Mobile Resources on Education
let's learn with each other

Organising institution: National Association of Educational Innovation and Inclusion in Schools (AENIE)

Country: Portugal

Age: 15-17 years old

Key question: Robotics as STEM* approach connecting all of the curriculum

Objectives:

The main goal of the general program for Digital Atelier is robotics supports learning with a focus on problem finding and then problem solving.

Robotics provides students with opportunities to question, think about, and create technological tools, rather than just becoming passive uses of technology. It addresses five of the most important curriculum key competencies:

- thinking,
- using language, symbols, and text,
- managing self,
- relating to others,
- participating and contributing.

Time: 6 hours

Software and apps to be used:

- planar and spatial kinematics, and motion planning,
- mechanism design for manipulators and mobile robots,
- wireless networking,
- task modeling,
- human-machine interface, and embedded software.

Brief presentation: Robotics is, to a very large extent, all about system integration, achieving a task by an actuated mechanical device, via an intelligent integration of components.

A robot is a mechanical device, that can be programmed to follow a set of instructions.

Beginners in robotics can start by using robotic tools such as Sphero, Wonder Workshop and Lego Mindstorms. These are controlled by a smartphone, tablet or computer.

Apps that use simple coding, no knowledge of actual coding is required.

Topics covered:

- Computational Thinking

- Abstract Thinking
- Storytelling
- Writing skills

Civic engagement: Robotics is fun and suitable for children with a range of abilities. Robotics provides opportunities for:

- sensory learning – students are emotionally and physically engaged in their learning
- improved socialisation – students practice observation, listening, communication, and collaborative skills
- hands-on innovation – students question, problem solve and design solutions that potentially have real world value
- reinforcing skills useful in future employment – students not only learn how to create and control technology, but also practice key skills needed in the future workforce
- learning to program – students learn to control a robot with precise instructions.

But not everything can be beneficial: Ernst & Young (EY) estimates that in seven years one in three jobs can be replaced with smart technology. The University of Oxford estimates that 47 percent of the jobs we know today are doomed to disappear over a 25-year horizon, and a study now released by CB Insights ensures that automation and robotics will put more than 10 million jobs at risk in the next five to ten years.

So what to do?

Technological advancement is very important. It helps man, it can not, nor should be a problem. The machine comes to help, but it can not replace everything and everyone.

With due differences, artificial intelligence and automation are a similar challenge. They will require a bet on the training, because only it will give the necessary tools, to be up to the challenges that quickly come to us. We can not "fight" against what we do not know, to overcome an "enemy" we must know it.

Materials needed:

Beginners: Pet bottles, cardboard box, straws, papers, bladders, tapes, sets with wheels and axles, among others.

Advanced: robots, arduino, computers, smartphones, graphic boards, Microcontrollers... Nowadays materials for advanced or initiating in robotics are very accessible, being possible to use these resources in most schools.

Main inspirations taken from personal research:

- "Programming should be a second language, taught to all children";
- "Learning to program increases the mind, helps to think better";
- "teaching robotics in school is becoming an increasingly indispensable part of the curriculum";
- "seven areas in which learning about robotics at school can benefit students: Creative thinking, Engagement, Preparedness, Programming skills, Perseverance, Teamwork and Fun".
- "Robots won't just take jobs, they'll create them"

Learning for wellbeing is one of the main areas of interest in education nowadays. It is now known that a happy and fullfilled student is capable of overrun much easily their obstacles.

Pupils could have the opportunity to study Robotics using the Lego Mindstorms robotics system. Through this methodology students learn the elements of 21st Century skills like algorithmic thinking and basic computer programming skills in a non-threatening, fun and hands-on environment, promoting the well-being of students.

How do you plan to give voice to students to present or show their personal skills and knowledge?

Beguinners Strategies: Starting conducting a survey with students about robotics. The teacher should explain what robotics is, by asking everyone to register in their notebooks. Divide the class into groups with 4 students and guide them in the construction to be carried out: for example, a car that locomotive alone. Ask them to make a sketch of the building, checking what materials are needed. Each group must carry out a construction, and it must move at least 30 centimeters. During the execution of the construction, the teacher will pass in groups, guiding them to the chosen system for locomotion (batteries or battery, bladder filled with air, etc.).

Mark the date for the finalization of the works and their presentation to the class. At that moment, the cars will be aligned on a tape glued to the ground, and, at the start signal, go through the 30 cm, reaching the point of arrival.

Properly structured, group projects can reinforce skills that are relevant to both group and individual work, including the ability to:

- Break complex tasks into parts and steps, -Plan and manage time,
- Refine understanding through discussion and explanation,
- Give and receive feedback on performance,
- Challenge assumptions,
- Develop stronger communication skills.

