NEXT STEP O2

Empowering schools to design a more desirable and sustainable future

NEXT STEP Scenario Template

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Short Description:

The scientific topic for this opera is inspired by the imagery and material shared through the WEBB telescope. NASA's biggest and most powerful space telescope ever launched on Dec. 25, 2021! The James Webb Space Telescope, or Webb, is orbiting a million miles away and will reveal the universe as never seen before. It will look at the first stars and galaxies, study distant planets around other stars, solve mysteries in our solar system and discover what we can't even imagine. Its revolutionary technology will be able to look back in time at 13.5 billion years of our cosmic history.

In this Template we are presenting scientific questions and answers on this theme through an art presentation/"Show and tell". Using design thinking and presenting it in our STEAM Ideas' Square.

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1. Introduction

NEXT STEP offers a range of exciting ideas and tools to use in your classroom and be able to realize STEAM activities. In this Template of STEAM education we will look at using the method of GSO when studying the universe under the title «Unfolding the universe».

Main aim

The NEXT STEP project is proposing a whole school approach to science learning. Building on previous successful European open schooling and STE(Arts)M initiatives, the project will bring about the NEXT STEP in education by providing a roadmap for the transformation of school classrooms into open and creative learning spaces. NEXT STEP methodological approach exceeds the state of the art regarding existing creative approaches and STEAM initiatives. In this framework the NEXT STEP project will design and set in operation the STEAM IDEAS' Square, an innovative learning environment which will be the nucleus of the school's activities. NEXT STEP will demonstrate how these environments a) can offer opportunities for deeper learning of STEAM, b) can improve the innovation and creative capacities of learners, c) can support the new role of teacher as a coach of the learning process, d) can facilitate effective cooperation with external stakeholders and e) can inspire policy-makers, school heads and school staff to imagine the schools of tomorrow.

Vision of the Project

The NEXT STEP vision for a creative and innovative school is the development of the creative and innovative classroom of tomorrow, the STEAM IDEAS' Square, in which education relies on an interdisciplinary, arts-based methodology within an entrepreneurship and design thinking framework.

The Self-Reflection Tool is offered to the participating School Heads.
You can register to the webtool through the website https://srt.the-next-step.eu .

STEAM IDEAS' Square - (SIS) which will be the main core of the school's creative and innovative activities will have two substances: digital and physical. In its premises and via its digital tools in-school interaction between STEM and other disciplines schoolteachers and among all the relative stakeholders (students, educators, parents, artists, scientists, local community authorities, industrial stakeholders, and policy makers) will be established with the purpose to run complex and exciting real-life educational world projects. Teams of students (from the same or different classes) can also work and cooperate under the SIS umbrella.
By connecting curious minds and specialists and leading them to think "outside of the box" will help to speed up the flow of ideas to **transform the school and its classrooms to** a unique creative space for educational innovation and STEAM education. Through collaboration and the appropriate pedagogies, prototyping, pedagogical innovation, creativity (along with distance learning opportunities) and well-being at school will be established .
In addition, the capacity to work with external organizations so as to explore how such partnerships and networks can be built through a long-term strategy, based on trust and common objectives they contribute to key competence development.
A way to implement and use the ideas of NEXT STEP project is through developing a series of scenarios of use that are in line with the proposed approach and involve schools in a series of creative and innovative activities for the improvement of the local cities, settlements, and communities' physical and built-up environments, while engaging key stakeholders (experts, researchers, local communities, businesses etc.) in the process. Different scenarios about different school typologies will be created and these with the help of the right Strategies will help schools to evolve
One of these scenarios that is suitable for a STARTER school (according to our typology) is the one presented later in this document.

2. Essential Features of the STEAM IDEAS' Square

The development of key competences is further facilitated by the provision of context from other disciplines and can:

a) offer opportunities for deeper learning of STEAM,

b) improve the innovation and creative capacities of learners,

c) support the new role as a coach of the learning process,

d) facilitate the effective cooperation with external stakeholders and

e) inspire policy makers, school heads and school staff to imagine the schools of tomorrow.

All the above in total in the context of a functional NEXT STEP STEAM IDEAS' square will drive to overcome the organizational and technical barriers and to integration of creative and innovative culture in every day school practices and to aggregate and create projects and activities customized to the specific needs of schools.

