



SPACE FOR EDUCATION @ ESA

ESERO Czech Information Day, 17 January 2023 Monica Talevi, Head of the STEM Education and Outreach Unit, ESA Education Office

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Space, according to ESA



ESA is one of the few space agencies in the world to combine responsibility in all areas of space activity

Mandatory contributions

- <u>Space science</u>: Solar System, astronomy and fundamental physics
- <u>Future studies</u>, <u>technological</u> <u>research</u>, <u>education</u>



in particular... this is a new exciting Space age



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Space 4.0



Space 1.0: astronomy (+ astrology)

Space 2.0: race to space (the Apollo / Soyuz era) to show capability and political/military power of individual countries **Space 3.0:** the ISS era - more nations collaborate in the name of scientific benefits to mankind

Space 4.0:

- Benefits for society & economy
 - Through the advancement of pure science & technology
 - Through the space down-stream exponentially growing dimension
- Integration of space-generated knowledge, data, services: space is a XXXL contributor to, and enabler of, the Internet of Things!
- Support to UN's Sustainable Development Goals





ESA ambitions: Agenda 2025



One objective - "For Europe to grow its role as a global space leader competing with the US, China and others, ... through the creation of a common European [space] ambition for 2035: one coherent space programme for Europe and its citizens, today and tomorrow, based on its own culture, values, societal needs and political priorities."

Five priorities to kick start the process



Current leadership areas: Earth Observation, Navigation, Science, Communication

New leadership ambitions for Europe

- Enhanced Broadband Connectivity for all (using Quantum Communication)
- > Digital twins of spacecraft, Earth, and the Universe for enhanced services to society
- Very High Resolution rapid response capability (Earth Observation + telecommunication + navigation)
- Ambitious human exploration of the Solar System, first woman on Mars!

ESA Agenda 2025 and education





"To boost ... the European space sector, ESA and its partners need to evolve focusing on three key ingredients: **talent**, access to capital and, fast innovation."

"Education" as one of the explicit enablers

ESA education objectives

- Motivate and enable young people to enhance their literacy, skills and competences 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
- Increase youngsters' awareness of the importance of space and its applications in modern society and economy





Space for Education 2030



Space for Education 2030 is the long-term vision for the ESA Education Programme, aligned with the ESA strategy and ambitions set by Agenda 2025.

S4E 2030 aims at strengthening the Programme's positioning at the forefront of innovation in education. It will contribute to capacity building for the evolving space sector and for a sustainable society, with a view to prepare "for jobs that have not been created, for technologies that have not yet been invented, to solve problems that have not yet been anticipated."



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An important example: the future of workforce in space industry





Emerging skill needs

✓ Digital/IT:

- > AI, Cybersecurity, Big Data, digital twins, quantum technology
- Enhanced collaborative tools
- ✓ Internet of Things, integrated applications and services
- ✓ New materials, advanced manufacturing techniques
- ✓ System engineering
- ✓ Model-based system engineering
- Thermal analysis/design
- Product and Quality Assurance
- Specialised technical skills for technicians
- ✓ Interdisciplinarity!
- ✓ Law, business, management (project mgt, WBS, organizational, contracts, planning, customer relationship, project control and subcontractor management)
- ✓ Soft skills
- Technical skills for technicians

Recommendations

- Career awareness!
- Diversity as enabler for innovation!

Future STEM programme: how we are evolving





- A programme keeping STEM didactics innovation at its core, continuing to pursue R&D in the application of the real practice of science in education, promoting interdisciplinarity, reinforcing role modelling and career awareness as linked to 21st century skills and to the emerging workforce skill needs
- An enlarged, diversified audience: in the formal education thread, opening to early-ages education (3-6 y/o); expanding to the non-formal education settings; explicitly addressing diversity; engaging parents as key players in the education path of their children; reinforcing the link between education and inspiration taking benefit from informal education
- New subject knowledge, skills and competences: reinforcing AI, coding, robotics, climate & environmental sciences; adding cybersecurity, entrepreneurship and system thinking through the use of downstream space themes and societal challenges, and more
- New methods: integration of didactics-sound e-learning, serious gamification and new technologies (AR/VR) in the delivery of learning activities
- <u>Collaboration</u> with ESA Programmes, HR, Communication, national space actors, special communities & NGOs, and high-visibility/high-impact international partnerships
- Increased impact: opportunities for higher numbers of participants
- Maximum possible synergy across activities

