Co-funded by the
Erasmus+ Programme
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PONTAL: Preventing NEETs status through active learning

Intellectual output 2:

A set of courses based on the "action learning" method – ROBOTICS AND CODING

Content:

Introduction

This material was created as a tool to support technical education involving Action learning and robotics.

Aim of the course:

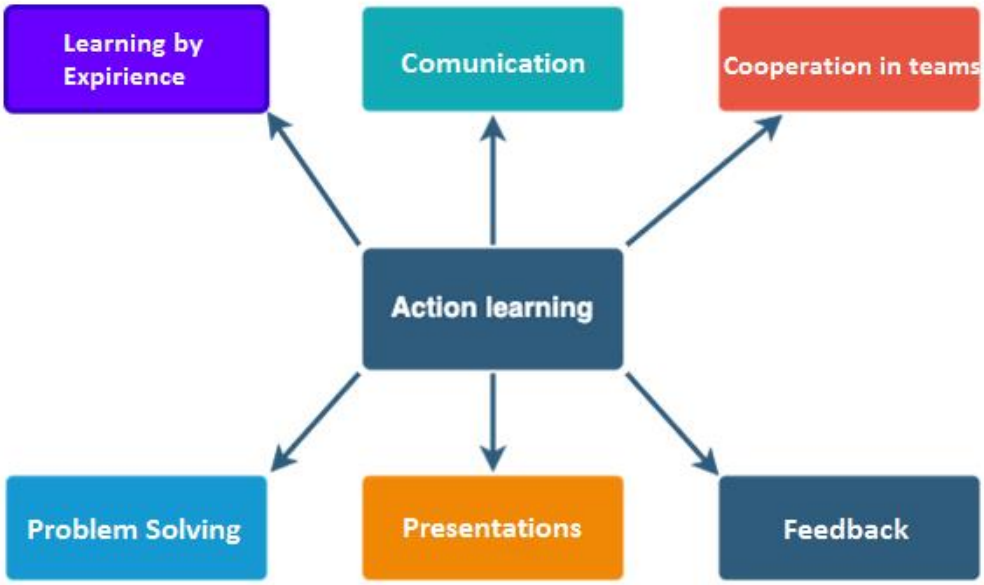
At the end of the course, participants will be able to:

Create a PC-controlled robot with a laser cutter that can move arms, turns on and off the "eyes" and, if approached by a hand, changes the "face color" to indicate the "state of mind" of the robot. The object is connected to the PC and controlled by Arduino, also via Scratch (S4A).

Coding techniques to animate, program and move elements to tell stories through the use of visual block languages such as Scratch / Snap.

Approach to information technology and computers as "clay", a creative tool to be integrated with other tools (reading, writing, calculation) to express oneself, "create" "solve problems".

Action learning:[1]



Action Learning is a process for developing creative thinking to solve complex problems of individuals, groups of people and corporations. It involves taking steps to solve a problem and consequently evaluating the effectiveness of those steps. In other words, one tries to learn from solving real problems. Later on, we can formulate a new, more effective solution to the problem and put that solution into practice.

Building teams and transforming organisations is being promoted as one of the most effective and cost-effective tools for problem solving, developing managment and leadership skills,. The great potential of Action Learning lies in the simultaneous achievement of all the described objectives.

This is an effective approach to development at all levels (e.g. individual or organisational). It is considered particularly well suited to team approaches to problem solving, effective learning, and to assist in team building within lessons, groups and organisations.

Action Learning uses cyclical learning. The acquisition of new experiences (ACTION) is followed by the need to look closely and think carefully about them (EXPLORATION). This is followed by forming general conclusions based on previous experience and comparing them

[1] Source: https://www.tcbs.cz/cs/action-learning/

with theory (LEARNING). The next step is a practical test (APPLICATION). It naturally leads to gaining new experiences, reviewing them...

Benefits of Action learning approach:

- by using this method, participants learn from the consequences of their own actions, find their own solutions and reach their own conclusions,
- students learn by experience and are thus able to remember much more
- they develop imagination, creativity and social communication,
- students learn to overcome obstacles individually and in groups,
- feedback and reflection are important,
- motivates learners and set a goal, showing, how to achieve it,
- competition has a positive effect on the method, it motivates learners to perform better,
- combines play and education,
- acqusition of key competences.

Picture 2: Actiopn learning vs academic education

ACTION LEARNING	ACADEMIC EDUCATION
Asks questions. Students are searching for answers with lectors.	Asks questions. Answers are given by teachers.
Students are working in teams.	Students are searching for answers individually.
Develops creativity and forces to think in a broader context.	Supports the context-sensitive perception of reality.
Experience and knowledge can be practically and very quickly applied in practice.	Knowledge needs to be verified over a long period of time, repeatedly, and then only practically used. The opportunity for this does not always arise.
The aim is the student's ability to apply the acquired knowledge in solving real situations with measurable benefits.	The aim is to pass a test demonstrating the ability to repeat the theory.
The result is the student's understanding of the context, "I taught them".	The result is the student's completion of a written, oral or other formal examination.

