

Module 3: Educational Robotics – Example Activities

There are many examples that demonstrate that we can increase the interest in STEM subjects if we change the way in which we work, starting from the first grades of schooling.

Today I would like to give you some suggestions, selected from some of my lessons, on how to make children grow many competences, starting from problem solving, math skills and digital literacy, using unplugged coding activities, first, and some simple games and projects involving also some robotic kits later.

Why use Educational Robotics?

Robots capture the interest of the students, because they are related with games. Robots promote team working and collaboration among students, which are powerful means of deepening the learning methodology.

In kindergartens and early-elementary classrooms, manipulative materials and games play an important role in children's learning, enabling children to explore mathematical and scientific concepts (such as number, shape, and size) through direct manipulation of physical objects.

Using Educational Robotics at Primary Level

To start out with I would introduce young students to a programming language, by making them practice with a little game, to be sure they understand what is a "procedure". After such introduction we can then start to use robots.

Blind one volunteer with a scarf: he will be a "submarine"; ask another participant, "the pilot", to put his hands on "submarine's" shoulders and drive it from one point to another, following the instructions of classmates.

As we want to work only with lower level instructions, the only possible commands should be:

- "one step ahead"
- "turn that side" (meaning by this, turn 90° on the right,)
- "turn this side" (meaning by this, turn 90° on the left)

After this first icebreaking game, it is now time to put on the floor some coloured circles for the "orientation" game.

Participants are split in groups: one of them is the "executor" who moves over the game surface, the others are the programmers, who have to "compile" the procedure to make the executor move from the start and reach a certain target, while solving some problems and completing levels, like in a digital game.

Little children love games. To help them become "makers" and build their own games, it is possible, after practicing the coding hands-on activity on the ground, to introduce them to the use of a simple programming language, like Scratchjr, and ask them to "help the seahorse" to reach "the seafish". Then, to fix the concept, some lessons will use the BeBot,

that is perfect because it uses the script “forward, left, right” making it moving through colors.

Teachers can use robots to teach many subjects: they can develop, for instance, concepts such as sensing, that is the perception of the environment by exploring the use of sensors on the robots.

Of course, when working with little children, the approach is different. If we want to study some facts about crocodiles, things are more engaging using distance sensors to make the crocodile’s mouth closing when an object is coming near. In the video you can see, anyway, that the teacher has to make some little adjustments, stopping the program, to increase the sense of mystery in the narration!

As children grow older, and learn more advanced concepts, the educational focus shifts away from direct manipulation to more abstract formal methods. It becomes very useful to employ some learning mediators such as “computationally-enhanced manipulative materials” (Resnick) which aim to enable children to continue learning with a “kindergarten approach” and helps them to learn concepts and grow competences that were previously considered “too advanced” for them.

For example, the use of robotic kits like Lego WeDo, together with Scratch Programming, improves the learning process, in fact the children can understand the link between the hardware movement and the specific program that they wrote.

A simple activity that helps in this purpose shows simple effects of rotations and the rotation direction

Working with older students, like those in the 4th or 5th grades, it is possible to introduce cause-effects actions, like those that we gain when blowing into the microphone or using the distance sensor.

The power of motors, and the turns of the mill, infact, depend on the intensity of the blow, or the distance measured. Best results come when observing the velocity of wheels, while blowing into the sound sensor of a Lego Mindstorm, while using the “test sensor” program on the brick.

I hope these examples have provided you with an idea of why and how you can start to use robots in your classroom.