D3.1.x Moon Village – a Global Science Opera (GSO)

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Figure 1: Image Credit ESA
(https://www.google.no/search?q=images+of+moon+village+esa&biw=1617&bih=739&tbm=isch&imgil=Iw_pfimQr4BNYM%253A%253BJ8pidW22_YPUiM%253Bhttp%25253A%25252F%25252Fwww.space.com%25252F32695-moon-colony-european-space-agency.html&source=iu&p)

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1 Introduction

1.1 Subject Domain

The Global Science Opera (GSO) annual production in 2017 ("Moon Village") focuses on astronomy, and specifically the technological innovations related to the creation of a Moon Village. Through both science and arts education activities, pupils will engage with inquiry-based activities.

1.2 Type of Activity

GSO is a global, trans-disciplinary creative education initiative made possible through digital interactions. It is a network of scientists, art institutions, schools, universities, in all of the inhabited continents. It exists at the meeting point of science and art, of pupils and scientists, of research and practice, and of all human cultures. GSO envisions, creates, produces and performs educational operas by and for a global community through real-time live streaming. Each school takes part in a local implementation which is also part of the international effort.

1.3 Duration

The process of creating the "Moon Village" GSO production will last for 12 months (January-December, 2017). During this time, teachers in the various countries choose to dedicate time according to their capacities, and their roles in the opera (e.g. performers, composers, etc.). The premier opera performance (scheduled for December 12th or 13th, 2017) is expected to last for 5 hours including sound checks, general rehearsal, and actual performance. The actual performance = 1 hour.

1.4 Setting (formal / informal learning)

GSO is open to all kinds of educational frameworks. Performing parties are schools which have integrated the GSO into their activities, universities, or art education institutions.

1.5 Effective Learning Environment

This example of an implementation relates to the following categorization (please see CREATIONS D2.3 for further details):

- **Arts-based** which addresses and enhances scientific interconnection of science with aspects of art
- **Dialogic space / argumentation** aiming to engage students in argumentation and dialogic processes for a better insight into the nature of scientific enquiry and the ways in which scientists work
- **Communities of practice (web-based/physical)** aiming to develop a network of online communities and channels sharing multicast-activities inspired by science on national or international level.
- **Communication of scientific ideas to audience** addressing the need to establish settings in which learners will be enhanced to externalize and elaborate on scientific concepts they have acquired while interacting with an audience (learners, teachers, scientists, parents, etc.); promoting this way a dual channel of communication: a) reflective processes (self-engagement for scientific

consistency and verification) and b) explicit elaboration of scientific ideas through interaction and 'extroversion'.

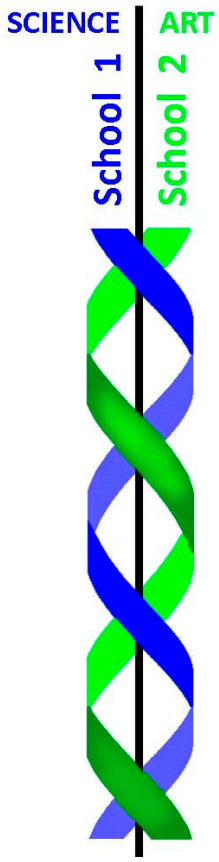
The GSO approach has been to communicate with "alpha-contacts" in each country, who thereafter engage institutions in their countries. For this reason, there has been a wide diversity in the approach to implementation, and to what effective learning environments represent.

- Global environment: Digital platform (Adobe Connect for meetings/rehearsals, and live-streaming for performance)
- Local environment: School, university, art institution or research center.

2 Rational of the Activity / Educational Approach

2.1 Challenge

While GSO provides many opportunities, it also poses challenges in the areas of implementation, common learning goals across country borders in different continents and different age-groups, common understanding of arts education procedures, the definition of artistic quality in this context, and a disparity regarding technical means between schools in varying countries.



Relevance for RRI: A goal of the GSO is to facilitate **inclusion** of any and every pupil regardless of any circumstances. That leads to situations, though, in which some participating schools have barriers to participation due to lack of basic technological equipment. Inclusion of these pupils must be based on a creative activity which can provide inclusion for many such schools. One approach to this is the development of a "Science Opera" app which will enable participation of whole communities of schools in the GSO. This app is currently being developed by the Erasmus+ project, "Strategic Partnership: Agents of Change in Education (SPACE)".

