The use of Educational Robotics and e-learning
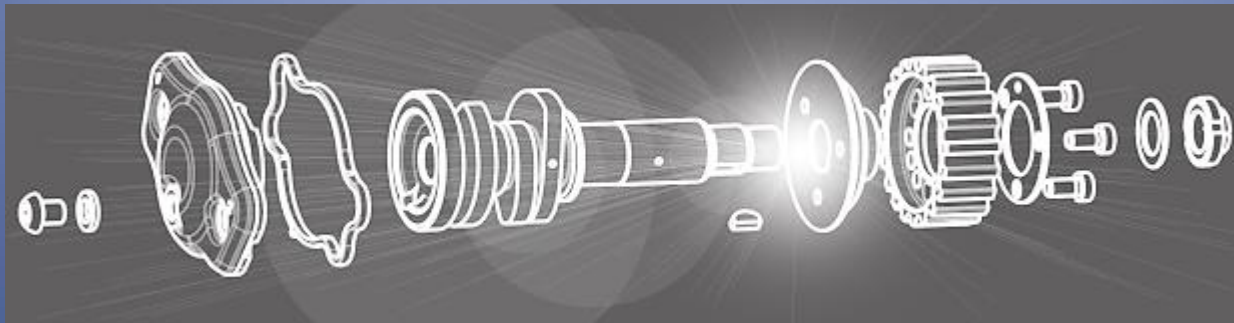
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EDUTRONIX Conference - Innovation in education
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Background

- Mechatronics: as a multidisciplinary approach it needs the contributions from different disciplines (Informatics, Electronics, Meccanics)

- Robots in the classroom will give students a more interesting (and fun) vision of science and engineering

- The students will be able to observe directly the practical application of theoretical concepts in the fields of mathematics and technology

- The e-learning methodology allows to create a course in a modular and multimedia way

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Robotics

Robotics are a key tool to stimulate education in the 21st century and, therefore, to counteract the low relative interest in science

Robotic was introduced in the Italian schools of many regions.

Robotics allow to develop **research** in Secondary School involving polytechnics / research centers.

The collaboration between public and private and the interaction between school and university, allow to build a **new training model** with knowledge and skills that can be spent both in the workplace and in the university.

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Educational Robotics

In the world of school, educational robotic can be used as a tool not only for innovation, but for the development of professionalism and skills in the technical and scientific field.

__What__ is studied, __when__ is it studied, __how__ is it studied?

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What is studied?

Two main categories:

robotics and computer education (a general instilment of the awareness of technology that could be referred as **technical education**)

and **non-technical education** (science and language).

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Technical education

- **Technical education** is the notion of giving students the knowledge of robots and technology:
  - the aim is to introduce computer science and programming and to familiarize undergraduate students with technology.

A lesson plan usually involves first an initial introduction to programming the robot (introduction phase) and then the students apply their knowledge practically by making their robots work (intensive phase)

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Non-technical education

The second observed domain in the area of robots in education are **non-technical subjects (such as the sciences)**

The employment of robots as an intermediate tool to impart some form of education to students, such as **mathematics and geometry**

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When is it studied?

The use of robots in education is either intra-curricular or extra-curricular.

Intra-curricular activities are those that are part of the school curriculum and a formal part of the syllabus.

Extra-curricular learning takes place after school hours at the school itself as workshops under the guidance of instructors, at home under the guidance of parents

One could even include some robot competitions (they can also take place towards the end of the learning activity and are a form of assessment-based learning)

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Competitions. What is First Lego League?

Guided by adult Coaches, *FIRST* LEGO League teams research a real-world problem such as food safety, recycling, energy, etc., and are challenged to develop a solution. They also must design, build, program a robot using LEGO MINDSTORMS® technology, then compete on a table-top playing field.

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FLL Competencies

It adds fun while the students learn to apply science, technology, engineering, and math concepts (STEM), plus a big dose of imagination, to solve a problem.

The students develop critical thinking and team-building skills, basic STEM applications, and even presentation skills, as they must present their solutions with a dash of creativity to judges.

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FLL IMPACT

Over 88% are more interested in doing well in school, and 87% have more interest in attending college.

FIRST LEGO League teams get to:

- Research challenges facing today's scientists

- Design, build, test and program robots using LEGO® MINDSTORMS® technology

- Apply real-world math and science concepts

- Learn critical thinking, team-building, and presentation skills

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How is it studied? Which Pedagogical Theories underpin research on Robots in Education?

