STEM education
ΟΡΓΑΝΙΣΜΟΣ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΡΟΜΠΟΤΙΚΗΣ, ΕΠΙΣΤΗΜΗΣ, ΤΕΧΝΟΛΟΓΙΑΣ & ΜΑΘΗΜΑΤΙΚΩΝ

National STEM Competition 2025

Open STEM Category (A - D grades of Primary School)

Small pioneers on Mars use simple machines!

Rules

A' edition (September 2024)

1 Created using TN (AI) tools

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Import

Since ancient times, man observed the night sky and tried to interpret it with the means at his disposal. It is only in the last 70 years that humanity has developed the appropriate technology to organize space missions, and now sending humans to the Moon or Mars for colonization seems very realistic.

In order to colonize other celestial bodies, it is necessary to develop technologies that combine sustainability with the exploitation of the natural resources of each celestial body. Indicatively, electricity production requires the utilization of renewable sources, while similar challenges apply to the optimization of agricultural production under adverse conditions.

In this way, space technology can make a significant contribution to improving living conditions on our planet as well, as many of the innovations developed for space are applied in our daily lives, from health and agriculture to energy and the environment. For example, water purification systems, originally designed for spacecraft, are now used in areas that do not have easy access to clean water. This is linked to Sustainable Development Goal 6, which is about ensuring clean water for all. Air filters are used in hospitals and schools to keep the air clean, helping to improve public health and Sustainable Development Goal 3 for good health and well-being.

In addition, food growing technologies in confined spaces can be used to produce food in areas with difficult climatic conditions, thus contributing to Goal 2 to eradicate hunger, but also to enhance urban agriculture on Earth, allowing food to be grown in cities and areas with limited space. This relates to Goal 11 on sustainable cities and communities.

Materials created to protect astronauts from extreme temperatures are now being used in buildings to save energy, contributing to Goal 7 on clean energy.

Material recycling and reuse technology has been adapted to help waste recycling on Earth and supports Goal 12 for responsible consumption and production. Similarly, the development of lightweight, durable materials used in spacecraft are being applied in creating durable prosthetics for amputees, providing them with a better quality of life. This supports Goal 10 to reduce inequalities.

Discover your own applications, or find out how some Earth applications can be used for life on other planets and we are waiting for you to share them with us!

Thematic

This year's topics can be drawn from Maslow's pyramid of human needs. In this pyramid we see 5 levels defined based on the theory of the hierarchy of human needs, starting from the basic/primitive to the mature/"civilized". In order for a person to go from the 1st to the 2nd level, he must have fully covered all the needs of the 1st. For example, if we do not have a place where we can sleep, eat, warm, such as a house, we cannot enter the process of making the area around it safer, engage in entertainment, develop friendly relations, art, culture and much more.

Maslow's hierarchy of needs

Astronauts who go on a mission to Mars, where we don't have the infrastructure we have on Earth, will have to follow this hierarchy in order to survive. What simple machines and how should we use them to not just survive on Mars, but thrive! **What level of the pyramid can our team reach?**

Examples:

- **Growing food**
  - Agricultural tools
  - Irrigation and water supply
  - Oxygen production
  - Wastewater recycling for fertilizer
- **Infrastructure**
  - Construction of geodesic domes for various uses (catering, production, control centers, etc.)
  - Energy, water, air, fuel, etc. supply networks
- **Transport**
  - Construction of bridges, roads, tunnels
  - Spacecraft landing/launch pads
- **Well-being**
  - Fitness equipment, entertainment and entertainment areas
  - Telecommunication, common areas for interaction and contact.
- **Safety**
  - Alternative systems for use in case of failure of the main systems
  - Shelters for protection from sandstorms, meteors and other emergencies

Target

Your team needs to work on a project with **at least 3 mechanisms** **using simple machines, the electric motor connected to the battery case** **and optionally a simple automation** described in the equipment materials**.** This year any team that wishes can use OPTIONALLY **only a simple automation**, as described below in the regulations and in more detail in this year's webinars.
Webinar STEM2024:

- 1st **webinar (CLICK)**
- 2nd **webinar (CLICK)**

Good practice of project development with students within the school curriculum:

- **Link to good practice on the STEM Education PORTAL (CLICK)**
- **Conference presentation for students to approach the theme of the competition in 2018 through creative writing (CLICK)**
- **Construction of a Geodetic Dome (CLICK)**

