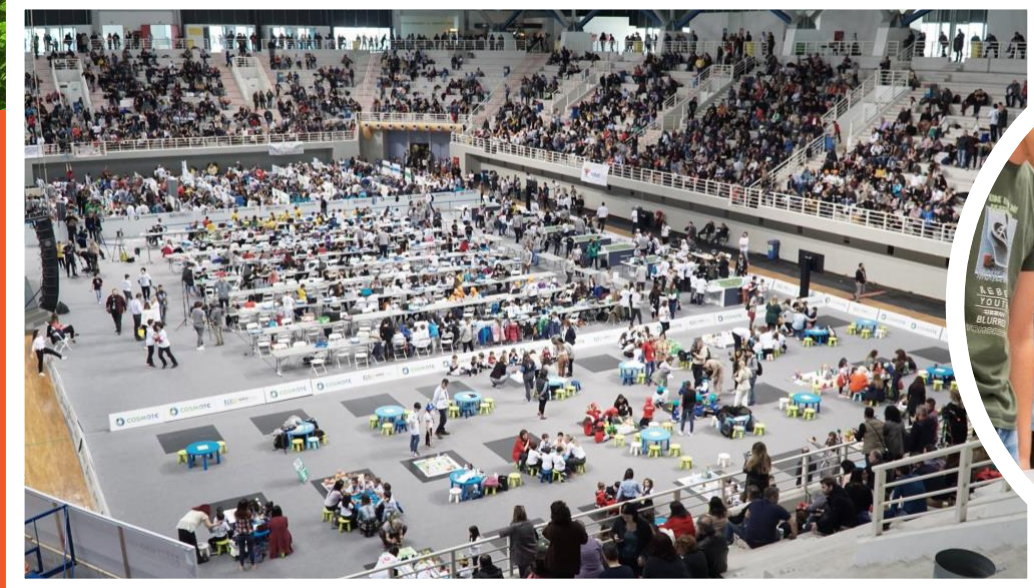
STEM education LLC



STEM Competition
From Human to Artificial Intelligence

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General description of the robotics competition: "From Human to Artificial Intelligence"

The robotics competition takes us on a journey from **Human Intelligence** to **Artificial Intelligence**. This event is an invitation to students to explore the impact and applications of robotics and AI in areas directly relevant to human existence and progress.

The thematic section: **"Human at the centre"**

The competition focuses on People and how Technology can improve their quality of life, solve modern problems and open up new horizons. Through five key pillars, we invite participants to develop innovative robotic and automation solutions:

- **Primary Sector:** How can automation, robotics, possibly incorporating AI algorithms, modernise agriculture, livestock, fisheries and forestry? Imagine autonomous machines that harvest, AI systems that predict weather conditions for better crops, or robots that care for animals.
- **Energy:** What is the role of robotics in the production, storage and management of energy, especially renewable energy? Think of wind turbine inspection robots, AI systems to optimise energy consumption in homes and cities, or innovative solutions for geothermal energy exploitation.
- **Culture:** How can robots and AI contribute to the preservation, enhancement and accessibility of our cultural heritage? Think of robots that restore ancient monuments, AI virtual tour guides, or interactive applications that bring history to life.

- **Arts:** Can robots be artists? Can they create works of art, from music and painting to dance and theatre? Explore robots composing music, creating paintings, or participating in performances, playing important digital games.

- **Transportation:** How robotics and automation can transform the transport sector, making it more efficient, safe and sustainable? Imagine autonomous vehicles, AI-based traffic management systems, robots for transport infrastructure maintenance (e.g., railways, roads), or smart supply chain solutions.

Objectives of the competition

The objectives of the competition are:

- To inspire and educate the next generation of engineers and scientists.
- Promote innovation and creativity in the development of robotic solutions.
- To highlight the positive impact of technology on society.
- Encourage cooperation and knowledge sharing between participants.

Teams are invited to develop original ideas, design and build robots, possibly incorporating AI algorithms, that meet the challenges of the above thematic modules. Both the technical excellence of the designs and the innovation, practical application and social impact of the proposed solutions will be assessed.