Deeper Learning Competences, as described by the Hewlett Foundation model (Pellegrino & Hilton, 2013) can be adopted in order to define the exact indicators needed to measure the efficiency of the project's objectives. A selection of certain deeper learning competences that correspond to a range of ages wider than the high school students (which is the main target group of the deeper-learning competences model) can be classified in the following three groups (Frans & Andreotti, 2018):

Group A: Cognitive competencies *(1) Mastering rigorous academic content - A1(2) Thinking critically - A2*
Group B: Interpersonal competencies *(3) Working collaboratively - B3 (4) Communicating effectively* - B4
Group C: Intrapersonal competencies *(5) Learning to learn (C5)(6) Developing academic mindsets - C6*

As defined in the Recommendation of the European Parliament and of the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC):

F1) Literacy competence (GA1)
F2) Multilingual competence
F3) F3M.Mathematical competence and F3S. competence in science, F3T. technology and F3E.engineering, F3MS, F3ST, (STEM=F3)
F4) Digital competence - F4
F5) F5P.Personal, F5S.social and F5L.learning to learn competence (C5)
F6) Civic competence
F7) Entrepreneurship competence
F8) F8C. Cultural awareness and F8E.expression competence

We use the Competences as Features taxonomy from the European Parliament and the Council's recommendation in our scenario.

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3. NEXT STEP Scenario Identification

For the scenario with the title: "Unfold the Universe"

3.1. Synopsis

We are inspired of methodology of the GSO (Global Science Opera) in this STEAM implementation. This means in short terms, that we are using art in the form of music, theater, dance and scenography, to acquire more knowledge about the universe. As we are going through the STEAM steps we are presenting the data and knowledge in an artistic performance for our communities ,often in 6 scenes. The school or group can present their work either physical or/and digital. The scientific topic for this opera is inspired by the imagery and material shared through the WEBB telescope. NASA's biggest and most powerful space telescope ever launched on Dec. 25, 2021! The James Webb Space Telescope, or Webb, is orbiting a million miles away and will reveal the universe as never seen before. It will look at the first stars and galaxies, study distant planets around other stars, solve mysteries in our solar system and discover what we can't even imagine. Its revolutionary technology will be able to look back in time at 13.5 billion years of our cosmic history.

Each school decides how the process fits into its curriculum and with the teachers involved, as well as how many subjects that will be integrated in the process. Feel free to make adjustments to the school structure, time and place.

3.2. Scenario Identification card: "Unfold the Universe"

Category	Description
Teaching theme/problem	Unfold the Universe: Through James Webb Space Telescope and exploring the universe.
Keywords	Solar systems, Stars, Galaxies, Planets, Time, Light
Language	English

Thematic classification	STEAM approach
Learning/Teaching main objectives:	• James Webb Space Telescope (T)(S) • Astronomi (S) • Making your own telescope (E)(M) • Making your own light cameras(E) • The principals of speed and light (M)(S) • Budget (M)(S) • Presenting the theme for the community, through art, music, dance, theater and scenography(A)(T)
Suggested age group	Students from primary to university-level, teachers, researchers, artists and scientific institutions
Estimated level of difficulty	Easy-Advanced. Adjustable to the group and school.
Material and technical infrastructure needed	STEAM IDEAS' Square in form of a presentation space booth physical and/or digital so this is adjustable.
Stakeholders Synergies	Field trip to local surroundings and invitation of local researchers on the topic.
Typical interaction time	1-2 weeks
Organizational structure	STEAM: Depending on time and group, teachers and school structure.
Teaching level	Adapted to local curricula and opportunities.
Level of interactivity	High
Type of interactivity	Study science through process and share through art. Physical and Digital on an open platform.
Authors, Publisher name	Magdalena From Delis
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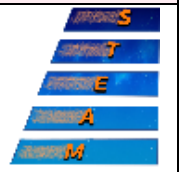
4.1. Feel.

