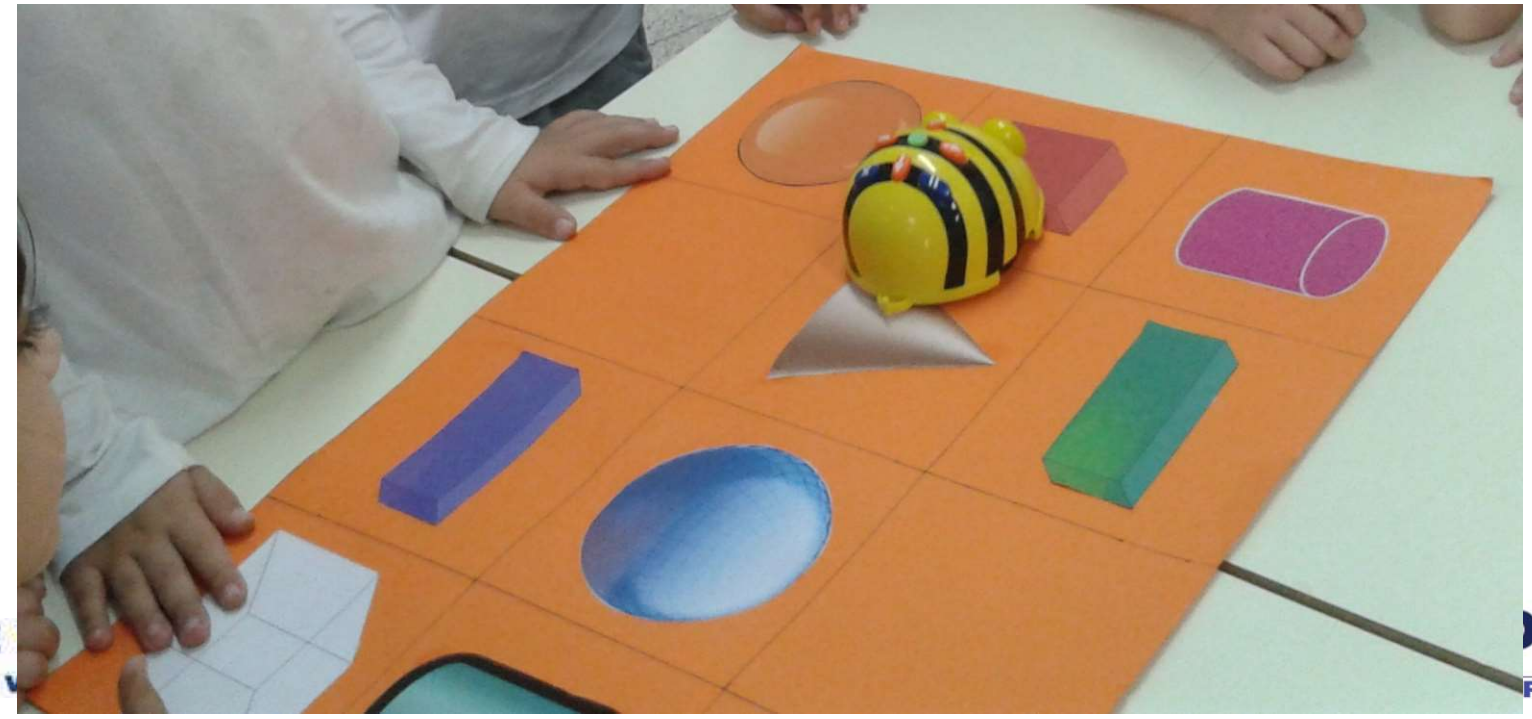

ΠΧΤ

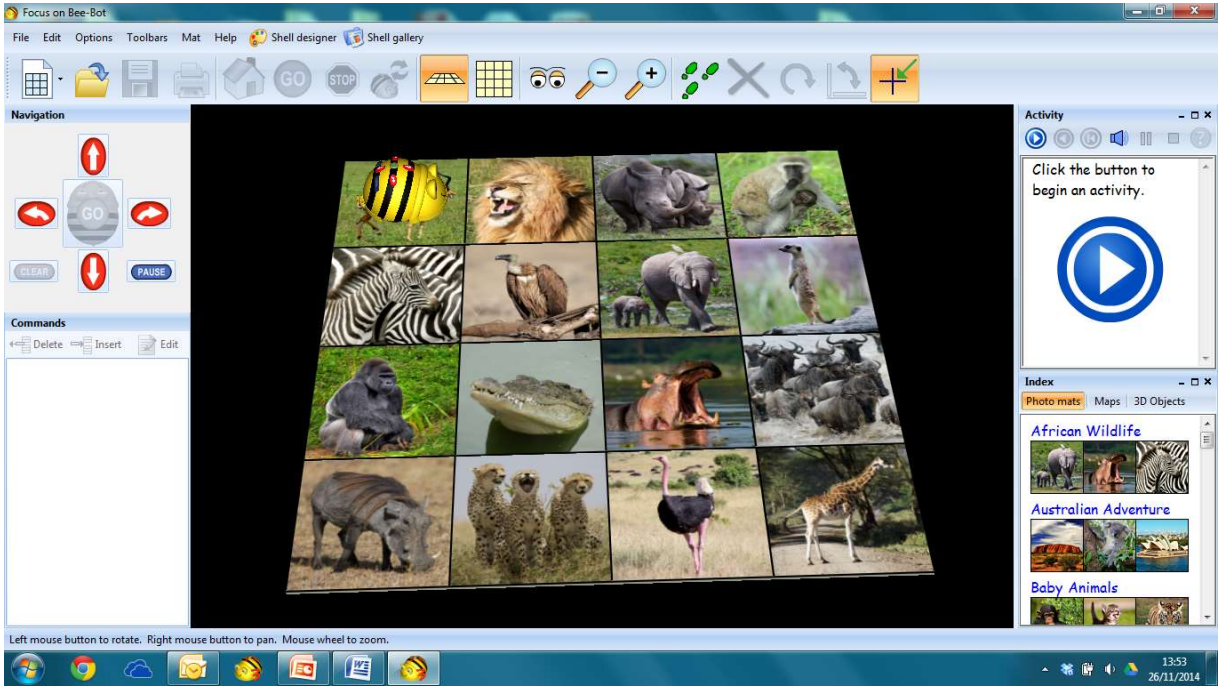
The Bee-Bot

Programming the Bee-Bot

Developing a floor mat






Focus on Bee-Bot