What will the student, under the guidance of the teacher, be asked to perform in the competition?

In this competition, students will be asked to demonstrate their creativity, technical ability and problem-solving skills, focusing on the application of automation, robotics, possibly incorporating AI algorithms, to real-world challenges. Specifically, the main activities that will be involved are:

1.Choice of general direction and category in which the team will participate

Choosing the general direction of participation: Track or Model?
Choosing the appropriate category for the team's participation in the robotics competition is one of the first and most important steps. The competition offers two main directions, each with its own specificities and requirements: track and model categories. The decision will directly influence the design, construction and programming of the robot, as well as the skills that the team members will develop. Let's look at what each of them implies:

1.1. Track Categories (Autonomous Challenge)

In the track categories, the team will be asked to design and build a robot that will perform specific tasks in a predefined environment, usually a track with lines, obstacles, or points of interest. The robot must be autonomous and perform its functions with precision and speed.

1.1.1 What the choice of the track category entails

- Focus on Autonomy and Control: Planning is critical. The robot must be able to perceive its environment (via light, ultrasonic, distance, etc. sensors) and make decisions without human intervention.
- Accuracy and Repetition: Track work often requires a high degree of precision in movements and repetition of the same procedures.
- Performance optimization: Speed and efficiency in completing tasks are often scoring factors. This leads to thinking about optimized algorithms and engineering design.
- Challenges: Addressing sensor errors, programming failures, and ensuring the robot can withstand repeated executions.

1.1.2. When to choose the track category:

If your team is interested in deep programming, robot control, problem solving in a structured environment and optimizing algorithms, then the track category is ideal.

1.2. Model Categories (Applied Innovation - Robotic Applications & Solutions)

The model categories offer a more open and creative field of action. Teams are invited to build a robot or an interactive model incorporating robotic elements and/or artificial intelligence in an environment that simulates a real-life situation or application from the competition's themes (Primary Sector, Energy, Culture, Arts). Here, the emphasis is on innovation, originality of concept and demonstration of functionality in a freer context.

1.2.1. What the choice of the model implies:

- Focus on Innovation and Implementation: The main issue is the originality of the idea and its practical application. How does the robot or AI system solve a problem or improve a process in the chosen topic?
- Integrated Design: In addition to programming and electronics, a good design of the overall layout, aesthetics and presentation of the project is required.
- Communication of the Idea: The ability to present your idea, explain the function and impact of your project is as important as the technical implementation.
- Flexibility in Programming: While programming remains important, it can be less focused on absolute motion accuracy and more on system interaction and logic.
- Challenges: Converting a theoretical idea into a working model, managing the complexity of an integrated system and presenting it clearly.

1.2.2. Concept and Idea development

First, students will have to choose one of the four modules: Primary Sector, Energy, Culture, or Arts. They will then be asked to conceive an original idea for a robotic system or an AI application that addresses a specific problem or offers an innovative solution in the chosen field. For example:

- **Primary Sector:** A robot for automatic seed planting or an AI system for irrigation optimisation.
- **Energy:** a solar panel inspection robot or an AI application for smart energy management in a building.
- **Culture:** a robot that helps restore ancient vases or a virtual tour guide with AI for museums
- **Arts:** A robot that can paint or play music, or an AI system that creates original musical pieces, or an educational game system for students...

1.2.3. When to choose a model:

If your team has original ideas on how robotics and AI can solve real problems or offer innovative applications in the areas mentioned, and you are interested in the holistic development of a project from concept to presentation, then the model category is for you.

Before you decide, discuss your interests, skills and goals within the group. Consider the challenges and opportunities offered by each category. In both cases, success requires teamwork, persistent work, creativity and a willingness to learn.

2. System/Robot design and construction

Once they have the idea, students will move on to designing and building their system or robot. This includes:

- **Mechanical design:** Material selection, structural design, and assembly of mechanical parts.
- **Electronics:** Selection and connection of sensors, actuators (motors, servos), microcontrollers (e.g., Arduino, micro:bit, etc.) and other electronic components.
- **Programming:** Developing the code that will control the operation of the robot or system. Thismay include algorithms for motion, interaction with the environment, sensor data processing, and integration of AI techniques (such as machine learning, natural language processing).