The **FEEL**-phase addresses real-world challenges and invites students (and teachers) to actively engage towards building their own future. This is done by encouraging students to take and share control in the collective creative process, where they understand the rules and make decisions in consideration of them. The safe, small-world society of the classroom is a good place for students to become active agents in their own learning. This may in turn inspire an engagement in the larger-world society. In both cases, the engagement is based on empathy towards others, both people and planet (and all those who reside here).
Both teachers and students *can* and *will* influence the process and the final output. No matter what the main scientific topic is, the aim is to adapt it to today's´ challenges, encouraging students to explore good solutions.

Act #	Description of activities, strategies, methods, means, resources and synergies			Learning goals - Learning outcomes Features/Competences	STEAM Fields
A1	**Educator/s Teachers (Different fields)**	**Educator actions** Start with an inspirational KICK OFF. Getting inspiration. Gathering information. Show videos related to their field and the theme "Unfolding the universe". Getting assignments that have to do with the topic. STEAM approach to find the connections between the different subjects. Find collaborate between teachers and community specialists like scientists or artists.	**Educ Method** *GSO-metodology based on the curriculum.*	• See Curriculum goals: S.T.E.A.M. • Doing field research. • Students with this activity will be capable of finding information and research about space and the atmosphere. • Get an understanding of how things and fields are connected. • Students must collect facts and data. • Discussions about fact and data with an awareness of critical thinking of what they found out. • Technology Competence throw apps. • Digital Competence of gathering notes.	
	Students	**Tools**: Taking notes during research and inspiration in different fields using notebooks, computers, tablets.			**In classroom duration 90 min / field**

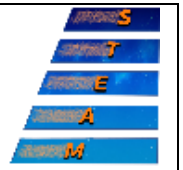
		Working with apps and instruments. Specific telescope. Research Tools.		
A2	**Students**	Group discussions critical thinking, curiosity, social awareness, sharing info in different fields making connections	Critical Thinking, Curiosity, Social Awareness.	**In classroom duration 90 min**
STEAM Ideas' Square (SIS) Operation **School-Stakeholders Synergies** **School**	Educators of STEAM Ideas Square (science, history, art, tech - teacher's) or other school members will collaborate and gather the information findings. Collected questions and answers in the Ideas Square to be organized later in the process. In the Imagine stage all should stay open and curious of all the presented knowledge. **Science teachers** should provide the necessary material and experiments to spark the interest of students on studying the atmosphere and work towards new findings and grasp the greatness of the universe. Studying the planets, around the sun, moon and stars and other atmospheres throughout time. **Technology** educators should prepare the supporting documentation to enable students to assess structures of space and which instruments they can develop, a telescope. Also understand instruments to catch the speed of light and other measuring tools that can be applied. Technology should explore ways to dig deeper in the understanding of how and in what way we can take part of the knowledge we are exploring and finding. **The Engineering** focuses on accurate data when you are exploring the universe and the engineering tools to develop instruments to be even more precise when it comes to data and measurements. Here it can be an idea to build an own telescope. How we can analyze and be more creative for the future. **Math teachers should** give assignments that develop an understanding of speed and size connected to science, technology and engineering. Supporting ways of reporting and collecting accurate data. We put an A for arts in STEAM. Because in this method we know that we are putting our Ideas' Square into a performing space with a design thinking approach. This will be something all the other fields will have to have in the back of their minds during the process. Art, how can we present all the data we gathered through Science, Technology, Engineering and Mathematics with text, theater dance, music and visual arts, like scenography in our Idea' Square for the community? The activities should be aligned with the Design Thinking steps and solutions produced together by the educators to provide students with a genuine STEAM experience.		**Time: 1days collaborative days.**

Community Synergies	Specialists in astronomy present info, and collaborate with engineers, artists, photographers, scientists, and talk, and discuss information and findings how you can present and develop an understanding for the findings you find during the process. Making field trips is a good idea.	**Time: 2x60 min**