File Edit Options Toolbars Mat Help Shell designer Shell gallery
Navigation
GO
CLEAR
PAUSE
Commands
Delete Insert Edit
Activity
Click the button to begin an activity.
Index
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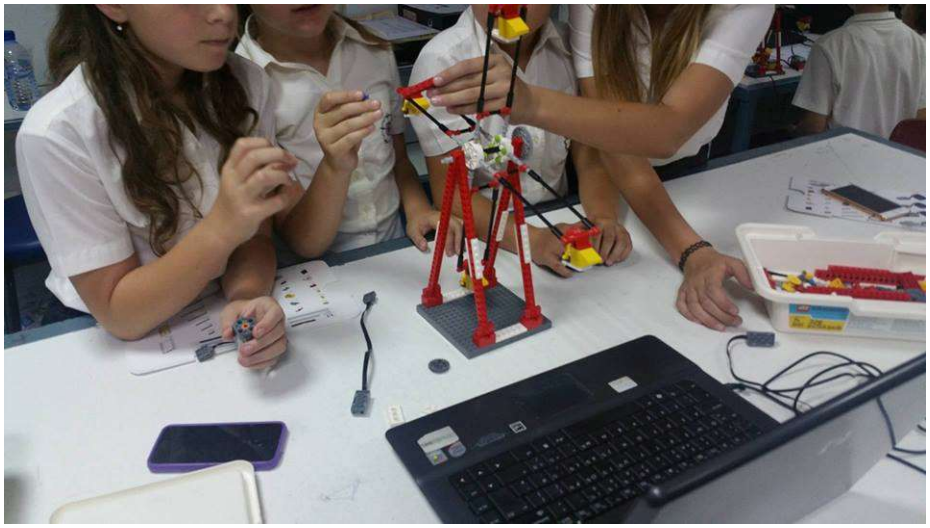
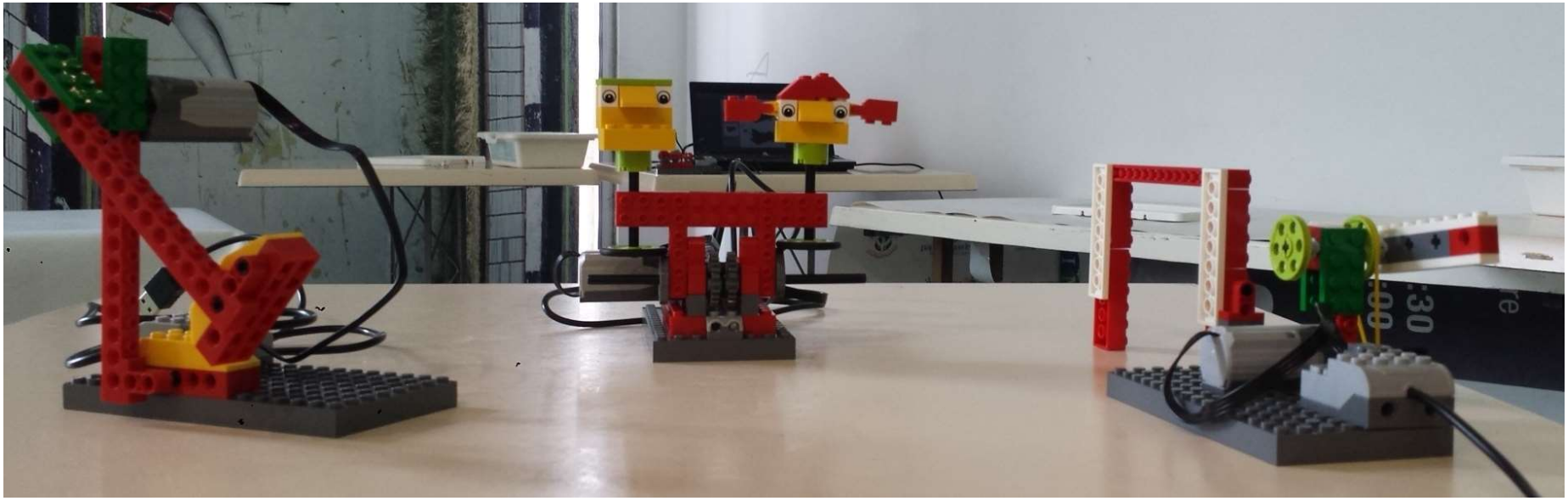
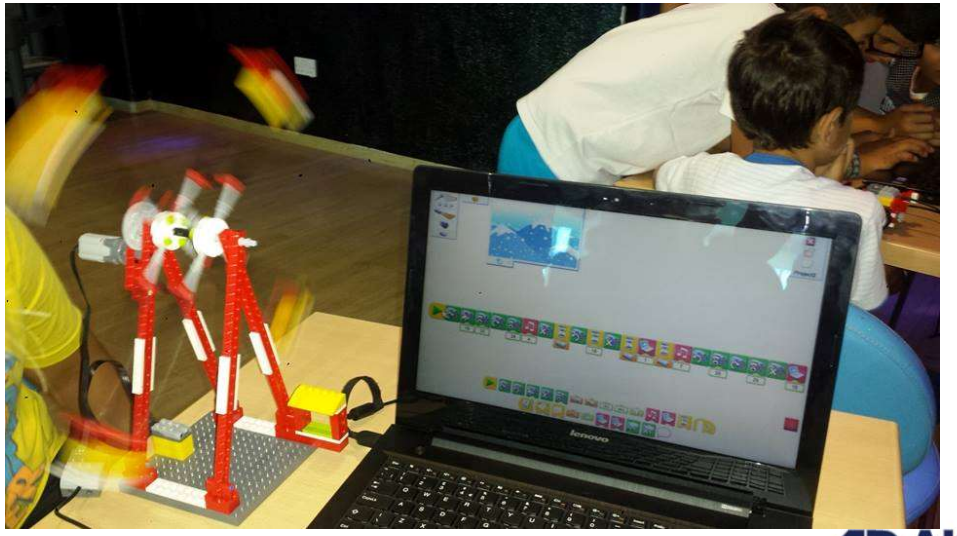