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History of the Action learning:

The spiritual father and pioneer of the Action Learning method is the world-renowned english manager and university professor Reginald William Revans (1907-2003). In the 1950s, he came up with the revolutionary idea that a successful organisation must be constantly learned.

R.W.Revans found that people learn much more easily, quickly and permanently by sharing their mistakes. Much more than by absorbing theoretical knowledge. He developed and promoted the method called the Action learning troughout his life.

[2] Source: https://www.tcbs.cz/cs/action-learning/

Robotics and Coding

Identification Data:

- School to which the initiative is addressed:

"GIULIO CESARE" COMPREHENSIVE INSTITUTE IN SAVIGNANO SUL RUBICONE FC

Training Content:

Purpose

Raise awareness and bring students at risk of school dropout closer to the technical-scientific fields of Robotics and prepare access for the skills of the future.

Aims

Build your Robot
Create a PC-controlled robot with a laser cutter that can move arms, turns on and off the "eyes" and, if approached by a hand, changes the "face color" to indicate the "state of mind" of the robot. The object is connected to the PC and controlled by Arduino, also via Scratch (S4A).

Coding techniques to animate, program and move elements to tell stories through the use of visual block languages such as Scratch / Snap.
Approach to information technology and computers as "clay", a creative tool to be integrated with other tools (reading, writing, calculation) to express oneself, "create" "solve problems".

Possible fields of experimentation:
• Coding and making (with devices like Arduino or Microbit).
• Coding and sensors (building detectors by connecting them to a PC for environmental monitoring).
• Coding and digital programming (build a remotely programmable machine).

Methods of implementation

• Introduction to coding languages.

• Computer programming using dedicated software (computer room).

• Remote machine control experimentation.

• Experimentation and control of motor and colored lights.

• Development of projects and final group exhibition in plenary (Hackathon type).

• Work in groups.

(Robot purchase is expected)

Main Methodology:

The aim of the project is to acquire ICT skills in the Coding of its applications to Robotics with analysis methodologies to be applied to Thinkering and use of the main Software Tools for the creation of prototypes also using resources from the Data Base of the school. These skills help to define the educational figures and also those most requested by the labor market.

The main methodology is Group business meetings:

- Introductory measures to Coding and computational thinking.
- How coding and computational thinking can be used to animate objects and elements through the construction of prototypes built by the students through projects, which are then inserted into the curricular program.
- Cooperative Learning for group and group learning.
- Tutoring.
- Implementation of peer-to-peer designed experiences.
- Approach to Thinkering
- Frontal lessons
- Laboratory activity with classroom tutors.
- Use of the computer lab.
- Final Mini-Hackathon: the kids show their project and how it works.

Expected Results:

a	Computer programming knowledge. Use STEAM independently.

b	Creating a Hi-tech product through robotization and prototyping
c	Dissemination of products within the school for the improvement of communication between the parties and the sharing of good laboratory practices to facilitate educational innovation.
d	Activation and re-edition of activities integrated with curricular teaching.

Duration Of The Training Project:

- Expected start date: MARCH 2022
- Expected end date: MAY 2022
- Indicative frequency of the meetings: WEEKLY
- Total number of hours foreseen: 16

Content of Lessons:

MODULE TITLE: LESSON 1 HOUR 2

Introduction to STEAM
Robotics Coding and 3D prototyping

AIMS

- Introduction to STEAM disciplines.
- Science, Technology, Engineering, Arts and Mathematics as an enrichment of skills.
- STEAM for interdependent projects and knowledge.
- STEAM from design to everyday life: models for thinking and solving.
- STEAM and creative thinking.
- STEAM learning and everyday life, from knowing to knowing how to do.

CONTENTS

- Introduction to STEAM languages.
- Application to real problems and simulations.
- Operationalize disciplines into operational projects.
- Hints on creative thinking and Thinkering models
- Practical example.

METHODOLOGY AND ACTIVITIES

Cooperative Learning introduce STEAM technologies through group work and are aimed at acquiring ICT knowledge The principles of Thinkering.

Methodology to be used:

- Frontal Lesson.
- Laboratory.
- Case history.
- Cooperative learning

ACQUIRED SKILLS

At the end of the course the student will be able to:

- Understanding the scope of the disciplines.
- Know their application.
- Identify the codes of thought.
- Making connections in practical life.

MODULE TITLE: LESSON 2 HOURS 2

Coding and Making (with devices like Arduino or Microbit),

AIMS

- Introduction to computational thinking.
- Conception, programming and verification of results.
- Learning to **Thinkering**
- The disciplinary bases of **Coding**
- Design a device.
- Introduction to intelligent systems: **Arduino** and **Microbit.**

CONTENTS

- Platforms for learning.
- Simulate machine control.
- Use a computer system for remote control.
- Assemble and program.
- Verify operation.
- A practical example.