4.2. Imagine

Imagination is a powerful tool! It may seem to be an under-estimated talent in the school-system. But where would we be, if we didn't imagine the impossible? There would be no inventions! No innovation! And little exploration. The **IMAGINE**-phase is about exploring possibilities, celebrating them.
This is the phase where students engage each other with new ideas through collective brainstorming-sessions, with ideas building upon ideas, gradually moving from a quantity of ideas to a quality idea through a collective process. It is about the willingness to take risks in finding the best solution (in a safe environment), immersing ourselves into the unpredictable process of creativity. Instead of taking and sharing control, this phase is about a willingness to lose part of the control in the name of progression in the creative process. It can be rather scary to enter the chaos that creativity is closely related to. Being open to new ideas that emerge can be a challenge both for students and teachers, especially if the sense of ownership to one idea is strong. Which is why the emphasis on a circular, collective process of developing ideas is so important: By breaking down the creative process of writing a story into smaller parts (or composing a piece of music, or creating steps in a choreography), and circling it from group to group, lots of ideas are shared. Each group has influence and can share ideas in each of the stories. This way, when one story is chosen at the end, there are no losers, and everyone is a winner, because everyone has contributed to all the stories!

Act #	**Description of activities, strategies, methods, means, resources and synergies**			**Learning goals - Learning outcomes Features/Competences**	**STEAM Fields**
A3	**Educator/s Teachers (Different fields)**	**Educator actions** Start with a BRAIN STORMING inspired by the feel phase. Supporting the students to make the choice on what field/s we should dig deeper	**Educ Method** *GSO* *Concept Formation* *Focus on curriculum.*	Testing ideas and exploring in practice through art. Using design thinking. Learn how to prepare a strategic plan.	

		into. Ask the right questions. Using design thinking. Starting with creativity and from the artistic perspective following the GSO method. Putting scientific work in the arts.		Be aware of the questions they are looking to answer. Make a democratic choice of topics, based on the facts and data the group should focus on. Telescope exploration, Technology competence exploring lights and movement in time. Solar system knowledge. 6 plots, develop text and scene scenarios. Artistic development.	
		Tools:			
	Students	Music: The use of "Next step" music instrument. Or build your own as engineering. Art: Making planets, sun, moon (art, scenography, costumes) etc. Tech: Play with light as scenography, film making. Dance: Connecting speed/time in movement/dance. Use mathematics and astronomy as base to create physical objects and movement. Theater: Develop Characters inspired by the scientific facts.			**In the "Show and tell" space 90 min**
A4	**Students**	TEXT: 6 PLOTS Develop democratic text based on characters and the scientific facts and data that we collected in the feel stage. Based on 6 plots/6 different scenes.		Develop and understand Artistic qualities and skills by a show and tell/stage production. Understanding of how to present science through art.	**In the "Show and tell" space 90 min**
STEAM Ideas' Square (SIS) Operation **School-Stakeholders Synergies**		Educators of STEAM Ideas Square inspiration with musicians, artists, historian, science teachers or other school members will collaborate and guide the students to put art and science together. Starting with the ART. Base the exploration and decisions on the knowledge we got in the feel process. Choose some parts and dig deeper into the knowledge exploring how it can be presented. Explore connecting points. Focus on questions and answers, conflict. For ex.: Science, how can we make costumes in proportions of stars, sun moon and planets put into the art and craft field and scenography. Technology explores elements of light and speed. In our solar system and even further beyond. Making music of these structures. Can this be connected to dance and movement? Engineering what can we unfold of the universe by our self-made telescope vs. James Webb. What is the story we want to tell facts and questions? Think of dialog and text.			**In classroom duration or SIS Space 90 min**

	Mathematics collections of data and presentation in forms and in structures that can make patterns. Can we use this as a base of music composing with sound and structure or as art & design?	
School Community Synergies	Specialists in art fields do workshops and develop music, dances, text and scenography with the inspiration and grounded in the science. Let the art present the science as an exploration. Every one of the students gets to try all art fields and develop small bits of the bigger 6 plots that will be put together in the later phases, created as a part of the STEAM education.	**In the "Show and tell" space 30x4 min**

4.3. Create

In this phase, **CREATE**, students will need to develop and to apply their solutions, what they have imagined in the previous phase. The ideas can vary widely depending on the type of activity and the solutions they seek, and the level of the problem students are trying to solve. They must
implement their ideas, interact with external stakeholders to ask for support and guidance and also be creative to find solutions while they are implementing. It is very important to note that the proposed solutions have to be based on scientific evidence and research results (coming as input from the Feel Phase). Students must be engaged in experimentations and data analysis to provide optimum solutions. Close cooperation with the local communities is necessary.