3. Presentation and demonstration

The highlight of the competition will be the presentation and demonstration of their work. Students will be invited to:

- **Present their idea (mainly in the categories Modeling, Applied Innovation -Robotic Applications & Solutions):** explain the problem they are solving, their approach, and how the robot or structure works.
- **Demonstrate functionality:** Demonstrate in practice how the robot performs its functions,addressing the challenges of their chosen module.
- **Answer questions (mainly in the categories Model, Applied Innovation - Robotic Applications & Solutions):** answer questions from the jury about the design, planning, challenges encountered and future potential of their project.

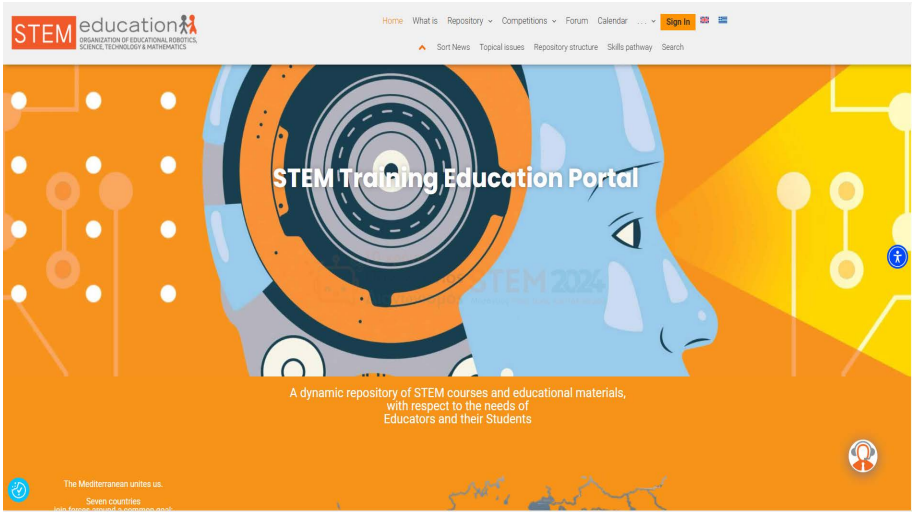
4. Cooperation and research

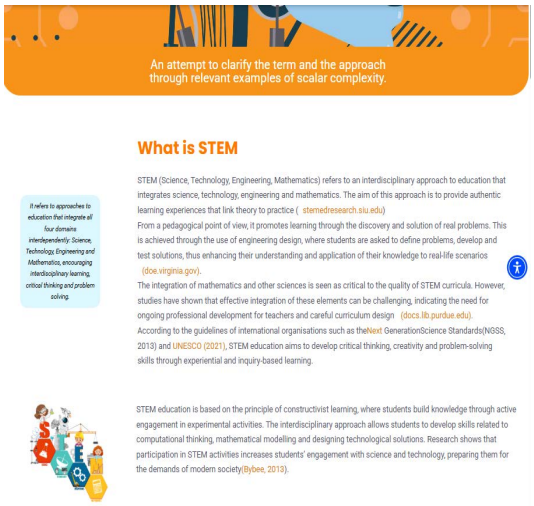
Throughout the competition, students will be encouraged to **collaborate** with each other, **explore** new technologies and approaches, and **experiment** with different solutions. The competition is an excellent opportunity to develop skills such as critical thinking, problem solving, teamwork and creativity, which are essential in both technology and everyday life. Essentially, they will become little inventors and engineers, taking the future of technology into their own hands and showing how **Human Intelligence** can lead to revolutionary applications of **Artificial Intelligence** for the benefit of mankind.