Group projects can also help students develop skills specific to collaborative efforts, allowing students to:

Tackle more complex problems than they could on their own, -Delegate roles and responsibilities,

- Share diverse perspectives,
- Pool knowledge and skills,
- Hold one another (and be held) accountable,
- Receive social support and encouragement to take risks,
- Develop new approaches to resolving differences,
- Establish a shared identity with other group members,
- Find effective peers to emulate,
- Develop their own voice and perspectives in relation to peers.

How do you collect information as the starting point of a Digital Atelier?

1. Analyze the constructions, asking the students to explain to the class what worked, what could be improved, what was observed in the work of another group and what could be used in future work.

2. Expose the buildings in a place in the school, stimulating the curiosity of the school community. Or perform a car race in the range, for example.

During robotics classes, students initially know the parts that come in the kit, such as light, range, proximity, contact and temperature sensors, a control module, servo motor, wheels, screwdrivers, batteries and chargers. From there, the group thinks about the object they want to assemble.

Introducing students to the key question – the research begings:

Most applications associated with robotics have a fairly autonomous component, with a lot of creativity and self-discovery, allowing the student to be totally immersed in the activities and quite focused on the final goal. They are also often interdisciplinary.

Cargo-Bot: In this game the objective is to move a robotic arm fulfilling various goals. It includes something very simple that very few other programming applications have: an initial difficulty selector. The child can start at a high level directly or at a lower level, depending on their abilities and previous knowledge.

Tynker: It is an application to create games using programming. It is so intuitive that children can learn how it works on their own, by messing with just a little bit of it. It also allows controlling, for example, the Sphero robot, the Parrot drones or the Philips lights.

Experimental phase

1. Action that unfolds the practical activity to clarify the question (experimental phase):
2. Active work of the students: Students organize themselves in groups to practice the collaborative work and teachers encourage them, when a doubt or problem arises, to talk before with the colleagues, to seek tutorials and information in the internet, to build together. The teacher enters as mediator between the students and the tool. Also because teachers do not know and learn with them. The traditional classroom format doesn't allow this. Often technology is seen as a time optimizer, but it is necessary to think of a workload that is sufficient for the student to construct and reflect on. Technology can't be a tool to make the student learn faster; it serves to give autonomy, emancipation and stimulate creativity.
3. Presentation of findings and results (visualisation of information): The final product can be presented in several formats/materials, but with a strong electronic component that makes movements, sounds and awakens the attention of the observer.
4. Analysis of results: Is done jointly by the teacher and student plus school community.

Project/design phase - part 1

1. Second action that unfolds the practical activity (project/design phase)
2. Active work of the students: Then they will be given time to create their solution on tinkerCad When the solution is finally created they are going to learn how to prepare the .obj or. Stl files on Simplify 3D When they finish this fase they'll be ready to move on to the last phase of the atelier.
3. Presentation of findings and results (visualisation of information): Findings can be presented making use of Microsoft powerpoint or other app on tablets.
4. Analysis of results:

Approach to a new software or a new app: The students will be directed by the Professor, being able to observe tutorials if necessary of the different digital software / platforms. The teacher will only be a guide/ mediator in the whole teaching-learning process.

The teacher, by itself, does not need to be an expert in technology. However, it is essential that he shows enthusiasm for her, after all, as educators, they want to get students' attention to their classes, and there is nothing currently that draws more attention to children and young people than technology. As educators, teachers exert great persuasiveness on their students and by demonstrating enthusiasm for technology, they can inspire their students to become the modifying agents of tomorrow's technology.

Links between the Digital Atelier and real life of the students: Some activities feature a real-life component of students since they are often replicating their ideas and dreams.

How do you plan to evaluate knowledge and skills?Through evaluation criteria's relevant to this area of education, considering the topics of an educational robotics class that should be evaluated: robot assembly, robot programming

and the resolution of the interdisciplinary proposed activity. In addition to these criteria, there are points about social relationships that are also relevant in educational robotics classes, such as social interaction, teamwork, concentration, creativity, participation, among others.

Conclusion: An introduction to robotics contributes to the fight against school failure. Robots enable project-based teaching, and change the learning environment by making it more flexible and less stigmatizing, especially for students experiencing difficulties. The word robotics refers us to robots that perform specific functions accurately. However, working with robotics is to build robots or other mechanisms that have autonomy to perform certain tasks, such as getting around. Therefore, conducting robotic experiments is accessible to all people, and we can execute them with scrap, elaborating interesting and functional constructions, like small cars, rockets, submarines, among others. In today's' technology-driven world, it's important now more than ever to prepare students for the future. Teaching robotics to young students throughout their schooling can increase their ability to be creative and innovative thinkers and more productive members of society. Many governments have already recognized the importance of robotics in the classroom and have begun to create programs and laws that would incorporate it into their public education system. By teaching our students the basics of robotics, we can open a whole new world to them and exciting opportunities that they wouldn't have access to otherwise.

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