METHODOLOGY AND ACTIVITIES

- Frontal Lesson.
- Laboratory.
- Case history.
- Cooperative Learning.

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Use learning platforms.
- Set up a simple program for remote control.
- Develop basic programming.
- Making connections in practical life.

MODULE TITLE: LESSON 3 HOURS 2

Monitoring sensors and detectors

TARGET

- The basics of electronics and electrical engineering.
- The function of a remotely connected sensor.
- Learning by doing: connections and graphical interfaces.
- Translating an environmental phenomenon into a graphic representation.
- Assemble a device.

CONTENT

- Elements of electronics and electrical engineering.
- Electronic components and their use: sensors.
- Connect a sensor to a device.
- Verify detection.
- Check the data flow.
- Interpret the graphic feedback.

METHODOLOGY AND ACTIVITIES

- Frontal Lesson.
- Laboratory.
- Case history.
- Cooperative learning.

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Recognize electronic components.
- Install a computer program.
- Check functionality.
- Make the survey operational.

MODULE TITLE: LESSON 4 HOURS 2

Making remote control displays

TARGET

- Electronic components.
- The function of energy to illuminate.
- The LEDs: assembly and operation.
- Programming light sequences with computer science.
- Simple programming languages: **Scratch** .
- Assemble and functionalize the device.

CONTENT

- Connection of the led lights.
- Construction of a simple light platform.
- Connect the device and check operation.
- Program a simple light sequence.
- Vary sequences with machine language (Scratch).

METHODOLOGY AND ACTIVITIES

- Frontal Lesson.
- Laboratory.
- Case history.
- Cooperative learning.

Robot purchase is planned.

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Apply the Thinkering model
- Design and assemble with electronic device.
- Programming simple light sequences.
- Verify operation.

MODULE TITLE: LESSON 5 HOURS 2

Prototyping and 3D printing

TARGET

- Prototyping : designing a product.
- From the idea to the graphic realization.
- Hints of three-dimensional geometries.
- Design a model.
- Analog and digital prototyping.
- Elements of digital graphics.

CONTENT

- Hints of material technology.
- Analog construction tools.
- Digital enhancement of the model.
- Elements of prototyping.
- Build a model graphically.
- Development of the prototype.

METHODOLOGY AND ACTIVITIES

- Frontal Lesson.
- Laboratory.
- Case history.
- Cooperative learning.

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Use prototyping techniques and tools.
- Graphically represent the prototype.
- Representing the prototype in digital form.
- Check the reliability of the prototype before printing.

MODULE TITLE: LESSON 6 HOURS 2

3D printing

TARGET

- Making pen holders with 3D printer.
- Remote Control of colored LEDs or a simple display that marks the daily date and time.
- Implement a small controlled fan that activates at the temperature difference or directly from the online weather service.
- Controller and functional checks.

CONTENT

- Introduction to Coding languages.
- Computer programming using dedicated software (computer room).
- Stereolithography.
- Laser sintering.
- Fused deposition modeling.
- 3D printing.
- Multi Jet Fusion.
- PolyJet.
- TetraShell.

METHODOLOGY AND ACTIVITIES

- Frontal Lesson
- Laboratory
- Case history
- Cooperative learning.

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Making pen holders with 3D printer.
- Check operation from PC.
- Extend the product with further accessory connections and check operation.

MODULE TITLE: LESSON 7 HOURS 2

Robotics 4 dummies

TARGET

- Robotics and interdisciplinary knowledge.
- Impulse and movement.
- Work physics.
- Yet it moves: issuing commands with machine language.
- Controller and functional checks.

CONTENT

- What is a robot?
- Principles of automation
- Mechatronic applications
- Use of mechatronics in everyday experience

METHODOLOGY AND ACTIVITIES

- Frontal Lesson.
- Laboratory.
- Case history.
- Cooperative learning.

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Understanding the physics of automated movement.
- Design an automated work session for small movements.
- Programming the robot's movements with computer language.

MODULE TITLE: LESSON 8 HOURS 2

Robotics and Hackathon

TARGET

- Making a robot **with a laser cutter**
- Check operation from PC
- Program the movements
- Implement the functionalities: move your arms, turn the "eyes" on and off and if approached by a hand you change the "face color" to indicate the "state of mind" of the robot.
- Connect to PC and control with Arduino, also via Scratch (S4A).

CONTENT

- The basics of mechatronics
- The basics of robotic design
- Use of mechatronics in everyday experience
- Robotics and simulation of movements in the laboratory

METHODOLOGY AND ACTIVITIES

- Frontal Lesson
- Laboratory
- Case history
- Cooperative Learning

ACQUIRED SKILLS

At the end of the course the participant will be able to:

- Develop a project with a pre-assembled
- Designing activities
- **robot** 's movements with computer language
- Check remote operation with **dedicated App or Software**