ESA Education activities

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ESA education objectives

- Motivate and enable young people to enhance their literacy & competence in sciences and technology (STEM disciplines)

- Inspire and enable young people to consider pursuing a career in the STEM field, in the space domain in particular

- Contribute to increase youngsters’ awareness of the importance of ESA (European space programme), space research, exploration and applications in modern society and economy
Education ≠ Outreach!
**Education** = a process which aims at the development of know how and competences through a structured path and methodologies that take into account the abilities and development stadium of a learner

**Outreach** = ‘reaching out’ in a general way; mainly aimed at inspiration and creation of awareness
### Targets & challenges

**Wide target:** 4-28 years old

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**Challenges**

- More than 80 million school-age pupils, 7 million teachers
- 22 Member States
- 18 languages
- Different lower education systems and curricula
- Lack of interest in STEM, girls in particular
- Shortage of specialized workforce in the space sector
ESA’s strengths in education

• Space is a modern myth – a unique motivational context for the study of STEM subjects → innovative learning environment

• ESA is a source of unique and multidisciplinary scientific knowledge – it can play a unique role to both transmit this knowledge and the way it is acquired

• ESA provides access to space data, facilities, experts

• ESA has an international collaborative dimension by definition, where scientific knowledge is produced by creativity, skills, motivation, partnership and dialogue beyond frontiers
There is NO STEM curricular subject that:

- is not covered by a space discipline
- cannot be linked to a space example
- cannot be linked to an ESA mission
- cannot be linked to a space career
Education @ ESA - a diversified approach

School pupils & teachers

Space is the context

**Formal education**, right into the schools, with:
- **teacher training**
- **classroom activities** to support the curriculum in an innovative way
- **European project-like challenges**: learning to think, learning to do, learning to collaborate

**Informal education**, learning while having fun

Universities

Space is the subject

**ESA ACADEMY**

**Hands-on space projects**
- Satellite projects
- Scientific instrumentation and experimentation
- Technology demonstration experiments

+ **Training & Learning programme**
- Courses, lectures and workshops by ESA & space experts
- Participation to conferences
Focus on primary & secondary education
European Space Education Resource Office
ESA’s main project in support of school education
Bringing space to the classroom

- **Targeting the teachers community**
  - as the key actors to make a real change in STEM education
  - as the most effective multiplying factor
  - since inspired teachers make engaged students
- **Using space as a theme/context to teach the STEM school curriculum**
- **Providing access to space content, data, facilities, methodology, expertise and role models** – key value in modern pedagogy of Sciences
ESERO’s strength

• Based on **national synergies** with national Space Agencies, Ministries of Education, national space sector, renown educational partners

• Establishing/maintaining the **institutional framework** to operate in the territory

• **Tracking the evolution and trends of national curricula**

• **Pedagogy and didactics expertise:**
  - Successfully designing/producing **classroom activities** with ESA and national partners
  - Successfully delivering **accredited** pre-service and in-service **teacher training,** and **training of trainers**

• **Large scale reach** across each country
ESERO keeps growing (and turns 10)
5000 teachers trained & 150000 pupils reached in 2015!
Progressive learning: from the classroom to European challenges

Classroom activities
From lessons to project-type activities

National challenges/activities
Project-type activities

European challenges/activities
Project-type activities

Coordinated by ESEROs

by ESA
An over-arching space portfolio

Earth and climate sciences

Satellite data
Space and Earth sciences

Sky Detectives (CESAR)

Satellites and rockets
e.g. CanSats

CDF

Careers

Space Exploration

Life & physical sciences
e.g. Zero-G science labs, Drop!

Space robotics
e.g. Moon/Mars Village, Spheres

Solar System and Universe
An over-arching space portfolio

with a **double entry:**

- per curriculum subject
- per space theme
School education has its own pace

• Do well once, repeat many times
• Use patience
• Re-use winning models
• Address all pupils, not only the geniuses
• Consider that innovation takes time
ESA-ESERO-science community: working like a network

- 3 active ESA/ESERO thematic Working Groups:
  - **Observing the Earth**
  - **Satellites and Rockets**
  - **Human spaceflight and exploration**
- Designing and exchanging classroom activities/training/project-like activities together
EO versus primary school curricula in Europe

• **Space not a topic in itself** but addressed as a topic through other curriculum chapters

• **Most popular** EO-related topics:
  - Seasons
  - Water cycle
  - Basic concepts of navigation (through the ages)
  - Atmosphere
  - Longitude & Latitude
  - Earth interior & surface
  - Oceans
  - Climate change
  - Biodiversity
  - Orbit & rotations
  - Satellite navigation (basics)
  - Cultural & historical viewpoint
  - Habitability
  - Satellites & (navigation) instruments
  - Coordinate systems
EO versus secondary school curricula in Europe

• **Space not a topic in itself** but addressed as a topic through other curriculum chapters such as geography and natural sciences (*).

• **Most popular** EO-related topics:
  
  o **Fundamental laws**
  o **Earth composition & structure**
  o **Seasons**
  o **Atmosphere**
  o **Climate change**
  o **Orbit & rotations**
  o **Earth interior & surface**
  o **Oceans**
  o **Biodiversity**
  o **Basic concepts of navigation (through the ages)**
  o **Longitude & Latitude**

(*) few exceptions (with limited scope): last year secondary school Flemish curriculum; last 2 years secondary school Dutch curriculum (optional); last year secondary school Italian curriculum
• **Least popular** EO-related topics:
  
  - Habitability
  - Satellites
  - Coordinate systems
  - Cultural and historical viewpoint
  - Celestial navigation & navigation instruments
  - Satellite navigation
Successful classroom resources

• Space as a context for other STEM subjects (natural sciences, physics, chemistry, maths, geography...)
• Modularity and high granularity
• Feasibility during classroom time
• Clear link between individual science concepts and real-life applications
Primary school level:
• Observe Earth from the ISS
• See your school from space, From the ground and from the sky
• The magic of light + Secret messages + Daily devices
• Watching a glacier + The ice is melting + The green house effect + Global issues from above
• …..

Secondary school level:
• Case studies based on EO data (Sarepta, Leoworks and other SW)
• Webcam hack + Global issues from above + EO and GPS
• Complementing apps: vegetation (Proba-V) + environment (Copernicus/Sentinels) + ice (Cryosat)

Plenty of classroom resources are continuously created by our pedagogical experts
NEW: Earth Guardians
European school challenge

• Primary + secondary levels, project-type activity
• Progressive learning:
  o Understanding the science behind Earth phenomena (ice melting, change of state, green-house effect, the water cycle...)
  o Select a theme: Climate, Land & cities, Forests, Seas and Oceans, Rivers & lakes, Atmosphere
  o Make and present a group project: identify a problem/environmental issue and propose a solution; use of EO data/products; citizen science approach?
Always striving for higher

- quality
- usefulness
- impact
- effectiveness
- efficiency
So, what is needed from ESA and the science community?

- Access to **space themes, content and expertise**, e.g:
  - ‘Internal’ thematic consultancy and workshops
  - Suggestions for typical real science cases
  - Historical perspective → modern challenges and trends
  - Thematic webinars for teachers and/or students
  - Dedicated MOOCs, YouTube videos

- **Teacher/student-friendly access to data** (over space and time)

- Audiovisuals/visualisation tools

- **Role models**

- Direct insight and access to **real space events & opportunities**

- European **overview, coordination, facilitation**

- **Smart funding**
Thank you!

www.esa.int/education