

Appendix A

Description and main features of DICA4 school activities; a detailed description of the activities and reference people can be found at <https://www.dica.polimi.it/dica4schools/>). Addressed SDGs: (2) Zero hunger, (4) Quality education, (6) Clean water and sanitation, (9) Industry, innovation and infrastructure, (11) Sustainable cities and communities, (12) Responsible consumption and production. (13) Climate action, (15) Life on land, (16) Peace, justice, and strong institutions.

Title	Brief description	Type	Durati on	Target: school/age	SD Gs
Meteorology and Climatology: Two Sides of the Same Coin	Meteorology focuses on short- and medium-term weather forecasts, while climatology studies long-term climate patterns. This seminar guides students through the history of these sciences and demonstrates how to use a meteorological station, emphasizing the importance of accurate atmospheric measurements and correct sensor positioning.	Seminar	90'	Primary/6-11 years Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 11, 13, 15
Soil, a resource to be protected and an important "ally" in the fight against climate change	Soil plays a critical role in the water cycle by controlling rainwater infiltration through permeability, which is disrupted by urbanization. This seminar examines environmental issues from land consumption and urbanization impacts, highlighting mitigation strategies to protect soil functions in urban planning.	Seminar	30'-90'	Primary/6-11 years Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 6, 11, 13, 15
The Science of Invisible Water	This activity introduces students to agricultural hydrology fundamentals from both scientific and practical perspectives. Key topics include plant water needs, the "water footprint" of food, and strategies for water management, with interactive discussions and a role-play on irrigation's importance in agriculture.	Seminar + game	90'-2h	Primary/6-11 years	2, 4, 6

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Waste Water: From Threat to Resource	Our sewers carry waste water that needs to be purified to prevent pollution of natural waters, but it also carries precious resources. The activity explores which technologies can already be used to recover waste water and transform it into secondary raw materials and renewable energy.	Seminar + game	2-3h	Primary/6-11 years Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 6, 11, 12
A journey to discover the secrets hidden in the stones	This activity introduces geomaterials—natural materials of the lithosphere crucial for construction and resource exploration—through hands-on workshops, and interactive games. Students learn about rock and mineral identification and key properties by participating in a treasure hunt at the Petrographic Collection of Politecnico di Milano.	Seminar + game + lab	2h	Primary/6-11 years	4, 11, 12
Dr. House: Diagnostics and analysis of the built environment	Buildings, like people, can "get sick" with visible symptoms of degradation and failure. Architects and engineers diagnose these issues using investigative techniques, much like doctors with patients. Participants build model walls and apply diagnostic methods to assess structural properties, learning to identify causes of degradation and understand building preservation methods.	Lab	2-3h	Primary/6-11 years Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 9, 11
Do you know what an earthquake is?	Through interactive activities like games and multimedia illustrations, this program teaches children and teens about earthquakes: their causes, measurement, and associated risks, with a focus on reducing risk to historic buildings. It also covers essential safety behaviors and basic principles of seismic emergency management.	Lab	90'	Primary/6-11 years Lower secondary/ 11-14 years	4, 11
Clay, bricks, masonry, and the Ziggurat	This lab begins with a lesson on ceramic materials and clay, the sedimentary rock used in brick and ceramic production. Students learn about clay processing phases—extraction, shaping, firing—and explore historical brick types, originating with the Sumerians for waterproofing roofs. The activity concludes with scaled brick-making, wall construction, and designing a Ziggurat.	Lab	2h	Primary/6-11 years Lower secondary/ 11-14 years	4, 9, 11

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Sustainable rainwater management	These lab activities focus on sustainable water management and urban water cycle restoration, using an on-site system with a rainwater collection and infiltration tank. Participants learn about monitoring instruments for hydrological and geotechnical variables, analyze real-time data, and observe scaled-down simulations of the system's processes.	Lab	2h	Primary/6-11 years Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 6, 11
Flood laboratory	This activity teaches children about floods—how rain causes them, why cities flood, and how to prevent and protect against flooding. Using interactive models, children explore the causes, impacts on communities, and the role of civil protection plans, fostering awareness of individual responsibility for sustainable development and flood prevention.	Lab	90'	Primary/6-11 years Lower secondary/ 11-14 years	4, 11, 13
We throw them away, but then... that's not waste! it's a mine of resources!	This activity focuses on waste separation and recycling, encouraging participants to recognize different materials and understand the importance of sorting waste at the source. Through hands-on experiments, children learn to identify materials, read package labels, and understand the recycling process, starting from the point of purchase.	Lab	90'	Primary/6-11 years Lower secondary/ 11-14 years)	4, 12
Bacteria in a battery	This activity explores the importance of soil and the problems caused by soil pollution, highlighting its impact on humans. It introduces the role of soil bacteria, which can break down pollutants and even produce electricity, like natural "batteries." Participants will learn how these processes work and how soil can be cleaned and restored.	Lab	2-3h	Primary/6-11 years Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 6, 12, 15
Groundwater	This lab offers interactive activities to explore underground water resources, which are essential but invisible. Students dig a well to discover how water is hidden beneath the surface and learn about its slow movement and impact on water quality through scale models.	Lab	90'	Primary/6-11 years Lower secondary/ 11-14 years	4, 6, 11, 13

