

Panhellenic Educational Robotics Competition 2023

Open Category

(3rd - 6th grades of Elementary School)

Smart Cities

Rules and Scoring

First Edition (October 2022)



Diligence

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WRO Hellas President's foreword

The big **celebration of STEM and Educational Robotics** is here! This year marks 17 years in the effort to introduce educational robotics as well as STEM methodology into compulsory education. This year's Panhellenic Competition **is organized for the 9th consecutive year** by WRO Hellas with COSMOTE as a Strategic Partner and is **under the auspices** of the **Ministry of Education and Religious Affairs**.

The **organization** of a major event such as the Panhellenic Educational Robotics Competition requires **experience and expertise** that WRO Hellas has acquired and offers completely free of charge in terms of **participation** in the service of the educational community.

Through the competition, the introduction of educational robotics, as well as the wider **STEM** (Science-Technology-Engineering-Mathematics) methodology, into the official education system is sought. The Panhellenic Competition is a unique way for young students to understand natural sciences, programming and automation, learn to think like engineers, develop their problem-solving ability and expand their creativity.

During their preparation for the competition, the students, with the guidance of their teachers-coaches:

- form teams (**teamwork**)
- study the relevant literature and experiment(**critical thinking**)
- explore the science of engineering(**engineer thinking**)
- face challenges and propose solutions (**problem solving**).

By exploring these skills in a hands-on and participatory way, children develop resources that are essential to them today and **for the future**, whatever career choice they pursue.

The elements that make up the new competition include the following innovative changes:

- Single theme for all ages
- The introduction of simple machines
- **The introduction of measurements in Primary School**

Overall, the Panhellenic Competition supports STEM as a methodology for compulsory education and defines the ways in which students will acquire the skills of the 21st century. At the end of the competition, the educational community - from Kindergarten to High School - is invited to participate in the competition to respond to the **convergence of Greece with technologically developed countries**.

Good luck

Ιωάννης Σομαλακίδης

Description of the subject

A smart city is a technologically modern urban area that uses different types of electronic methods and sensors to collect specific data.

The information obtained from this data is used to effectively manage assets, resources and services. In return, this data is used to improve operations across the city. This includes data collected from citizens, devices, buildings and assets that are processed and analyzed for monitoring and managing **traffic and transportation systems, power plants, utilities, water networks, waste, criminal investigations, information systems, schools, libraries, hospitals and other community services**. Smart cities are defined as smart both in the ways their governments leverage technology and in the way they monitor, analyze, plan and govern the city.

The smart city concept incorporates Information and Communication Technology (ICT) and various physical devices connected to the Internet of Things (IoT) to optimize the efficiency of city operations and services and connect with citizens. Smart city technology allows city officials to directly interact with both the community and city infrastructure and monitor what is happening in the city and how the city is evolving. ICTs are used to improve the quality, efficiency and interactivity of urban services, to reduce costs and resource consumption, and to increase contact between citizens and government.

Smart city applications have been developed to manage urban flows and enable real-time responses. Therefore, a smart city may be more ready to meet challenges than one with a conventional relationship with its citizens. However, the term itself remains vague in its specifics and is therefore open to many interpretations. Many cities have already adopted smart city technologies.

Deakin and Al Waer list four factors that contribute to the definition of a smart city:

- The application of a wide range of electronic and digital technologies in communities and cities.
- The use of ICT to transform life and the working environment in the region.
- The integration of such Information and Communication Technologies into government systems.
- The territorialization of practices that bring ICT and people together to enhance the innovation and knowledge they deliver.

Source: <https://el.wikipedia.org>

<https://www.tovima.gr/2022/06/29/opinions/eksypnes-poleis-proypothese-is-gia-epityxi-anaptyksi-tous/>

The identity of the Competition

WRO Hellas - as a member of the World Robot Olympiad Association (National Organizer -) is the **official organizer of the WRO™ Educational Robotics Olympiad** for Greece.

WRO Hellas is the **main organizer of educational robotics competitions** in Greece and in the wider region of Southeast Europe.

It organizes two distinct competitions:

- The qualifiers for student participation in the WRO Educational Robotics Olympiad (March – July) and
- the **Panhellenic STEM - Educational Robotics Competition** (October – March)

It has the following categories per education level, for students:

- Kindergarten
- Elementary School
- Junior High School

The **Elementary** Level includes:

- the **Open Category (STEM)** and
- the Football 2x2

The **Open Category** of the Panhellenic Primary School Competition is divided into two levels for:

- the **First classes (1st-3rd grade)** and
- the **last grades (3rd-6th grade).**

The contest referred to in this document and hereinafter is going to be referred to as **Contest** is this one:

- of the Open category,
- of the "Last classes (3rd-5th)",
- of the Elementary School,
- of the Panhellenic STEM Educational Robotics Competition,
- of the WRO Hellas.

This **contest**:

- is an educational activity,
- has a topic related to Smart Cities,
- is addressed to groups of 3-6 children, who are accompanied and guided by an adult coach (teacher, parent...),
- will be held (the final) live (unless unforeseen) in Attica,
- announced in October and completed at the beginning of the next Spring (end of March),
- is organized by WRO Hellas, with strategic partner COSMOTE,
- offers free intensive distance seminars for coaches related to
- in general it aims to act as a nursery of students experienced in automation and robotics and to create an active core of educators-coaches trained in the philosophy of STEM.

The participation in the **Competition** from the first year in 2015 until before the pandemic was impressive, with participation per year varying between 300 and 360 teams, which implies approximately 1600 children from all over Greece per year.

Due to the large number of entries, the **Competition** is held in two phases:

- in the **Regional Competitions** in which the teams of each Region of the country participate and are held at the headquarters of each Region at the end of Winter approximately 3-4 weeks before the Final Competition. Depending on the total pan-Hellenic participation, with a quota from each Region and taking into account the number of teams that can be accommodated in the Final Competition, a certain number of teams qualify for the Final Competition.
- in the **Final Competition** which is held in Attica for life (unless unforeseen) and the teams that qualify from the Regional Competitions participate. The first three teams claim the **medals** (gold, silver and bronze), while special **thematic awards** are awarded to a limited number of teams whose projects are distinguished in individual criteria of the competition, e.g. the best codeVision, a truly original idea, an impressive mockup, a theatrical presentation, etc.