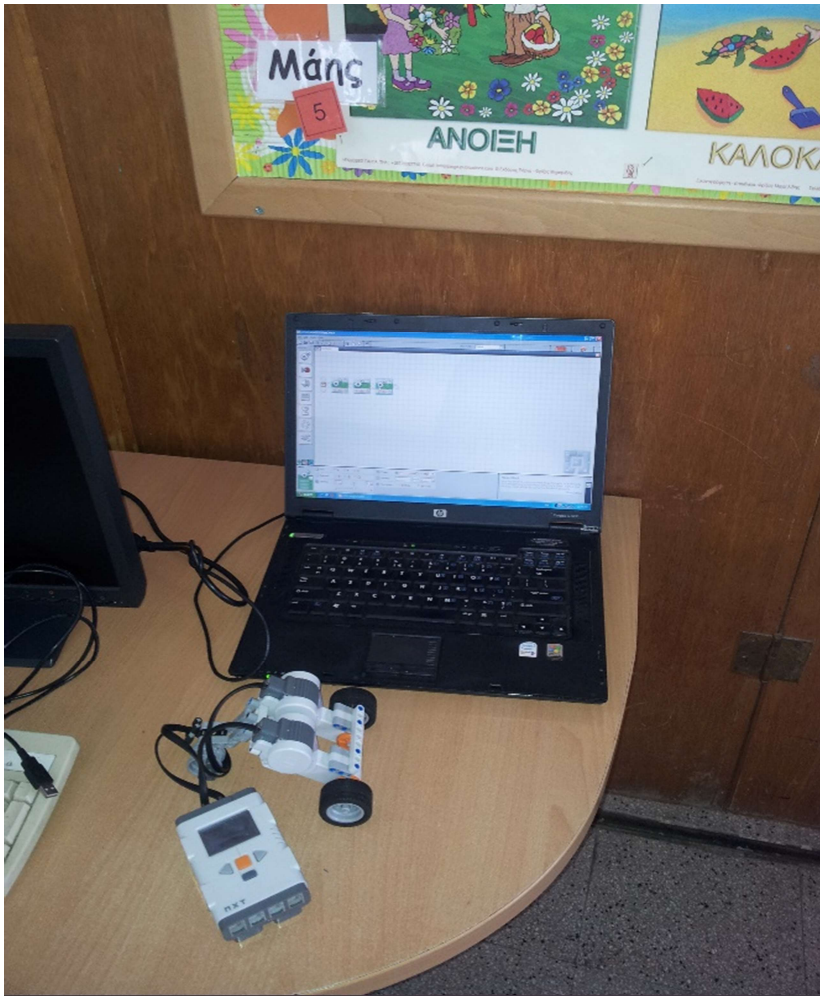
African Wildlife
Australian Adventure
Baby Animals
Left mouse button to rotate. Right mouse button to pan. Mouse wheel to zoom.