General Rules

- Your team consists of:
  1. the coach (**over 20 years old**)
  2. **3-6 students** who are in grades A' - D' Primary **School during the current school year**
- The coach is over 20 years old, constantly accompanies the children, takes care of their safety and needs, cooperating with the organization. It has a responsibility to be a role model and promote fair play among students, parents and other participants. He is responsible for the behavior and attitude of his team.
- 3-6 students who are in grades A' - D' Primary School during the current school year.
- The equipment is recommended below in a special paragraph in the regulations.
- **Mechanism** is considered a construction with moving parts, which achieves some clear result for the purpose, for which it was designed using simple machines
- **Simple automation** is considered a construction that has 3 basic pieces for their operation:
  1. **Input**: a Sensor that measures changes in the environment
  2. **Processing**: The instructions given in the form of a program with code and showing how decisions are made by the system
  3. **Output**: an engine that starts or stops because a detected change was made with the sensor **or** a color change in
- The program should be done with a program That uses blocks with images for first - second grade children (eg wedo, wedo2, spike essential klp). For third and fourth grade children they can use, if they wish, blocks with words (eg Scratch, makecode, etc.)
- These **3 mechanisms** must
  1. contain at least 2 simple machines (in addition to the shaft).
  2. all or parts thereof manually or motor-driven
  3. one of them must have a motor with a switch for its operation.
  4. you can make more than 3 mechanisms, **CAUTION** the rating is total for everyone
  5. The automation motor can replace the motor with a switch
- During the presentation in the competition the mechanisms can be prefabricated and pre-assembled.
- **ATTENTION:** Projects that **are not relevant to the theme** of the competition or **include only automation** or **use complex automation** will not be evaluated.

Types and Examples of Simple Machines

Simple machines are parts of the mechanisms you aim to build. The most fundamental of these are the following 6:

Wheel with Shaft/Gear	Pulley	Lever
Wedge	Screw	Ramp

We find them in many objects that children use, such as at home as an educational STEM game and at school as educational material.

Gear

Pulley

Lever

Wheel and Axle

Screw

Ramp

Wedge

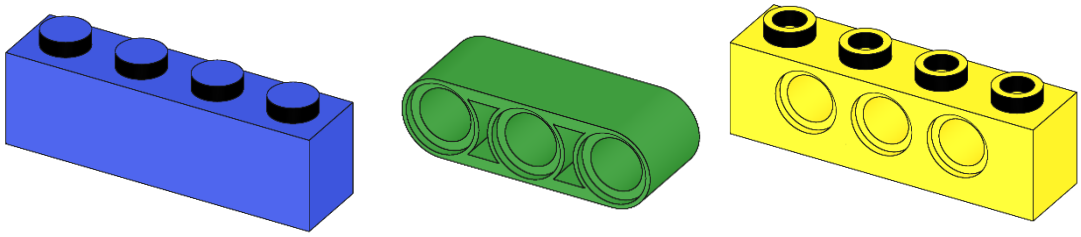
Scissor lift (Lever, screw, toothed bar)

Manual winch with wire rope (Gears, ratchets, shafts, screws and lever)

Equipment materials

The building materials of the mechanisms and motors must be Lego Classic, Technic or hybrids. Lego pieces from students' toys can also be used.

The following 3 pieces belong to the corresponding Lego Classic, Technic and hybrid systems.



Depending on what you are missing, see the following suggestions.

Recommended packages and individual components (click on the blue letters to view them)

1.Engineering Packages (if you don't have equipment)

PROPOSAL A	**Simple Machines** 	**Power Functions M-Motor** 	**Power Functions Battery Box** 
PROPOSAL B	**Composite Electrical Machines** 		
AUTOMATION PROPOSAL	**My First Automation** 		

2. Individual mechanism components (to complement your existing equipment)

Engines and accessories	Battery Box 	M-Motor 	L-Motor 
	XL Motor 	8" extension cable 	Extension Wire 20” 
	Control Switch 	Servo Moto 	IR Receive 
	Rechargeable battery for models 	Construction Remote Control Kits 	Electric Compressor Pneumatic Set Construction 
	Electronic Modules – My First Automations 		Smarthub My First Automation 
	Motion Sensor 	Tilt sensor 	Medium Motor 
Spare parts	Spare Parts 		

Especially for pulleys it is allowed to use rubber band, thread for their operation. The use of any material is allowed in the construction of the mock-up.

Technical specifications of presentation venue

In the competition, each team will be allocated:

- An area of approximately **1.5 m x 1.5 m** where all the material parts of the project should fit
- In this space there will be a table size approximately **100cm x 60cm** and electricity will be available. **The model of the project should not exceed the dimensions of the table**
- The posters can be placed on a back to the booth about 2 m high or held by the team during the presentation.

Required deliverables

At least 7 days before participating in the Regional competition of their region, teams should **post in their registration form the link to the portfolio** described below. They are necessary for the jury committees on the day of the competitions and the free sharing of good practices in the educational community of Greece!

Steps to post the portfolio:

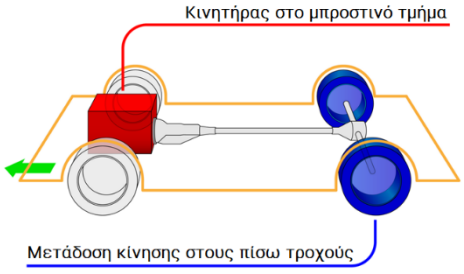
- The teams will create a cloud folder (Google Drive, One Drive, Dropbox, etc.) that will belong to them and upload the portfolio described below.
- The link that leads to the team's cloud AND with download rights (!) should be shared in the registration form to anyone who visits it.
- This notification is done by editing their registration form and filling in the field "Required deliverables" with the link mentioned above.
- To edit your registration form at any time, find in your inbox the email with subject "Confirmation of participation" and sent by eventora.