The philosophy of the Contest

The Contest was designed from the beginning as a nursery for the qualitative upgrading of students' skills in educational robotics, within the context of STEM education.

Its aim is to create a large **pool of students with the necessary skills**, from which those who can claim to represent our country at the WRO International Educational Robotics Olympiad can be drawn.

The philosophy of the Competition is the young and beginner students involved:

- to acquire knowledge through analysis and synthesis when trying to solve problems,
- to accumulate experiences working creatively in various fields such as:

- the structural construction,
- the electronic part of automation and
- programming the simulation with animation,

- to freely develop their imagination in the construction of the model,
- to improve their communication skills when presenting the project,
- to familiarize themselves with teamwork,
- to enjoy the joy of creation,
- to gain confidence in feeling that they are producers of potentially innovative products.

The knowledge background that can be both a prerequisite and a result of participation in the **Contest** is a solid knowledge of the development of mechanical systems and computer programming (for more see the paragraph "**The dual nature of educational robotics projects**" in the Appendix). WRO Hellas considers that educational robotics rests on two pillars: the **construction of mechanical systems** and **computer programming**. In this direction, WRO Hellas with its partner the Organization for Educational Robotics, Science, Technology & Mathematics **STEM Education** (<https://stem.edu.gr/%ce%bf-stem-education/>) has published targeted educational material:

- for the construction part with the four issues "**Mechanical Systems - Student Book**", 449 pages.
- an introduction to identifying gears by categorizing them can be found in the paper https://www.academia.edu/87241718/%CE%A0%CF%81%CF%8C%CF%84%CE%B1%CF%83%CE%B7_%CE%BA%CE%B1%CF%84%CE%B7%CE%B3%CE%BF%CF%81%CE%B9%CE%BF%CF%80%CE%BF%CE%AF%CE%B7%CF%83%CE%B7%CF%82_%CF%84%CF%89%CE%BD_%CE%B3%CF%81%CE%B1%CE%BD%CE%B1%CE%B6%CE%B9%CF%8E%CE%BD_%CF%83%CF%84%CE%BF_%CF%80%CE%BB%CE%B1%CE%AF%CF%83%CE%B9%CE%BF_%CF%84%CE%B7%CF%82_%CE%B5%CE%BA%CF%80%CE%B1%CE%AF%CE%B4%CE%B5%CF%85%CF%83%CE%B7%CF%82_STEM
- for the programming part the book «**Let's Scratch-3. Οδηγός εκπαιδευτικού**», 451 pages (<https://stem.edu.gr/%ce%b5%ce%ba%cf%80%ce%b1%ce%b9%ce%b4%ce%b5%cf%85%cf%84%ce%b9%ce%ba%cf%8c-%cf%80%ce%b5%cf%81%ce%b9%ce%b5%cf%87%cf%8c%ce%bc%ce%b5%ce%bd%ce%bf/lets-scratch-3/>).
- This material forms the basis for the online course (MOOC) of KEDIVIM of the EAP: «Teaching Approaches to Programming with Scratch» which can be attended by teachers for free. https://coursity.gr/courses/course-v1:EAP+Prog2+2022_T3/about

The innovations of the Contest

Since its inception, the **Contest** has been constantly trying to introduce innovations.

- Since the beginning of the competition (2015), the first innovation is the use of MIT's free software **Scratch** to control the automations instead of the software proposed by the manufacturers of the hardware used. This allowed, in addition to controlling the automations, the development and production of a **simulation** on the computer screen using animation, in one of the automations. The result was to significantly increase the **specific weight of programming** in the students' projects. For the pedagogical dimension of Scratch see more in "The pedagogical dimension of Scratch" in the Appendix.
- The next innovation that went ahead - after the previous ones were assimilated by the participants - was the representation of the code using **codeVision**. This was done gradually, at first optional (2018), from next year mandatory and allowing time for it to mature in the consciousness of students and coaches.
- In the same way in 2021 (keeping the same theme of the competition for the following year so that the transition is smooth) the **web camera** was introduced as an additional sensor. In the previous competition (2022) an attempt was made to evolve the way of using the web camera. Web camera exploitation can be integrated into ICT activities by connecting via the Internet with **Machine Learning** and **Artificial Intelligence** platforms. Also using the web camera IT activities can be developed with the proposed use of the web camera in the process of **image recognition**. This is aided by the synergy of CodeAthon-2021 where students are asked to develop relatively **simple pattern and shape recognition** programs(https://drive.google.com/file/d/1bti9lkxZvk-RsZlZpR_oWPHre9uI6akf/view).
- The next step in this series of innovations was in 2022 the use of an additional - low-cost - **micro:bit** microcontroller from the BBC (<https://microbit.org/>). The purpose of using the micro:bit is to acquaint Primary School students with the experimental collection of data from a **sequence of measurements of physical quantities** (something that is absent from compulsory education) and **data processing**.
- Following the staggered integration of innovations in the tender process, the use of automation with micro:bit is now given **special emphasis from the measurements that are made, e.g. the maximum value, the average, etc. of measurements (without the need to use data structures / lists in Scratch) and from being used to make a decision.**

Acknowledging that the accumulation of all previous requirements acts as a deterrent for teams of students and coaches who have no previous experience **to participate in the Competition**, this year:

- The projects of the teams that **have all the prerequisites** (provided they qualify from the regional competitions) to compete:
 - for the **first three place medals** and
 - for the **thematic prizes** *in the final phase of the Competition*

- Projects of teams that have **less than the prerequisites** can participate in the regional competitions claiming **thematic awards** without advancing to the final stage. However, **projects of exceptional quality** which, although they do not meet all the prerequisites, **by decision** of the judges of the **Competition**, may exceptionally participate in the final phase of the **Competition** claiming **thematic prizes**.