13:53
26/11/2014





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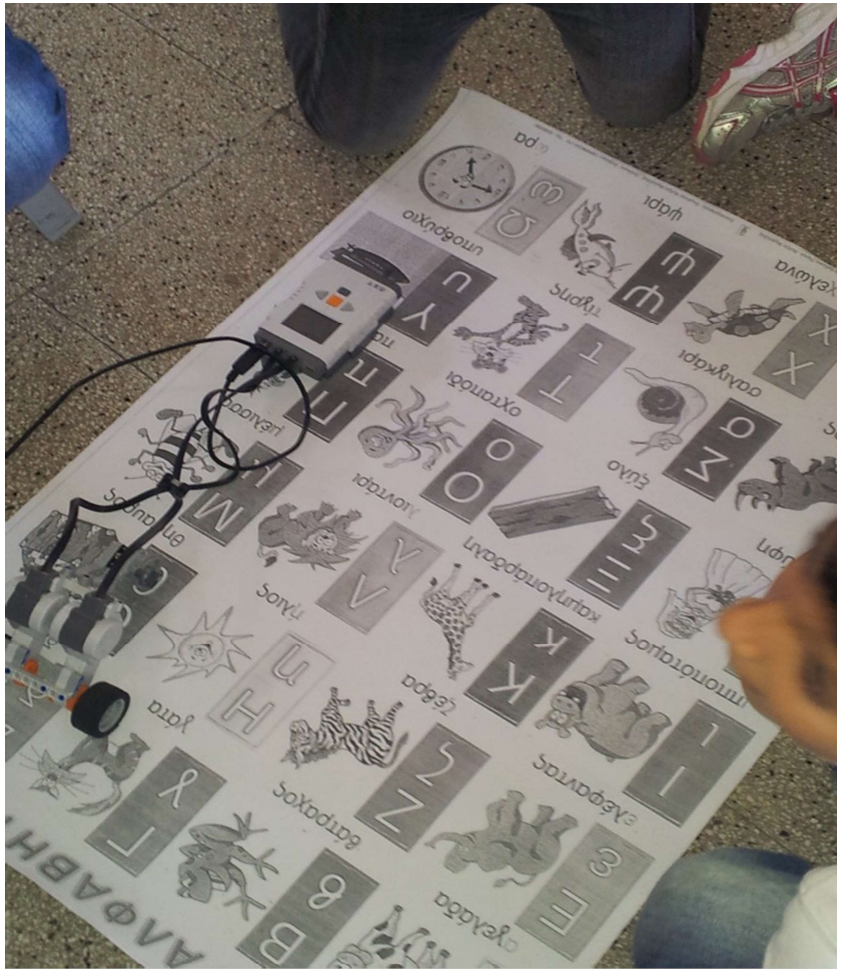

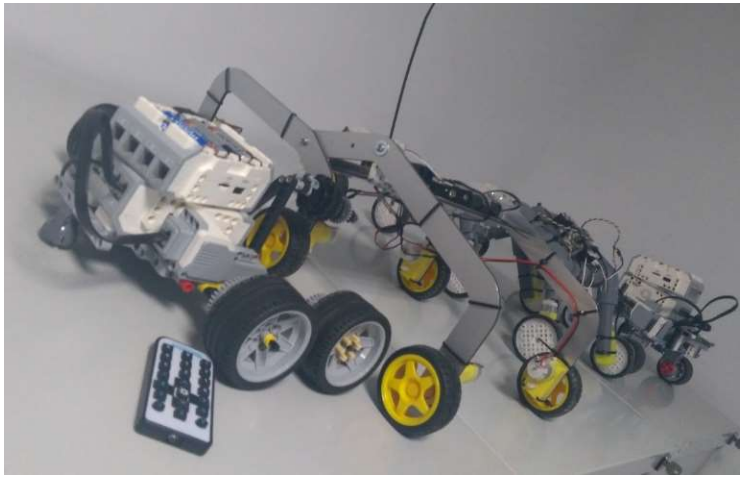