Act #	Description of activities, strategies, methods, means, resources and synergies			Learning goals - Learning outcomes Features/Competences	STEAM Fields
A5	**Educator/s**	**Educator actions** Mainly organizers. Developing a script of some short. Start with a "show and tell" picking up from where you left off in the imagine phase. Letting the groups share their explorations. Then start putting the arts and facts in a system to lift the science and data to higher knowledge using the Idea´s Square. The teacher acts as the director during the later phase of create. To guide the student through rehearsals.	**Educ Method** *GSO* *Focus on a plot/scenes*	Showing parts of their developing process. Research what part of the process is building up the thesis and answers to questions they got in the imagine phase. Critical thinking and collaboration. Putting the show and tell structure together. Using the 6 plot (6 scenes) method. Killing our darlings and filling holes to make the facts and data solid through democratic discussions. Budget developing.	

		Understanding of a budget.			
		Tools:			
	Students	Whatever the student created in the imagine phase. It can be instruments, the handmade telescope, costumes, lights or other experiments and digital platforms.			**In classroom duration 3 h**
		Tools:			
A6	**Students**	Use the Idea's Square as the "Stage" forum. To put the text, song, music, dance in the space of costume and scenography to be presented. Based on the script of the 6 Plots based on the science and facts that are supposed to be presented. Here the students need to do several run throughs after putting the scenarios together.		Collaboration, social awareness and respect for each other. To look for the science in text and hold it forward in the presentation in all the art fields. Rehearsing the script. (Dialog, music & dance).	**30 min x4**
STEAM Ideas Square **School-Stakeholders Synergies**		High level of organizer skills needed. Putting the STEAM Ideas Square together. This is where everything comes together, and all the fields should come together in the physical form. The teachers, students and the school should work closely together and back the GSO project to be scientifically correct from different points of views. Try to aim for a high level of art and scientific facts in the presentation. Science should go over the dialogue in the actor's text and songs. So, they are correct from the scientific point of view. Technology should see that the different elements of for example light, speed, and so on are presented correctly in for example dance movements or in the scenography. Engineering department should see how the construction of the scene presentation and costume could develop. And collaborate with Mathematics that the planet costumes are the right size to be presented as an accurate measure for the universe and the questions and answers that have been found during the process. This also includes budget understanding. The Art should put all together, acting, text, music, dance. To make it presentable to understand for an audience. But also, to the students to have a deeper process of understanding in art and science.			**Time 2x2h**
School Community Synergies		To use the community collaboration that was in the imagine phase can be a good support in this phase in terms of presentation solutions and also to borrow things the project lacks like: instruments, costumes, lights, but also scientific tools like telescope, pictures for the background and projector and so on. Use the collaboration as an outside force to be precise.			**Time 1 h**

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4.4. Share

Young people have to be interested in societal challenges and find creative solutions. According to the Open Schools to Open Societies project results (https://www.openschools.eu/) nowadays schools work as ecosystems (Sotiriou et al. 2017), which not only produces knowledge but also links this knowledge to the real world and real needs. Moreover, collaboration between formal, non formal and informal educational providers, enterprises, industries and civil society should be enhanced to ensure relevant and meaningful engagement of all societal actors with science.
At this step, students should develop the needed approach in order to communicate their results into the local, national or international community. Students, facilitated from their teachers, should communicate with the rest of the schools but also outside the school. They should inform the the community for their results and how these could contribute to any possible issue that the community is facing.

Act #	Description of activities, strategies, methods, means, resources and synergies			Learning goals - Learning outcomes Features/Competences	STEAM Fields
A7	**Educator/s**	**Educator actions** Producer and host role. The teachers should have an overview of what the students are supposed to present in the "show and tell". And to whom. Send out invitations to an «audience». It can be some of the other students in the school, other schools, parents and family, community collaborators. Doing the after work with the students of reflection and analyzing the process.	**Educ Method** *GSO* *"Show and tell" (performance)*	The students will have different responsibilities in the presentation. This should have been practiced so they feel comfortable and proud of the "show and tell" presentation. Have a deeper knowledge of the scientific topic "Unfolding the Universe". Understand an art process from beginning to end. Learning to reflect and analyze processes. Understanding of design thinking.	
		Tools:			