It is suggested that **teams are composed of students of all ages** (competitors) so that the **expertise** gained from the team's participation in one **Competition** is retained, disseminated and deepened by the team's participation in subsequent **Competitions**, thus ensuring **continuity** of the ambitious effort of the children, the team and the school.

As the experience of the **Competitions** has shown, as a rule, **winning distinctions** is the result of **long-term participation** of students and coaches in the **Competitions**.

But "championship" is not the point. The profit for each child from his participation in the **Competition** is on the one hand the **joy of creation** that he experiences during his involvement in the project and on the other hand the **positive memory** of this experience that will accompany him throughout his life after school.

The participation project

The group of students participates in the **Competition** with an **original project** that they have developed during the preparation period.

The project should:

- to be based on an “**innovative idea**” (innovative at least for children),
- be supported by an inventive “**script narrative**”,
- to satisfy a need to **solve a problem**,
- to choose the **best possible solution**,
- to describe the **compromises** reached between the initial design and the final product;
- to implement the solution by developing **automations** and building **mock-ups**,
- to document the **programming choices** made.

The theme of the Competition

One of the **long-term goals** of the **Competition** is to leave its mark on robotics and STEM among the young participants, so that they will have recruits when later in their adult lives they are called upon to face similar problems in their real dimensions. This targeting is manifested in the selection of the **Competition** topics. So the combination of the desire to leave a mark with the **topics** being **authentic and interesting for children**, has led to choices that raise children's awareness of issues critical to our country and planet, such as:

- in 2015, "My Town",
- in 2016, "Our Galaxy",
- in 2017, "Vehicles and Transport of Tomorrow",
- in 2018, "Aegean Archipelago: Technology helps develop the islands",
- in 2019, "Mars Colonization",
- in 2020 & 2021 "From Archimedes to Da Vinci"
- in 2022 "The primary sector of agricultural production"

The selection of the **theme of the 2023 Competition** is part of this context. The projects that will participate in the competition should have a theme **related to the "Smart City"**.

The concept of the "**Smart City**" is not static... and does not have a clear definition!

It is a process or rather a series of processes by which cities become more "sustainable" and "resilient" and thus able to respond more quickly to new "challenges". In Smart Cities, digital technologies are harnessed and translated into better services to citizens, better use of resources and less impact on the environment.

The ultimate goal of a "Smart City" is to improve the quality of life of citizens in the context of sustainable development.

"Smart Cities" want... SIMPLE, EASY AND AFFORDABLE SOLUTIONS

Innovation begins with a "spark" and forward-looking people.

Interested in creating your own Solutions... for your city?

Projects that are not relevant to the theme of the competition will not be evaluated.

The hardware required for the project

For construction can be used:

- **the LEGO WeDo Robotic Kit (1.0 or 2.0)**

AND

- **the micro:bit microcontroller**, with additional optional external sensors (listed below)

AND

- **Web Camera**

AND

- **Up to two computers.**

The use of other materials (other than those mentioned above) is only allowed for the model and the **scenery** of the project.

The software required for the project

As software can be used:

- **Scratch-2**, to ensure the operation of existing WeDo 1.0 equipment

OR/AND

- **Scratch-3**, (<https://scratch.mit.edu/>)

OR/AND

- the Scratch-like environment **Mind+**, (<http://mindplus.cc/en.html>)

Automation of projects

The project requires at least **3 automations*** of which:

- the first automation to use **at least one of WeDo's sensors**

AND

- the second automation to use **at least one Micro:bit sensor** to obtain a sequence of **measurements** of one or more basic **physical quantities**.

AND

- the third automation to use **the web camera for image recognition****.

Apart from the web camera, it **can additionally** use any other (from the permitted) sensors and actuators.

The **types of sensors** allowed to be used are:

- from the **Wedo kit**: the **tilt** sensor **and/or** the **distance** sensor,
- from the **micro:bit** collection: one or more of the **built-in sensors** or **selected external sensors**:
 - temperature (waterproof),
 - conductivity (moisture),
 - brightness.
- the **web camera**.

The **types of actuators** allowed to be used are:

- the **motors** and **leds** from the **Wedo** kit and
- the **micro:bit** built-in actuators.

***Automation** is the process in which a real-world stimulus is perceived by a **sensor**, the **program**, after being informed by the sensor, processes the data and issues a command that changes the state of the **actuator**.

Examples of automations:

- I have the escalator in the subway that works depending on whether passengers are passing and I assume that the detection of passengers is done by a weight sensor.
 - If the weight sensor is simply triggered by the weight of the human (or a dog or a suitcase) THEN that's automation
 - If the weight sensor is a button that the passenger has to press with their foot (manipulation) THEN this is NOT automation (doesn't work with dog or suitcase).

- I have a drone and a tilt sensor
 - If a sensor is on the drone (e.g. a quadcopter) and it takes values depending on the inclination of the quadcopter, it transmits them to the computer and it increases and decreases the intensity on the corresponding motor to balance THEN this is automation.
 - If I demonstrate the former without flying the drone but holding the drone by hand and tilting it to simulate flight, THEN that is automation.
 - If I use the sensor as a joystick to (remote) control the drone THEN that is NOT automation.

** Tutorials for creating programs for **image recognition** are available here: https://drive.google.com/file/d/1bti9lkxZvk-RsZlZpR_oWPHre9ul6akf/view. The purpose of this automation is to recognize image patterns from camera shots and then act on some trigger. In Scratch-3 this is achieved by using an (internal or external USB) web camera (still or moving), the image of which is projected as the background of the Scene. With the "video sensing" function (found in the "sensing" menu), Scratch can **detect**: motion, speed, color recognition or interaction with sprites already present in the Scene.

Similar and enhanced features are provided in the Scratch-like software Mind+.