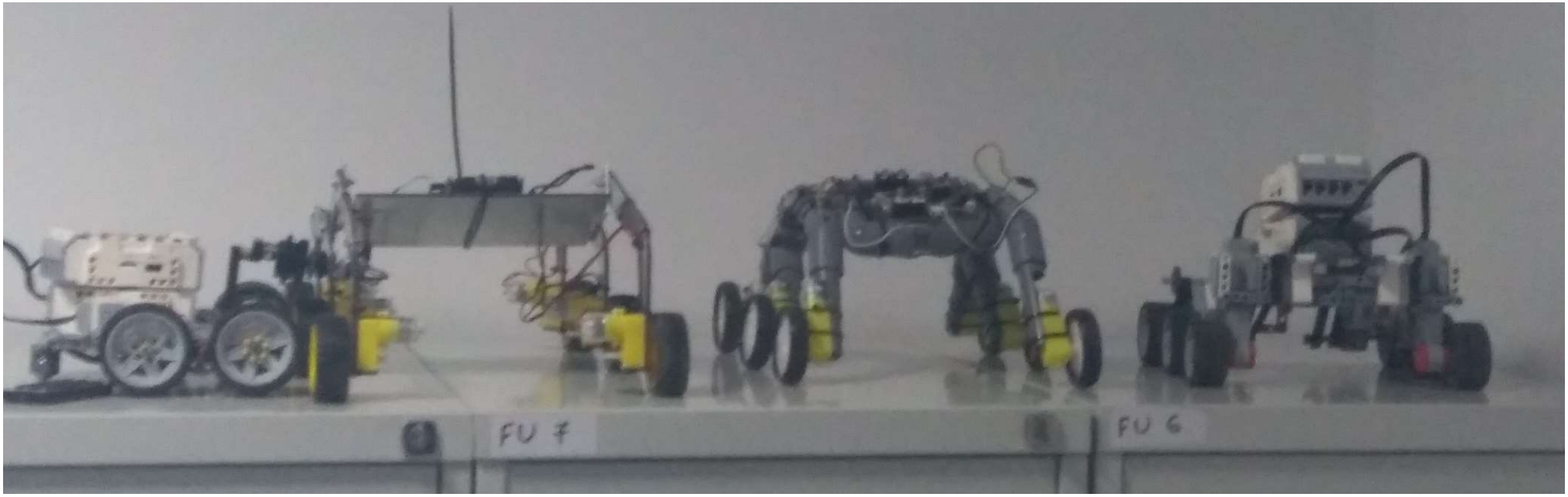
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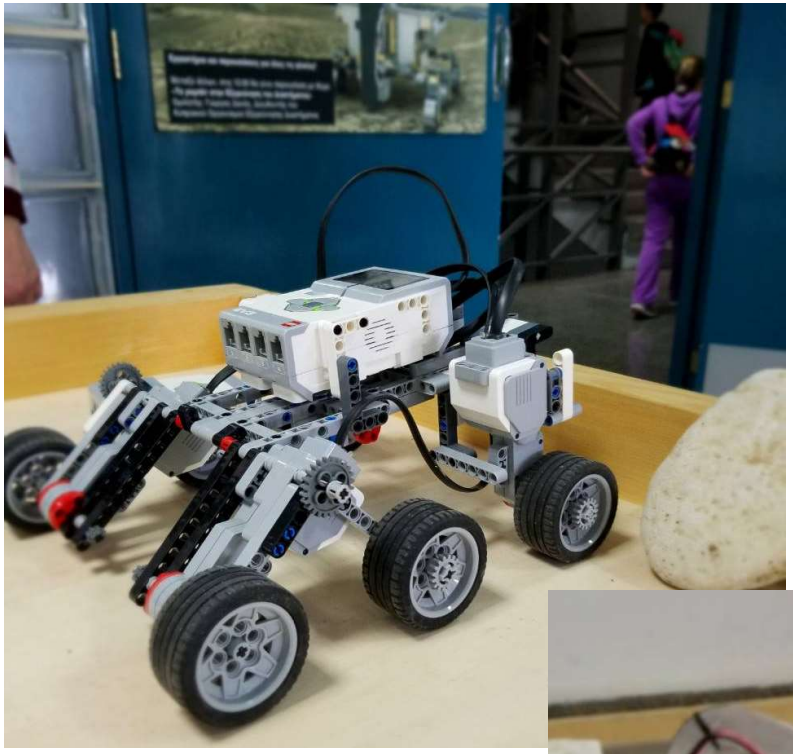

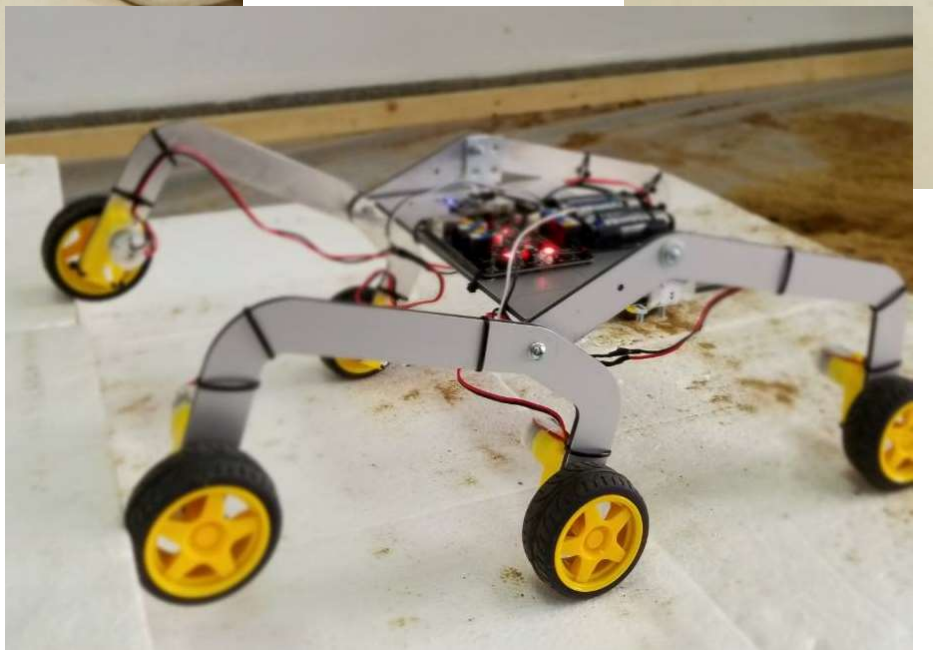


ΕΞΕΡΕΥΝΗΣΗ ΔΙΑΣΤΗΜΑΤΟΣ