Support for teachers and students

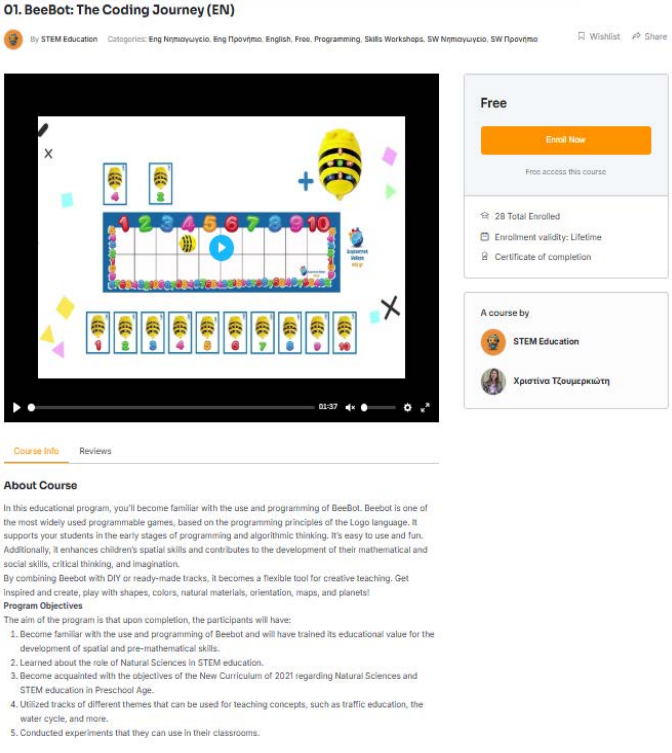
STEM Education Portal. A dynamic repository of STEM educational material and good practices

Portal is a dynamic repository of STEM courses and educational material. A meeting point for ideas and good practices. Always respecting the needs of the Teachers and their students.