The simulation of automation

Automation using WeDo's sensor requires simultaneous execution of the program and simulation on the **computer screen using animation**.

Specifically during the operation of the automation the input data from the sensor should also be used by the simulation program so that **parallel** to the activity of the automation the simulated - virtual actuators are **simultaneously** activated and their action is displayed in the form of animation in the Scratch or Mind+ environment.

The CodeVision of the program

At least for the two automations that are graded, the code needs to be **represented by creating one or more codeVisions**.

CodeVision is a code representation tool whose main goal is to facilitate the teaching of visual programming by allowing the observer to have both an overview of the entire code and access to its details, helping him not get disoriented while immersing himself in the code details. In codeVision, the set of scripts of all the objects of a program is depicted in a two-dimensional table (**anatomy of the code**) and the ways of communication between them are represented (**functionality of the code**).

More information about codeVision can be found at the link:

<https://www.dropbox.com/s/pvhygbzdzk9uxc/CodeRepresentation%20v2.pdf?dl=0>

The deliverable: Portfolio folder

Each group should submit an electronic file with a portfolio containing:

- A. The documents with the **consent of the parents** for the use of their photos or videos in which their faces can be seen (special printable forms that will be posted on the WRO Hellas website).
- B. A brief **description of the project** (word document) highlighting the problem it solves.
- C. **The program** file(s) in Scratch and/or Mind+.
- D. A folder (zip) with the files with **photos** showing the stages of construction and in particular the construction of the mechanisms.
- E. A file (or its link) of at least one **video** where the students will present describing and showing the operation of the construction, with an emphasis on the automations (zoom-in to see the automation) in operation and its size should not exceed 100MB . (Extremely necessary if the competition is conducted online). Attention: Projects whose video size will exceed 100 MB will not be included in the portfolio evaluation process.
- F. The file with the **codeVision** (in xls or pdf or png or jpg).

For the above, they will create **separate folders named A, B, C, D, E, and F within the group's dropbox** into which the aforementioned required files will be uploaded (not compressed all together in one zip).

It is the **responsibility of the coach** that the portfolio file is **submitted electronically** and **on time** with a specific date communicated by WRO-Hellas (at least 10 days before their participation in the regional competition of their region).

Projects submitted late are at the discretion of the Jury to decide whether to participate in the **Competition** and be evaluated.

Steps for submitting the portfolio:

- The teams will create a dropbox account that will belong to them and upload the portfolio there. Attention: Access permission should be granted to third parties (competition judges).
- The link that leads to the group's dropbox will be shared with WRO Hellas. Specifically, the teams will edit their initial registration form and fill in the "Required deliverables" field with the link to their dropbox.
- Teams can find and edit the registration form at any time by checking their inbox, specifically the email with the subject "Participation Confirmation" and from eventora.

The mockup of the project

The project should be supported by a "**narrative script**" which will unfold in some space. This space will be represented in the project with a **model** that will be the **setting** in which the automations will be integrated.

On the day of the competition, each team will be allocated a "booth" with a space of approximately 150 cm x 150 cm and with a vertical width of approximately 2m. The printed material can be stuck on the back, e.g. the codeVision (if it is large) or to view (with a group projector) the presentation.

In the booth there will be a **work bench** approximately 100cm x 60cm in size. In this space, the model should be installed together with the automations. Alternatively, the team can also place their work on the floor, as long as it does not exceed the limits of the booth.

Power supply with multi-socket will be available in the stand.

There will be no wired internet or wifi.

The presentation of the project by the students

On the day of the **Competition** (Regional or Final) the teams must:

- install in the "stand" that will be made available to them the model, the automations and the scenery that are transported **prefabricated and pre-assembled**,
- ensure that the facility complies with the regulations,
- demonstrate and present their work to the public (if requested).

For judging the projects, a **limited amount of time** is allocated to each group (resulting from a compromise between the number of groups and the total assessment time available). Indicatively, this time can be **seven minutes**, of which a part e.g. five minutes will be for the presentation and the remaining time for questions from the judges.

During the evaluation of their work by the judges, the teams present their work by **narrating** their "innovative idea" and their invented scenario in a "**theatrical way**". The presentation **can** be supported either by a **short form** or by a **Power Point** in which the main features of the project are mentioned.

In an atmosphere of teamwork, each member of the team, depending on the role he played during the development of the project, gets the floor and:

- states how their work relates to the competition theme,
- narrates the "script" on which the work is based and guides the judges through the mock-up,
- explains how automation solves the requested problem
- performs a demonstration of the **operation** of the automations
- demonstrates simultaneous simulation during automation operation
- refers to codeVision to explain the automation and simulation code and the acquisition of the sequence of measurements
- answers potential questions from the judges, related to their project and its development process.

During the assessment no help of any kind is allowed from the coach or anyone else to his team.

Indicative project evaluation criteria

The way the **Competition** is conducted is a living process that evolves year after year. In particular, the Regional Competition of Attica, due to the very large number of participants that asymmetrically increase the complexity of its management, presents particular problems and is often used as a pilot for the implementation of organizational changes for the Final Competition. Throughout the years of the competition's existence, the procedures that are carried out each time are constantly analyzed, concerns are developed, improvements are proposed, innovations are adopted and after checking if they are feasible, they are tested in practice. The result of this development is the imprint that follows in the appendix "Procedure for conducting the Tender".

In the **Competition**, the evaluation of the projects is done by **panels of judges** that are usually made up of **experienced teachers specialized in STEM education and educational robotics**. Each committee consists of 2 to 5 judges who rank the projects of the groups assigned to them. In competitions in which several teams participate in the final stages of the competition, all judged teams are evaluated by the same committee. In such competitions, often in addition to the judging committee that evaluates the medals, there is also another committee that evaluates the individual thematic awards.

In judging for medals judges **may consult** the following rubric.