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Future ESA Academy: how we are evolving





- <u>New training models</u>: online learning, challenges, hackathons and a novel approach towards usage of experiments and platforms
- An enlarged, diversified audience: Open to technicians (e.g. professional bachelors, vocational training), young graduates and early-career professionals; students and graduates from STEM and non-STEM backgrounds, including business, law, agriculture, architecture, arts, ...
- New subject knowledge: cybersecurity, AI, coding, climate & environment, space safety & security, downstream & business applications, ...
- New methods: asynchronous learning, e-learning, blended learning, personalised learning; highly interdisciplinary projects and trainings
- Structured engagement models with academia and industry
- Increased impact: opportunities for high numbers of participants
- Maximum possible synergy across activities: Transversal (re-)use of training modules; Expert support across activities; Interactive participants' and alumni community

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New programme architecture





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Future STEM Programme: STEM Learning & Inspiration

→ 3-18 y/o



A vast portfolio of activities to support educators from formal and non-formal education venues - from early-ages to upper secondary age-groups: professional training, didactics resources, interdisciplinary school projects, thematic workshops and hackathons, and an international community of practice Inspirational events, role modelling, career awareness, and access to space experts for youth and their families, to address the importance of space and STEM, help to break diversity barriers, boost accessibility and promote sustainability in order to innovate towards a better world

STEM Learning & Inspiration governance



International component ESA-led



- European-level STEM Programme steering and coordination
- Network-level cross-fertilization and exchange of best practices on didactics applications
- International teacher/educator training and facilitation of interdisciplinary projects
- European-level inspirational, role modelling & career initiatives
- Access to European sci-tech sector expertise, data, facilities
- Access to, and collaboration with, international stakeholders and policy makers
- International collaborations for the objectives

ESA-ESERO STEERING COMMITTEES + + ESA/ESERO NETWORK ACTIVITIES

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BOTTOM-UP EVOLUTION DRIVER OF THE ESA STEM PROGRAMME



National component ESERO-led

- ✓ National teacher/educator training
- National didactics resources
- National participation in interdisciplinary projects, either facilitated by ESA and/or national only
- National inspirational, role modelling & career initiatives
- Access to national sci-tech sector expertise, data, facilities
- Access to, and collaboration with, national stakeholders and policy makers
- National collaborations for the objectives

ESERO – what a network!



20 MS in 2021! +2-4 in 2023





ESA STEM Learning and Inspiration Programme Guiding principles, winning recipes



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1. Use the strenghts of space



- Space is a modern myth a unique motivational context
- Space is a prominent part of contemporary culture
- Space is a large part of the solution to global challenges
- Space is a source of cutting-edge
 multidisciplinary scientific knowledge
- Space is a real-life model of inquiry/problem based scientific methodology
- All STEM subjects, skills and competences can be linked to a space example and to a space career
- Space is a cradle for creativity and an enabler of innovation and transformational processes
- Space is a powerful model of international collaborative dimension and dialogue beyond frontiers - a contemporary educational behavioral value

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2. Be aware of the education venues



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Intentional education		Incidental education
Curricular	Extracurricular	
Formal education	Non-formal education	Informal education
How	How	How
 Learning objectives 	Learning objectives	No learning objectives
 Framed methodologies 	Framed methodologies	No methodology in particular
 Framed technologies 	Free use of technologies	Unframed technologies/ venues/
 Framed time 	Framed or Unframed time	time
Where @ Pre-school and school @ Pre-service and Continuous Professional Development venues	 Where @ Public (science) centres/museums @ In the family @ Associations, clubs 	Where @ virtually everywhere

3. Respond to the education needs – the school example



Respect curricular needs

- Subject knowledge
- Skills and competences
- Core values and attitudes



- Delivering methodologies
- Activity type
- Supporting tools



Boost innovation/help curricula to evolve, e.g

- Interdisciplinarity
- Role modelling
- Careers awareness
- i.e. help "bridge the gap between the theory thought in school and the real practice of science"

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4. Be inclusive

Not every recipient has access to the same level of resources and privileges!

- ◆ The ESA Education programme is for all (no elites) → free of charge for the beneficiaries
- * Fair access for all on a large scale
- Easy access and replicability
- **Cong-term sustainability**:
 - <u>No one-offs (give different generations of teachers/students same/similar opportunities)</u>
 - ✓ Financial affordability





5. Promote and enable a culture of sustainability









Thank you!

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