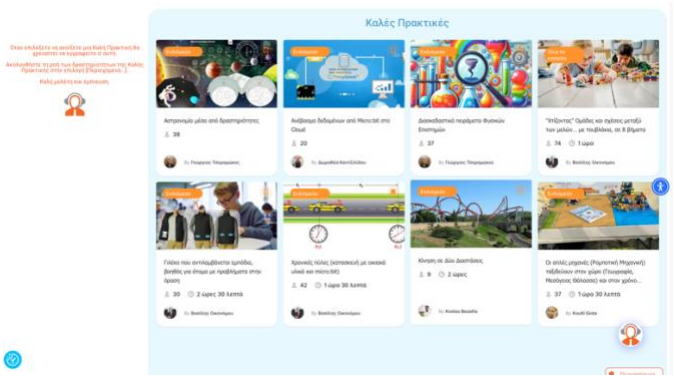


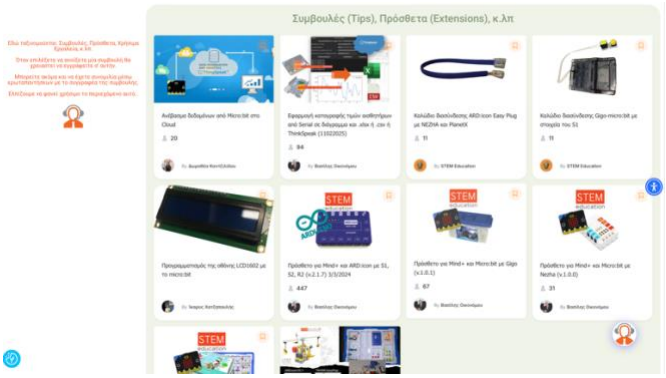


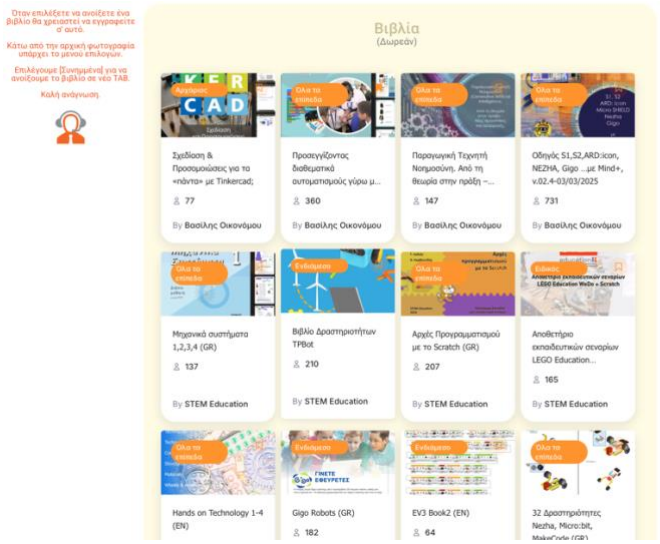
The educational content is based on programs from some of the most prestigious universities in the world (MIT, Carnegie Mellon, Tufts) as well as renowned teachers who are part of our scientific team.



Supporting material, books, add-ons, good practices and examples of applications are already available for use in the context of the Competitions.







Projects from previous competitions

On Portal apart from the educational material, projects are published (Description, MMA, Connection, Investigation and Reflection, video) from the deliverables of the Teams (Team name, Teacher) that participated in the National Competition with the aim of:

- To reward the efforts of teachers and by extension their students.
- To be a source of inspiration and ideas for teams that want to participate in future competitions.

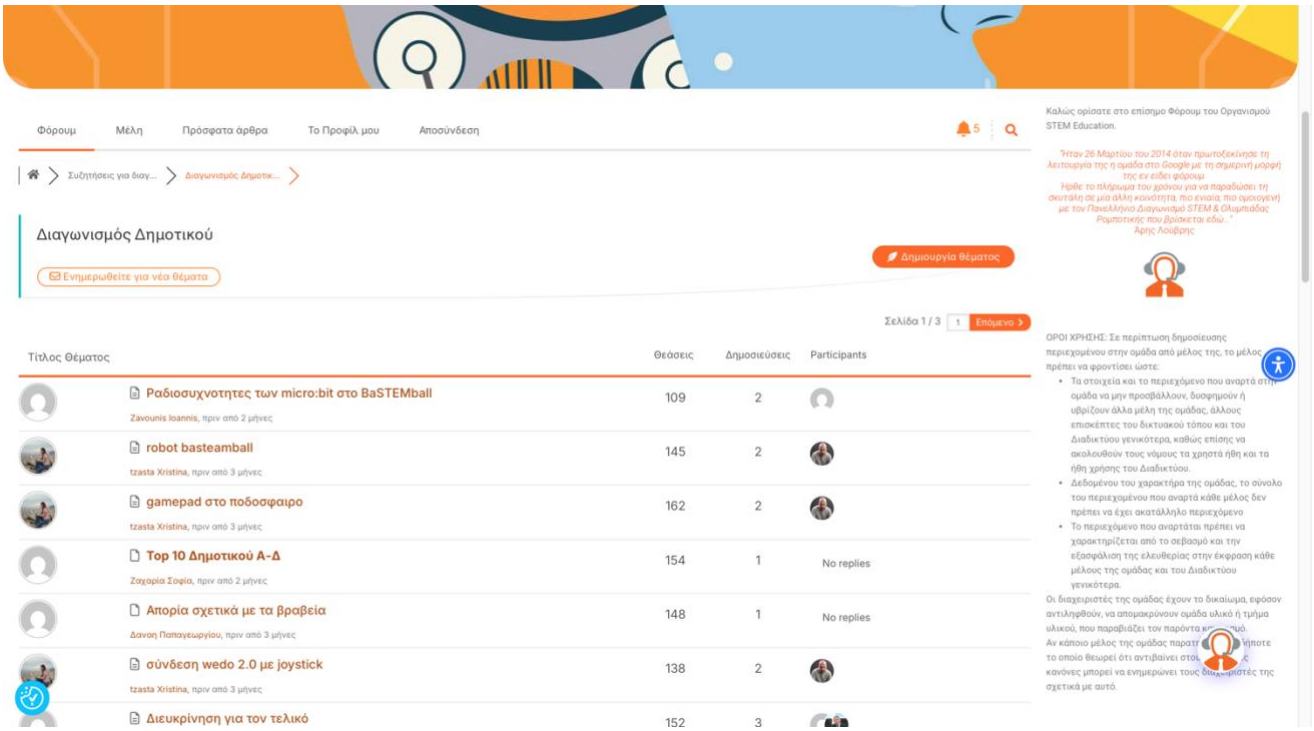
Discussion Forum: (a dynamic community)