Rubric with **indicative** evaluation criteria

CATEGORIES	#	CRITERIA	SCORE
Conception of Idea/ Project	ΣΥΝΟΛΙΚΟΙ ΒΑΘΜΟΙ: 40		
	1	Creativity, Research and Idea Development	20
	2	Construction and Qualitative resolution of the challenge	20
Educational Robotics/ Automation	ΣΥΝΟΛΙΚΟΙ ΒΑΘΜΟΙ: 80		
	1	Mechanical Construction, Calesthesia	20
	2	Automation with WeDo sensor	20
	3	Automation with WEB camera as a sensor	20
	4	Automation with Micro:bit sensor	20
Program in Scratch	ΣΥΝΟΛΙΚΟΙ ΒΑΘΜΟΙ: 40		
	1	Codemap - Visual representation of code	40
Virtual world	ΣΥΝΟΛΙΚΟΙ ΒΑΘΜΟΙ: 40 Correctness of Logic, Complexity of Software and automations		
	1	Correctness of Logic, Complexity of Software and automations	20
	2	Representation of automation with animation, Interface, Aesthetics	20
Presentation	ΣΥΝΟΛΙΚΟΙ ΒΑΘΜΟΙ: 40		
	1	Assessment of Presentation, Communication Skills and Collaboration	30
	2	Decoration, Videos, Posters	10
MAX SCORE:		240	

Complaints and objections procedure

The "waterfall process" followed in the **Competition** does not allow for time delays and because of this **it is not possible** to effectively implement an objection process during the competition.

Objections, complaints, objections and suggestions - in written form - are accepted, evaluated and utilized by the scientific and organizational committee of the competition, for the continuous improvement of the following competitions.

In our experience, the few objections to the evaluation arose from a lack of understanding - usually on the part of those who expressed them, perhaps with justification - of the rules of the competition.

Due to the open nature of the competition, the evaluation includes factors that do not allow a weighted and "objective" score for non-quantifiable (but recognizable) qualities of the contestants' works such as originality, aesthetics, presentation, etc. Thus, from the first competition - although a rubric with a quota for the score is indicatively used - the **"cup" model** was adopted, which highlights the cup winner with **successive eliminations** instead of the "championship" model, where the champion is highlighted by the score he collects. This "cup" model is adopted in the evaluation phases, in which groups (the groups of teams that each committee will evaluate) are formed. The rubric can act as an advisory for panel judges.

The spatial proximity of groups belonging to different groups and the comparison between them gives rise to complaints of unfair treatment. The random placement of the teams in the various groups is something that objectively cannot be avoided and it is the duty of the team coaches to understand this way of working and to explain it to the children in their teams and to the parents.


It is important as a personal assessment that each child compares himself with how he was before he got involved in the competition process and what he has conquered on his behalf and how he has evolved through his participation in the competition.

ANNEX

WeDo materials

Only LEGO motors and sensors are allowed in the competition. Other materials may not be modified to work with WeDo.

Allowed materials, sensors and motors:

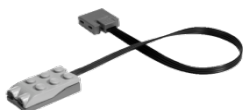
	<p>708882 Power Functions XL Motor</p>
	<p>709584 LEGO WeDo Αισθητήρας Κλίσης</p>
	<p>708881 Power Functions Battery Box</p>
	<p>708871 Power Functions Extension Wire 20''</p>



708882 [Power Functions XL Motor](#)



708886 [Καλώδιο Επέκτασης Power Functions 8''](#)



709583 [LEGO WeDo Αισθητήρας Κίνησης](#)



709670 [E-Motor](#)



709581 [LEGO WeDo USB Hub](#)



708882 [Power Functions XL Motor](#)



708870 [Power Functions Light](#)



708883 [Power Functions M-Motor](#)

Επίσης επιτρέπονται τα παρακάτω υλικά του WeDo 2.0



745301 [Smarthub 2 – Διασύνδεση WeDo 2 Με PC Ή Tablet](#)



745303 [Medium Motor LEGO Education WeDo 2.0](#)



745305 [Αισθητήρας Κλίσης LEGO Education WeDo 2.0](#)



745304 [Αισθητήρας Κίνησης LEGO Education WeDo 2.0](#)



745301 [Smarthub 2 – Διασύνδεση WeDo 2 Με PC΄Η Tablet](#)



745302 [LEGO Education WeDo 2.0 Add-On Power Pack](#)

The micro:bit materials

	<p>Micro:bit Elementary Competition Set</p> <p>https://www.why.gr/product-category/open-hardware/microbit-2/</p> <p>The package includes:</p> <ul style="list-style-type: none">● The micro:bit V2 board● Battery case with switch and suitable plug for micro:bit.● USB cable 1.8 m.● Crocodile cables (10 pcs).● Expansion Board for Microbit.● Conductivity sensor (soil moisture measurement).● Photoresistive sensor.● Voltage measurement sensor.● Waterproof temperature sensor DS18B20. <ul style="list-style-type: none">● 1602 LCD screen.
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Technical clarifications related to WeDo

- The **sensors are connected to the computer** via a hub (WeDo) and a USB connection.
- In case a group **does not have two hubs**, the first sensor can be placed on the hub to present the first automation, then the first sensor can be removed, the second sensor can be placed to present the second automation. A similar procedure can be followed in the case of using **two motors** and a sensor through a hub.
- All parts of the construction that contain automation or mechanical parts moving with

motors will be made with LEGO elements. The remaining parts of the structure can be made of any other material (such as foam, paper, etc.)

- WeDo 2.0 in the MAC environment works normally. In the windows environment it works normally with Offline Scratch 2.0 with the following prerequisites:

https://www.dropbox.com/sh/9rk2z3uac1wlvw7/AADC_R5Ys6gjzEjplhz1p1b-a?dl=0

Technical clarifications related to the micro:bit

Instructions for **simultaneous micro:bit, WeDo 2.0 and web camera interface on mind+**

In the proposed process Mind+ software (largely compatible with Scratch-3) is used in combination with a version of the **ScratchLink** software to achieve the desired result.