Required portfolio contents:

Inside the cloud folder you will create 6 separate folders named bold and containing the files described below. On the day of the competition and during the presentation to each group of judges, they must be delivered a folder containing in A4 size the content of files 2, 4 and selectively material from 3 and 6.

1. **Consent Documents**: Documents with the consent of parents for the use of photos or videos in which students' faces may appear (special printable forms that will be posted on the WRO Hellas website)
2. **Team Report**: The Team Report form and a table for each engine you present (you will find them at the end of the regulations)
3. **Photos**: Clear photos showing the stages of construction, and in particular the construction of the mechanisms
4. **Sketches**: The sketches of the simple machines of the mechanisms either in electronic form (pdf, jpg, png) or in digital photo or imprinting on rice paper (Information in webinars that you can watch live or asynchronous).

   Example of a digital construction sketch with the simple machines used highlighted:



5. **Video**: At least one video where students will show and describe the operation of the mechanisms, with emphasis on the simple machines they used. Zoom-in to show construction details paused and running!! The video will be uploaded

by the coach on Youtube on the STEM Education channel. The goal is to create a Playlist With the students' works every year as you can see in this **playlist (CLICK)**!
Instructions for Upload have been given in this **webinar (CLICK)**!

6. **Rest of the material**: posters, presentation and any other material related to the project!

Tender Procedure

During the (Regional or Final) competition, teams must:

- Install their project in the space that will be allocated to them (including the placement of posters, scribble, etc.).
- Go through scrutiny for harmonization with regulations.
- Demonstrate and present the project to the judges, answering their questions
- They visit the booths of the other teams, keeping an eye out for inviting them back to their booth.
- Demonstrate and present the project to the students of the other groups who will visit their stand.

During the presentation to the judges, they should be handed the envelope described in the required deliverables in 3 to 4 copies.

Evaluation

For the judging of the projects, limited time will be allocated to each team - indicatively seven minutes - of which a part (eg five minutes) will be for the presentation by the team and the rest for questions by the judges.

- The students will present the project they have created and indicate how it relates to the theme of the competition
- The team report and the tables of the mechanisms contain important information for the judges, which the team should present.
- There will be a demonstration of the operation of the project, with emphasis on the presentation of simple machines.
- The sketch will be presented through the digital or printed poster, with reference to the operation and solution of the problem it solves.
- The students will answer any questions the judges may have related to the project.

During the evaluation no kind of help or involvement from the coaches to the teams is allowed.

Evaluation Process

There will be only one round of evaluation of the students' projects, after a meeting the jury will give special prizes to all teams based on the points that their project stood out!

The criteria of these awards are shown in the evaluation table, linked to the achievement of one or more of UNESCO's 17 Sustainability Goals.

It is important for the most efficient and faster processing of the process that the Portfolios of the teams are updated 1 week before the final, the content of the deliverables is taken into account at the committee meeting!

Scoring Criteria

Categories	#	Criteria	Points
Concept & Innovation	**A**	**Category 60 total points**	
	1	Idea and creativity	15
	2	Research and development of the concept	15
	3	Workable and qualitative solution to the challenge	15
	4	Originality of the idea	15
EducationalEngineering	**B**	**Category 60 total points**	
	1	Structural stability, Elegance	15
	2	Mechanical performance	15
	3	Correct indication and nomenclature of simple machines	15
	4	Functionality of the mechanism	15
Our first Automation	**C**	**Total category 20 points**	
	1	Functionality of Automation	10
	2	Hint of the 3 steps of automation **Input**/sensor > **Process**/program > **Output**/actuator	10
Sketchesconstructions	**D**	**Total category 20 points**	
	1	Accuracy in depicting the skeleton of structures	10
	2	Accuracy in the depiction of construction mechanisms	10
Presentation & team spirit	**E**	**Total category 40 points**	
	1	Presentation Evaluation	15
	2	Communication skills, Collaboration	15
	3	Stand decoration, videos, posters	10
		MAXIMUM RATING:	**200**

TEAM REPORT

Group Name:		
Coach Name:		
Member Names:	**1.**	**2.**
	3.	**4.**
	5.	**6.**
Topic or themes we **focus on**		
What are we trying to **invent** or **improve**?		
Where did **we look for information**?	Internet Libraries Museum Professionals Other:	
What **solutions did you agree** to attempt to build?		
How many **mechanisms** will you present?		
What **difficulties and challenges did you encounter**?		

Mechanism Table No___

Mechanism Name:	
Problem	Solution
Photo of the construction	Sketch of the mechanism
Simple machines used	
1 Wheel with Shaft / Gear 2 Pulley 3 Lever	4 Screw 5 Wedge 6 Inclined plane