The STEM Education Forum is a dynamic community dedicated to the promotion of STEM (Science, Technology, Engineering, Engineering, Mathematics) education and robotics in Greece. It was established with the aim of creating a space for collaboration, exchange of ideas and support for its members.

Today, it operates as an official platform under the National STEM & Robotics Olympiad Competition, offering a unified and homogeneous environment for students, teachers and amateurs.

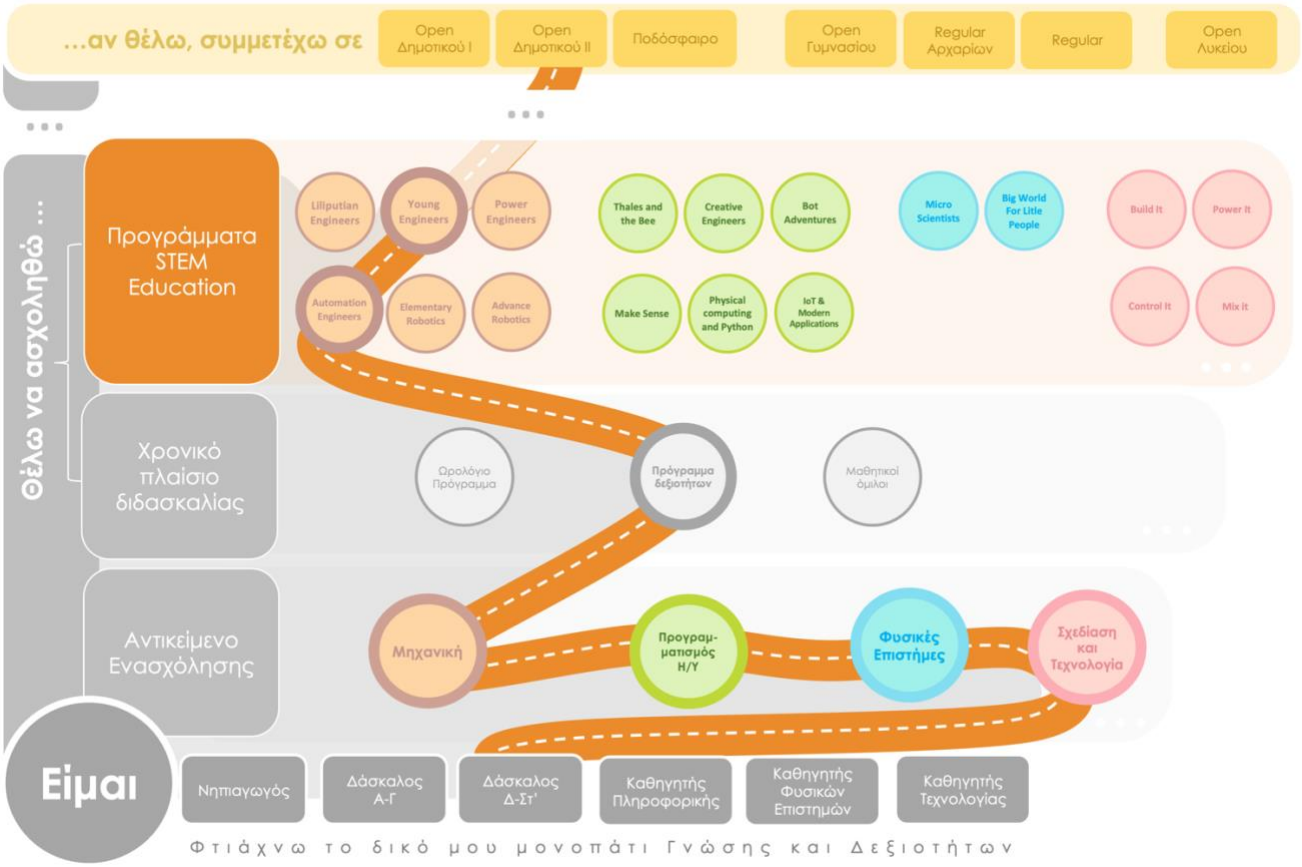
Specific terms of use have been drawn up to guarantee respect, security and freedom of expression, with the aim of protecting all members from inappropriate or offensive content.