A **basic condition** for the bluetooth connection of WeDo with the computer is that the computer during the WeDo search process has Internet. After the bluetooth connection is restored, the Internet is not necessary.

In the event that a wireless network is not provided in the area then it is suggested to give the computer a wireless network through a mobile phone.

In the following procedure the Micro:bit is connected to the computer with a USB cable and the camera is the internal computer or external USB.

Download and install mind+ software

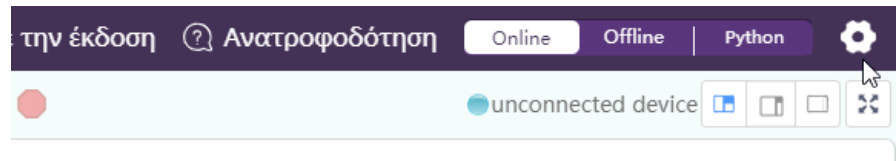
- Download the software from:
http://download3.dfrobot.com.cn/Mind+_Win_V1.7.1_RC2.0.exe
- Run the executable
- Follow the installation process

Download and install a specific version of the Scratch-Link software

- Download the program from the link: [Scratch-Link http://download3.dfrobot.com.cn/scratch-link_forMindPlus-v1.1.msi](http://download3.dfrobot.com.cn/scratch-link_forMindPlus-v1.1.msi)
- Follow the installation process.

First launch of mind+ software

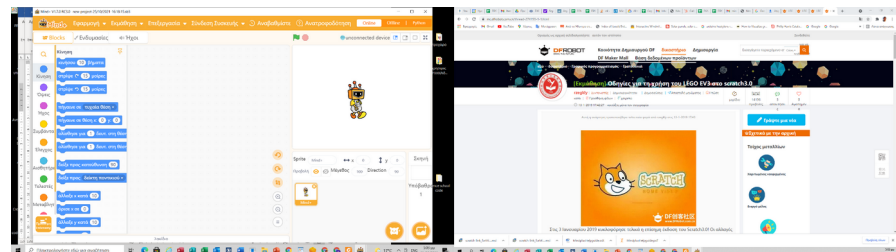
At the first launch the program will be in another language, whenever to change it click on the top right gear.



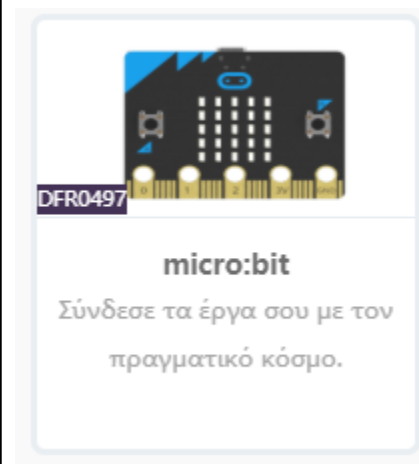
Select Language (Greek).



Select Online mode



- Make sure the Scratch-Link program you installed earlier is running.
- Open the mind+ program.
- Click on the “Add Extension” button at the bottom left of the window.
- Click on the box that says micro:bit.
- Go back and while you have connected the micro:bit board with the USB cable press connect device.
- Select the micro:bit board.

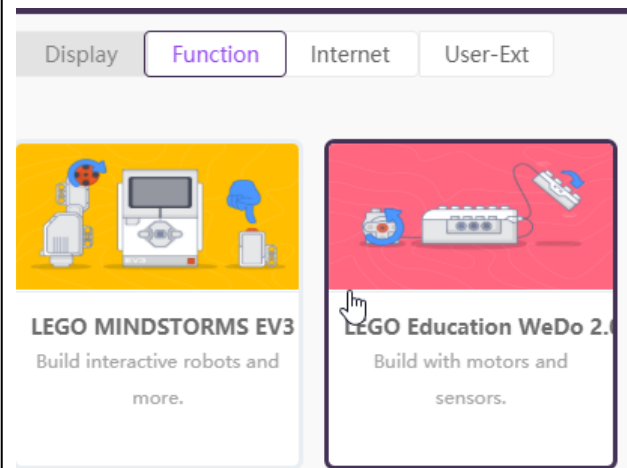


LEGO WeDo 2.0 Connection

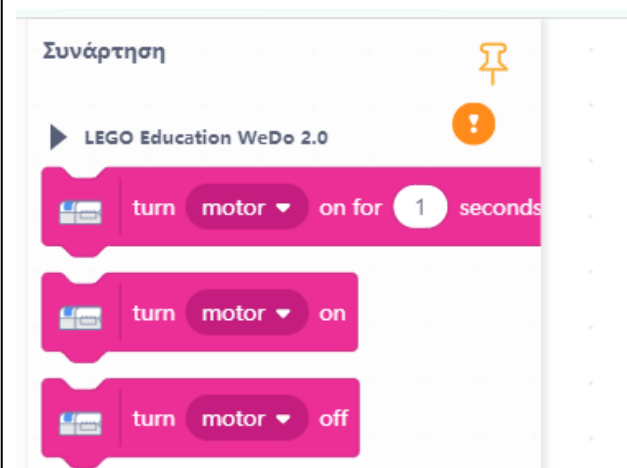
micro:bit connection

Click on the “Add Extension” button at the bottom left of the window.

Open the “Function” tab and select “LEGO WeDo 2.0”.



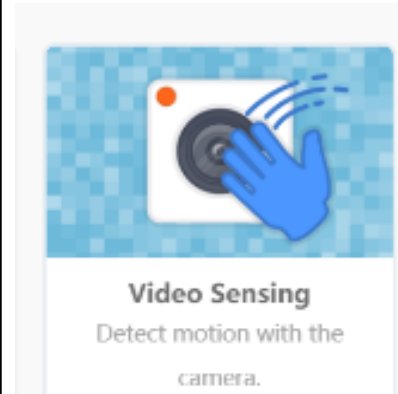
Press the exclamation mark and then connect to the WeDo hub.