Research in robots in education lends itself well to the constructionism theory and is by far the most adopted in robotics curricula

Most robotics curricula are hands-on, encourage students to think and be creative and are based on problem solving

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E-learning courses

The model to be used for designing e-learning courses is shown in figure and covers 5 stages:

Access: To fine-tune the environment that needs to be easily accessible and logically well-organized, decide whether the structure at the course will be sequential (linear sequence between arguments and concepts), or parallel type when there are cross-linking elements between concepts and arguments of multiple modules;

Socialization: to allow clear identification of learners;

Group work: the learner needs to be familiar with the environment and with the other learners to achieve collaborative learning;
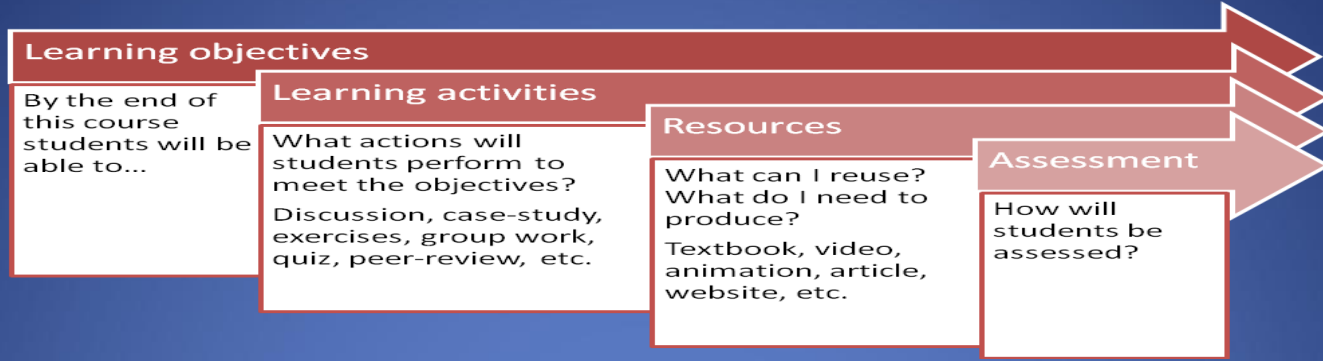
Group discussion: Create discussion groups for cooperative learning;

Development: The learner is the creator of his learning.

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E-learning platform

The e-leaning platform must foresee how the learner will learn and then define online learning activities for a specific period of time. It will then consist of 4 levels of intervention, as shown in Figure:

Learning objectives: learner learning objectives,

Learning activities: planned didactic activities that enable the achievement of objectives,

Resources: Educational materials made available to the learner,

Assessment: verification and evaluation tools (self-assessment).

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The Advantages of eLearning Training

Flexibility – eLearning can be done in short chunks of time.

A set amount of learning, normally divided into modules, so you can work on those topics you want to focus on.

Tailored to you – eLearning courses aren't confined to be fixed to try and suit the needs of the majority. Everyone is able to learn at their own pace – a massive factor that only eLearning can provide for.

Technological Possibilities – The computer based nature of training means new technology is being introduced all the time to help with the learning.

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The Disadvantages of eLearning Training

Lack of Control – Learners with low motivation tend to fall behind when using eLearning as there are no set times to be doing it and they are responsible for the organisation themselves.

Learning Approach – It doesn't appeal to all learning styles so some learners will not enjoy the experience – especially strong activists and pragmatists.

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E-learning support for a course of robotics

One example: The course can be built in BlackBoard environment (a virtual learning environment and course management system developed by Blackboard Inc.), and many different e-learning tools can be used during the course (multimedia materials such as video materials about robots, tests, discussion groups, etc.)

Many tools for communication and additional structures to support learning can be used:

- Forums - to solve learning problems, discussing interesting matters, exchanging experience.

- Chat room - here teachers and students meet online by a scheduled timetable during the course. Students can receive fast feedback to their problems.

- List of terms - as robotics brings along many new terms

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Another use of Web based learning: remote control

Remote-controlled robot can be developed. It's useful if If one has no robot, but wants to program one:

A person can prepare a program to govern this robot at school (or his/her home).

Subsequently (s)he will have to reserve a "robot time" with a robot (located in another place or Laboratory) using a web-based reservation system, and upload his/her program to the server. In a given time (s)he will be granted a possibility to load remotely the program from the server to the robot using Bluetooth connection, and to start it.

To be able to see what happens, video connection will be set up. During the devoted time the author of the program can make corrections in his/her program and run it repeatedly.

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Conclusion

- We believe that not only are robots built on advanced technology but they also provide a tangible and physical representation of learning outcomes: a valuable aspect of employing them in education.
- We encourage pedagogical experts to further understand the practical aspects of the utilization of robots in education.
- We highlight the added value that robots can bring to the classroom in the form of a stimulating, engaging and instructive teaching aid.
- We promote E-learning methodology because it is useful for theoretical course cases and it can, also, gives serious support to a very practical course like the course of educational robotic.

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