Through the portal.stem.edu.gr/community website, the organisation fosters networking, learning and participation in educational activities, competitions and initiatives that encourage innovation and creativity.



"Building my own Knowledge and Skills Path"

…promoting the idea that each teacher is free to choose his/her own path based on his/her profile, interests, student level and teaching needs.



The graph is a diagrammatic tool to support educational planning and professional development, specifically designed for teachers. It clearly illustrates the path from personal educational identity to the selection and implementation of STEM (Science, Technology, Engineering, Mathematics) subject areas, offering flexibility and guidance. The teacher can:

- choose the subject area he/she is interested in (engineering, science, computer science, design and technology),
- link it to appropriate educational programs,
- creatively integrate them in different learning contexts (formal lessons, skills workshops, student groups),
- and adapt the implementation to the needs and characteristics of each age group.

This highlights the possibility of an individualised pathway, according to the interests of the teacher and the profile of his/her classroom.

1. Starting point: I am...
The course starts from the teacher's personal identity (bottom of the picture). There are different options: Kindergarten teacher, Teacher/teacher 1st to 3rd grade, Teacher/teacher 4th to 6th grade, Professor of Computer Science, Professor of Science, Professor of Technology. *The 'Teacher 4th - 6th teacher' option is the one of interest here and seems to lead to skill building through selected subject areas.*

2. I want to get involved with...

The teacher is asked to choose his/her thematic field of interest: engineering, computer programming, science, design and technology. *The diagram shows that from the profile of teacher 4th-6th, paths can be created that intersect more than one object.*

3. STEM Education Programs

The basic category that follows is "STEM Education Programmes", which include specially designed thematic subsections/lesson series that can be implemented with varying degrees of difficulty and at different educational levels.
The courses are divided thematically and colour-coded:

3a. Orange circles - Engineering/Robotics: Lilliputian Engineers, Young Engineers, Power Engineers, Automation Engineers, Elementary Robotics, Advance Robotics
3b. Green Circles - Computer Science/Computational Thinking: Thales and the Bee, Creative Engineers, Bot Adventures, Make Sense, Physical Computing and Python, IoT & Modern Applications
3c. Blue Cycles - Science for Young People: Micro Scientists, Big World For Little People
3d. Pink Cycles - Design and Technology / Construction: Build It, Power It, Control It, Mix It, Mix It, Build It, Power It, Control It, Mix It, Build It, Power It, Control It, Control It, Control It, Mix It.

4. Timeframe of teaching

The image suggests integrating the above programs either:

- in the Timetable (i.e. within formal teaching),
- or in the Skills Programs (e.g. Skills Workshops),
- or in Student Groups (outside the timetable).

The choice determines the duration and scope of the training implementation.

5. Age levels and student participation

The top of the picture shows the educational levels for which the programmes are suitable: Open Elementary I, Open Elementary II, Football, Open High School, Open Middle School, Regular Beginners, Regular, Open High School
The yellow boxes indicate the level/structure of participation. *The "Open Elementary I and II" option seems to be linked to the 4th-6th teacher and leads to many of the STEM programs.*

6. Flow of training course

A dotted orange path runs through the graph, connecting:

- The starting point "Teacher 4th- 6th"
- Subjects of interest (Engineering, Computer Science, Physical Sciences)
- With STEM Programs (robotics, science, construction)
- And finally with the age levels of students.

The flow indicates freedom of choice but also an organised path from simple to complex.