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A visual path of groundwater flow through a scaled hydraulic model	This activity uses a small-scale hydraulic model to illustrate the behavior of underground water. Students observe how water moves through different types of aquifers (free or confined) and simulate water extraction from a well, visualizing its movement inside the well and nearby areas.	Lab	30'	Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 11, 12
Underground water resource: observe the aquifer and measure its temperature	This activity involves measuring the underground water table and temperature in two piezometers located in a public park, at depths of 30 and 60 meters. Using manual and automatic tools, students independently assess the water depth and temperature at various levels. They compare results from the two piezometers and discuss their findings.	Lab	30'	Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 11, 12
Let's meet metamaterials : what they are and what they can be used for	This activity introduces metamaterials and their unique properties, such as auxetic structures, through hands-on experiments. Participants will build origami models and test 3D-printed metamaterial samples to explore the differences between regular materials and metamaterials. The session concludes with a discussion of current and potential technological applications for metamaterials.	Seminar + lab	60'	Lower secondary/ 11-14 years Secondary/ 14-19 years	4, 9
Numerical simulation in movies and video games	This seminar explores the role of numerical simulation in revolutionizing the film and video game industries. It explains how methods originally designed for engineering are used to create special effects in films—like explosions and natural disasters—and dynamic environments in video games. The seminar also connects these techniques to solving complex engineering challenges.	Game	30'-90'	Secondary/ 14-19 years	4, 9

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<p>The Collapse of the Twin Towers: Structural Engineering vs. Conspiracy Theory</p>	<p>This seminar examines conspiracy theories surrounding the collapse of the Twin Towers on September 11th, 2001, particularly the idea that explosives were pre-planted by the American Secret Services. It focuses on the structural analysis of the collapse, aiming to demonstrate that the towers fell due to the plane impacts and fires, not controlled demolition. The seminar challenges participants to critically assess the evidence and draw their own conclusions.</p>	<p>Seminar</p>	<p>45'</p>	<p>Secondary/ 14-19 years</p>	<p>4, 9, 16</p>
<p>Earthquakes and historic buildings</p>	<p>This activity combines a seminar and practical demonstration to explore earthquakes and their impact on historic masonry structures. The seminar covers earthquake basics, seismic waves, environmental effects, and Italy's seismic history, along with mitigation strategies. The second part features a shaking table model to demonstrate how earthquakes affect buildings, exploring whether historic buildings can still be safe with proper mitigation measures</p>	<p>Seminar</p>	<p>90'-2h</p>	<p>Secondary/ 14-19 years</p>	<p>4, 9, 11, 13</p>
<p>Geo-Engineering Challenges: The Earth in Your Hands</p>	<p>This activity introduces geomaterials through seminars, a visit to the Petrographic Collection at Politecnico di Milano, and hands-on workshops. Students learn about the interaction between humans and geology, focusing on slope dynamics and groundwater resources protection.</p>	<p>Seminar + game</p>	<p>2h</p>	<p>Secondary/ 14-19 years</p>	<p>4, 11, 12</p>
<p>Practical and interactive laboratory of structural engineering</p>	<p>In this hands-on program, students explore structural engineering by using educational kits with magnetic rods, spheres, and bars to understand basic principles. They then visit the Nervi Laboratory at the Lecco Campus, where they examine 3D models of real structures, reinforcing classroom concepts and offering a tangible, engaging approach to the field.</p>	<p>Laboratory</p>	<p>8h</p>	<p>Secondary/ 14-19 years</p>	<p>4, 9, 12</p>

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Breathe the Future: Pollution and Climate Challenges	In 2-3 seminars, students learn about air quality, pollution sources, health impacts, and control strategies. Topics include: 1) Air pollution phenomena (greenhouse effect, ozone hole, fine dust), 2) Methods for measuring pollution, and 3) Data processing and communication. Seminars may include labs on air quality data analysis.	Seminar + laboratory	2-3h	Secondary/ 14-19 years	4, 11, 13
The Internet of Things: What are MEMS and How Can They Be Used?	This activity explains how Micro-Electro-Mechanical Systems (MEMS) like accelerometers and gyroscopes enable functions like screen rotation on phones and motion-sensing in gaming. Students learn about the design of these tiny sensors, found in phones, cars, and drones, and explore how MEMS allow real-time data acquisition for interactive experiments.	Seminar + laboratory	100'	Secondary/ 14-19 years	4, 9