Σύνδεση Κάμερας

Click on the “Add Extension” button at the bottom left of the window.

Open the “Function” tab and select “Video Sensing”.



Ideas - Suggestions

Collections of **notable projects** that have participated in the **Competition** can be considered **good practices** from which to draw ideas for project development. Such collections exist:

- At “[Ψηφιακή πλατφόρμα εκπαιδευτικών σεναρίων](https://wrohellas.gr/%ce%b5%ce%ba%cf%80%ce%b1%ce%b9%ce%b4%ce%b5%cf%85%cf%84%ce%b9%ce%ba%ce%bf-%cf%80%ce%b5%cf%81%ce%b9%ce%b5%cf%87%ce%bf%ce%bc%ce%b5%ce%bd%ce%bf/%ce%b5%ce%ba%cf%80%ce%b1%ce%b9%ce%b4%ce%b5%cf%85%cf%84%ce%b9%ce%ba%ce%b1-%cf%83%ce%b5%ce%bd%ce%b1%cf%81%ce%b9%ce%b1-2/)” on the website of WRO Hellas
<https://wrohellas.gr/%ce%b5%ce%ba%cf%80%ce%b1%ce%b9%ce%b4%ce%b5%cf%85%cf%84%ce%b9%ce%ba%ce%bf-%cf%80%ce%b5%cf%81%ce%b9%ce%b5%cf%87%ce%bf%ce%bc%ce%b5%ce%bd%ce%bf/%ce%b5%ce%ba%cf%80%ce%b1%ce%b9%ce%b4%ce%b5%cf%85%cf%84%ce%b9%ce%ba%ce%b1-%cf%83%ce%b5%ce%bd%ce%b1%cf%81%ce%b9%ce%b1-2/>

It is an online library, openly accessible to all educators, which hosts original educational robotics educational material. The basis for the creation of the library is the rich material provided to WRO Hellas by the teachers in the context of each competition. The scientific committee of WRO Hellas selects the representative projects from each competition, following the following criteria:

- to be structurally sound
 - to be programmatically correct
 - to be a model for teaching STEM
 - to be offered for teachers to include in their teaching work.
-
- in the book «[Αποθετήριο εκπαιδευτικών σεναρίων LEGO Education WeDo + Scratch](https://stem.edu.gr/%CE%B5%CE%BA%CF%80%CE%B1%CE%B9%CE%B4%CE%B5%CF%85%CF%84%CE%B9%CE%BA%CE%AC-%CF%83%CE%B5%CE%BD%CE%AC%CF%81%CE%B9%CE%B1/)» (ISBN: 978-618-84064-1-4) (<https://stem.edu.gr/%CE%B5%CE%BA%CF%80%CE%B1%CE%B9%CE%B4%CE%B5%CF%85%CF%84%CE%B9%CE%BA%CE%AC-%CF%83%CE%B5%CE%BD%CE%AC%CF%81%CE%B9%CE%B1/>).

Indicative procedure for conducting the Competition

Keywords

Team, (Team) **Code**, **Stand**, **Awards** (final ranking or Special/Thematic), **Committee** (ranking or special thematic awards), **Group** (groups), (time) **Zone**, **Phase** (judging).

Indicative schedule of the Competition

08:00-09:30	Registration
08:00-10:30	Setting up and completing the preparation of the booths
10:30-13:00	First evaluation phase
13:00-13:30	Intermission for the teams that did not qualify to leave
13:30-15:00	Second evaluation phase
15:00-15:10	Announcement of results
15:10-16:00	Withdrawal of teams

A) Registration

On the day of the competition, the teams come to the reception area (registration) to complete their registration.

After registration, the team is given a folder with the contestants' cards and the **team's code**, which they will have throughout the competition. This code is the team's identifier for the entire duration of the competition and cannot be changed. The children must write this code on their cards in case they are asked.

B) Installation in the booth

The team code corresponds to the **number of the stand** where the team will exhibit its work. Any change of position (e.g. for reasons of accessibility for the disabled) must be done with the agreement of the President of the Organizing Committee, who will be contacted by the team coach. The team code will remain the same even if there is a change in the team stand.

Teams have the opportunity to install their project and do the necessary **setup and testing** until the evaluation process begins.

Γ) Assessment process

The evaluation process is carried out according to the indicative criteria described in the relevant announcement of the competition.

The following text refers to the Attica Regional Competition of March 2020 (postponed) and is indicative.

As the exact number of teams that will compete cannot be known in advance, it is assumed that this will be approximately the average of the respective competitors of the last three years (it is estimated that up to 70 teams will compete on any given day) . Also, the number of teams that will qualify from the Attica Regional to the Panhellenic Competition is calculated proportionally to the number of teams in Attica in terms of the number of teams from all over Greece and therefore it is estimated that there will be 22-28 teams.

Thus, for each day in the first evaluation phase, 30 teams qualify from the approximately 70 teams. In the second evaluation phase, from the 30 teams, 11-15 teams qualify to participate in the final of the Panhellenic Competition.

The times of the assessment

A limited amount of time will be allocated to each group for the judging of the projects - seven minutes as an indication, of which a part (eg five minutes) will be for the presentation by the group and the remaining time for questions from the judges.

The duration:

- for the first evaluation phase it is approximately 150 minutes,
- for the second evaluation phase it is approximately 90 minutes,

After the completion of the first evaluation phase, the teams that qualify for the next phase are announced and the rest can leave.

The children of one team, after being evaluated by the judging panels, can visit the stands of the other teams and see the works presented by their fellow athletes. But there should always be a representative at their booth who can demonstrate their work to visitors.

Children must be in their booth when the next assessment phase begins.

First Evaluation Phase

The teams are numbered (the team code) from 1 to 70. The judges are divided into 7 committees and each committee will see 10 teams. Specifically, committee No. 1 will see all the projects of the groups starting from 1, adding for each subsequent one 7, i.e. groups 1, 8, 15, 22, etc., committee No. 2 will see all the projects of the groups that have a number group 2, 9, 16, 23 and so on, so we continue for the rest of the committees. In order to avoid overcrowding of the committees, committee No. 1 starts the evaluation from group 1, committee No. 2 starts the evaluation from group 9, committee No. 3 starts the evaluation from group 17, and so on.