	Students	The STEAM Ideas Square as a presentation stage to be the biggest tool. The students have been put into presentation groups of musicians, characters, dancers, technicians, pr/marketing and so on. And in this phase, they should use the chosen tools in the Create phase to complete the Share performance/presentation. Tools:		**In classroom** **Duration** **2 h**
A8	**Students**	Text, instruments, costumes, props, scenography and the tools that have been developed from the start like telescope and other material things will be used and practiced in the sharephase.	High collaboration value, presentation, and artistic skills. Entrepreneurship competence.	
STEAM Ideas Square **School-Stakeholders Synergies**		**All on board in the** STEAM Ideas Square and the presentation. ● PR/Marketing, sharing information of the "show and tell", maybe selling tickets that match the budget. ● Preparation before, under and after. ● "Show and tell" support. ● Watching the presentation (should if possible be documented) ● All parties can be invited to meet in the aftermath of the project to reflect on the process and results.		**Time** **2 h** Presentation 30-60 min Reflection 1 h
School Community Synergies		Invited to the STEAM Ideas Square and "Show and tell" and also to the after reflection together with students and teachers.		**Time** **2 h**

5. ANNEXS

6. Abbreviations, links, short terms apps used in Educational Scenarios in different phases.

- James Webb: https://webb.nasa.gov
- Cultural artistic representation of the skies/constelations - https://figuresinthesky.visualcinnamon.com/
- This is an interactive tool used to produce 3D visualizations of planet ephemerides, sizes and shapes- https://www.cosmos.esa.int/web/spice/cosmographia
- Lots of stuff - https://www.skymaps.com/store/cat06.html
- Links for Started in Sonification - https://astrobites.org/2021/06/17/getting-started-in-sonification/
- Moon phases calendar - https://www.jpl.nasa.gov/edu/learn/project/make-a-moon-phases-calendar-and-calculator/?fbclid=IwAR1Jhdc99KsDWM2K4llr07DAKW0zZEBr1aBTD2y7ru3hnrdKXReYPMnB5RQ
- I made the translation of this site to portuguese - https://www.earthspacelab.com/pt
- Resources - https://www.astro4dev.org/resources/
- A vídeo I made about Asteroids - https://www.facebook.com/watch/?v=282607003099539&__tn__=F
- Cube for Android App is https://play.google.com/store/apps/details?id=com.MergeCube.ObjectViewer&hl=en_US&gl=US
- GSO: https://gso4school.eu

3.5. Features / Competences

Deeper Learning Competences, European **As defined in the Recommendation of the European Parliament and of the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC):**
To address these strategies a Deeper learning approach as described by the Hewlett Foundation model (Pellegrino & Hilton, 2013) can be adopted in order to define the exact indicators needed to measure the efficiency of the project's objectives. A selection of certain deeper learning competences that correspond to a range of ages wider than the high school students (which is the main target group of the deeper-learning competences model) can be classified in the following three groups (Frans & Andreotti, 2018):

Group A: Cognitive competencies
(1) Mastering rigorous academic content - A1
(2) Thinking critically - A2
Group B: Interpersonal competencies
(3) Working collaboratively - B3
(4) Communicating effectively - B4
Group C: Intrapersonal competencies
(5) Learning to learn - C5
(6) Developing academic mindsets - C6

As defined in the Recommendation of the European Parliament and of the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC):
F1) Literacy competence – GA1
F2) Multilingual competence
F3) F3M.Mathematical competence and F3S. competence in science, F3T. technology and F3E.engineering //or/ F3MS, F3ST (STEM=F3)
F4) Digital competence - F4
F5) F5P.Personal, F5S.social and F5L.learning to learn competence (C5)
F6) Civic competence
F7) Entrepreneurship competence
F8) F8C. Cultural awareness and F8E.expression competence

F1-F2-F3-F4-F5-F6-F7-F8-F?-F??-F???
A1 – A2 , B3, B4 (F5), C5=F5L , C6

NEXT STEP Partnership

Western Norway University of Applied Sciences

SCIENCE VIEW

ELLINOGERMANIKI AGOGI

NUCLIO
Núcleo Interactivo de Astronomia

DUNDALK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA DHÚN DEALGAN

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