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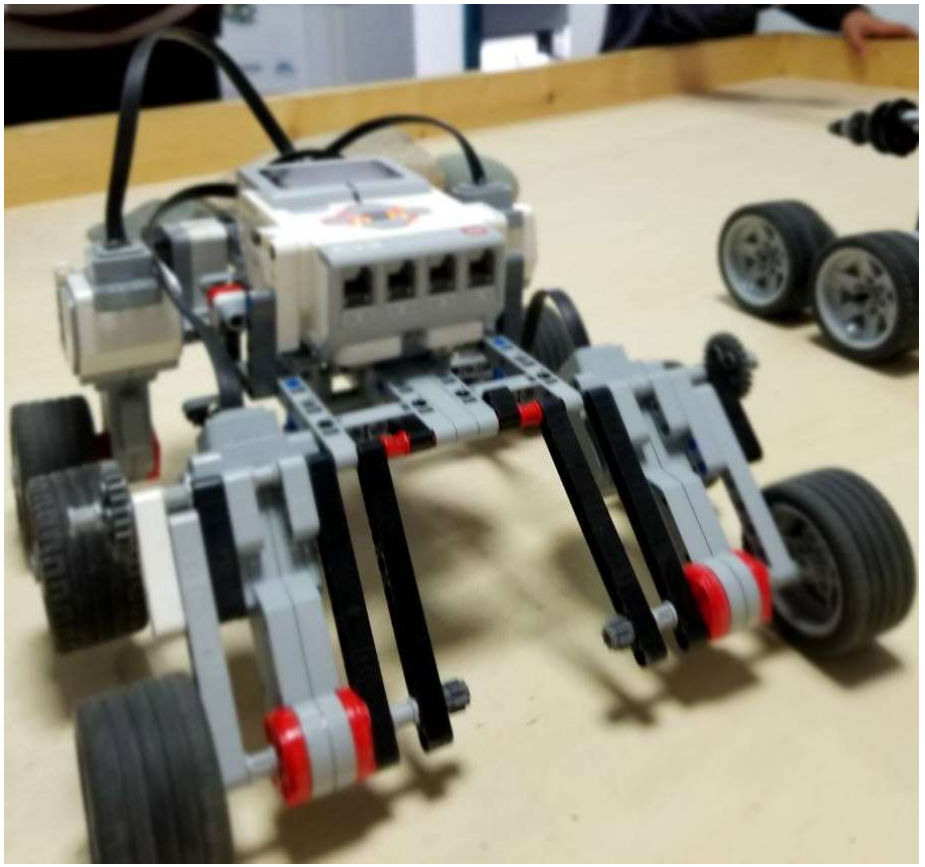

Thanks
Any Questions!

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