A team if it is not ready when the panel comes to assess it, may ask the panel to pass later, provided the panel deems it possible (eg in terms of time).

Each committee prequalifies four of the ten teams it examines, resulting in a total of 28 teams for the next evaluation phase. There is flexibility if some committees decide that they should exceptionally qualify three or five teams, provided that the number of total teams does not change significantly.

Second Evaluation Phase

In the second phase of evaluation, there are four committees and their members result from mixing the members of the committees from the previous phase. So for example the new committee No1 will have members from the previous committees No1, No3 and No5, the new committee No2 will have members from the previous committees No2, No4 and No6 and so on. This is so that almost none of the members of a committee have reviewed the same teams, but also that each member of the committee has a more holistic view of the contestants by seeing as many teams as possible. Each committee will see six or seven teams from which they will advance three. Thus, 11-15 teams qualify for the final of the Panhellenic Competition.

The dual nature of educational robotics projects*

According to Komis (Komis et al. 2017), central concepts of educational robotics are the "construction" and "programming" of robots. These concepts are part of the pedagogical current of Constructivism, which claims that learning consists in the organization of the internal representations and experiences of the individual (Piaget, 1974). The ideas "Learning by making" and "Learning about making" gave the impetus to the foundation of Papert's "Constructionism" approach (Papert, 2000), which aims to form a framework for utilizing ICT in the educational process, capable of causing substantial changes in the way teachers teach and students learn (Ackermann, 2001), as the student from a passive receiver of information becomes an active subject, who investigates and processes what he perceives with his senses and creates knowledge (Frangou, 2005).

The artificial structure created by the students utilizes a set of building materials, having sensors to capture events, an actuator that sets the whole structure or a part of it in motion. But the operation of the structure is based on the software that determines the behaviors of the structure such as detecting a stimulus and reacting by activating a motor. So in the process of developing the physical structure and its control program, there is a two-way relationship. The design of a physical structure (hardware) as well as its mode of operation (software) presupposes the interconnection of these processes. It is considered particularly effective that on the one hand the students with the role of programmers have understood the development model of the construction and on the other hand the students with the role of builders are involved to have built the mental model of the operation of the construction. This dialectical relationship between the development of the construction and the programming of its operation will lead to constructions (at least in the initial stage) that will be possible to program efficiently considering that "the programming of robotic constructions has a particularity in relation to the programming in other conditions or situations. It is identified with the performance of behavior in an artificial construction" (Tsovolas & Komis, 2008).

*excerpt from the book «[Αποθετήριο εκπαιδευτικών σεναρίων LEGO Education WeDo + Scratch](#)» (ISBN: 978-618-84064-1-4)

The pedagogical dimension of Scratch

Scratch (<http://scratch.mit.edu>), was created by the Lifelong Kindergarten Group at MIT as a multimedia-rich system for beginning programmers. It is a **visual programming language** that allows users to program through graphics instead of text and is embedded in a special programming environment. This allows the user-programmer to see the results of executing a program directly, while at the same time overcoming the limitation of syntax difficulties that exist in traditional programming languages.

A common **teaching metaphor** used to understand project development in Scratch is that of producing a play. There they need:

- a theater **stage** which is the space where the play takes place and in Scratch there is a two-dimensional space corresponding to the stage in the background of which various static props are projected,
- **actors** (objects) wearing various **costumes**,
- **roles** (sprites) played by the actors when they appear on stage,
- **script** followed by the roles. In Scratch the **behavior** of the roles is determined by pieces of code called **scripts**. The **director** and **screenwriter** co-exist in the Scratch **developer** and
- **viewers** which in Scratch correspond to the users of the program.

In Scratch, **programming is event-driven** and is implemented by **combining command-tiles** (a metaphor from Lego bricks) that fit together to determine the behavior of the roles (sprites) of two-dimensional objects that "live" in a specific space (scene- stage). A command-tile in Scratch follows a **color coding** that refers / corresponds to the class of commands it belongs to. Developing programming in Scratch allows students to create and develop programs related to **animation, storytelling, and games**, which can expand their understanding of **computational concepts** as well as **computational practices**.

Scratch as a programming language is the means of **communication** between intelligent entities, **man and computer**. Communication takes place at the level of the lower mental entity, the task of the higher entity is to understand the "culture" of the other entity, to analyze its thinking and simplify it. According to Papert "to get the computer to do something, you have to describe the process in detail enough to be executed by the machine... **by teaching the computer how to think, children embark on an exploration of their own way of thinking** and thinking about thinking makes the child an epistemologist.'

To teach programming, **microcosms** that are environments suitable for learning programming can be used. As microcosms are considered small but relatively complete subsets of representation of the "real" environment, which represent a part of the theoretical "world" and can be understood in an observational, experiential and exploratory way. Although microcosms are directly aimed at developing **problem-solving skills** and algorithmic (convergent) thinking, under conditions they can be used as educational tools for developing **creative (divergent) thinking**. In such environments it may no longer seem contradictory to ask children to work creatively by addressing them in non-creative ways. A programming environment is a **nursery of potential innovations**, in which the student can accumulate experience cultivating his algorithmic thinking. Under scaffolding conditions the teacher can guide the student to think creatively outside the box and produce something "innovative" for him.

Scratch supports a variety of **programming styles** such as serial programming (with elements of

structured/departmental and hierarchical programming), parallel programming, **event driven programming** and **object based programming**, while using clones it has elements of object-oriented programming. In Scratch, the ability to visually program with tiles combined with the variety of programming styles it can support and in light of the pedagogical approach of "**emergent literacy**", makes it an ideal tool for beginning programmers with limited programming background, offering them an accessible starting point for learning.