2.2 Added Value

GSO provides learning opportunities in which pupils from around the globe may cross-inspire and learn from and with each other. In addition to being a crowd-sourced collaborative creativity environment, it provides social and emotional settings during which pupils of various cultures, traditions, ages and religions, may explore together. GSO invites Possibility Thinking (see CREATIONS Deliverable 2.1), as it requires the invention of solutions for a variety of artistic, science education and technological procedures. Also, for school pupils, preliminary data has shown that the concept of "performing in front of the whole world" provides a growing opportunity. Several of the scenes in "Moon Village" will be created by educational institutions in more than one country together. In some cases (e.g. Australia/UK), continued collaboration has been established beyond the GSO production boundaries.

3 Learning Objectives

3.1 Domain specific objectives

The scientific domain in 2017 is astronomy and the ESA's Moon Village[1]. GSO pupil ages vary from country to country, meaning that learning objectives must be defined locally by each school. All schools, though, will learn about the Moon Village and its related science and technology, as a common theme.

Within arts education, the objectives are to learn school opera as a methodology, including specific skills and inquiry with the various included arts education domains (music, drama, scenography, light design, etc.).

3.2 General skills objectives

The objective of skills may be seen as developing social and emotional skills, cognitive skills, and, especially, meeting points between these, within an international context. Creativity and critical thinking, both considered to be "21st century skills", may largely be said to occur in the interaction, and cross-fertilization between these groups of skills (OECD, 2015).

More specifically, learning across boundaries, inquiry spanning over more than one school collaboratively, and technological skills, are part of the inquiry process in GSO.

[1] https://www.youtube.com/watch?v=amYK5voqLSk&feature=youtu.be

4 Demonstrator characteristics and Needs of Students

4.1 Aim of the demonstrator

The aim of the demonstrator is to describe the GSO methodology for implementation of the "Moon Village" opera, explore further its challenges and opportunities, receive feedback, and support its implementation within the CREATIONS project while liasing with other R&D projects in the fields of creative science education.

4.2 Student needs addressed

Needs addressed are the creation of a Living Dialogic Space within creative science exploration, and rigorous engagement with Possibility Thinking (see CREATIONS Deliverable 2.1).

5 Learning Activities & Effective Learning Environments

GSO exercises flexible implementation whereby several options are provided to the "alpha-contacts" in various countries, from which they may choose to implement their participation.

During the "Moon Village" opera production in 2017, the global network simulates an "opera company" in which performers, composers, designers, scenographers, science educators, etc., collaborate to create the opera. There is no "one size fits all" approach. Typically, a school will receive a scene in the opera, which they will write the libretto for following their exploration of the scientific theme at hand. Then they will compose music for it, and perform that scene by video or online, as part of a global community.

In the Global Science Opera, the various opera scenes take place around the globe. In this image from a previous production, Portuguese students watch one of the Greek live performers.

Science topic: Astronomy and Technology (Relevance to national curriculum) Class information Year Group: GSO is open to all grades. Most classes are 5th grade or higher. Age range: GSO is open to all ages. Most pupils are of age 10 and older Sex: both Pupil Ability: The scenario allows space for pupils of various abilities to participate. Each teacher is responsible for connecting the scientific theme to the level of his/her pupils, with a focus on science and/or art, according to the educator's specialization, yet all participate in both exploratory processes to various degrees. GSO is open to pupils with disabilities, and the Dutch team has focused on involving pupils with disabilities in the project.	Materials and Resources *What do you need?* This depends on the specific activity taking place in each school. Examples: Performers will need access to video and/or streaming facilities, as well as costumes. Composers need access to music lessons and instruments. All participants need access to high level scientific information, which is continuously in dialogue with scientists and science educators. *Where will the learning take place?* Each class will decide this for themselves. Most learning will take place in the classroom, in labs, or in a local arts institution. *Health and Safety implications?* No. *Technology?* Yes. Taking part in the rehearsals and streaming (for countries performing live) involves access to internet. *Teacher support?* Both science and art teacher support is needed. GSO encourages contact with teachers or professionals within the other discipline(s), or collaboration with one of the other teams in order to make up for the lacking capacity in that specific school/university.
Prior pupil knowledge	

Individual session project objectives*:*

The GSO "Moon Village" production will be an opportunity for students to explore issues related to astronomy and technology. These topics will set the inquiry process for the opera in motion. GSO is focused on science inquiry in a creative framework. Also, science communication is a major factor by allowing a scientific theme to inspire a multi-disciplinary artistic project's outputs.

The project will also allow students to interact and develop social and collaboration skills, thus experiencing how science can be a group activity and not only a solitary one: Individual, collaborative and communal activities for change. This takes place also within the added digital dimension, in which pupils take part in a "Global Classroom" with other pupils around the world.

Pupils will be introduced to the common creative impulses of science and the arts.

Specifically, the following aims are present:

- Active participation in the negotiation of scientific concepts
- Developing creative skills based on the CREATIONS inquiry approach
- Understanding of scientific concepts and phenomena
- Scientific interconnection of science with aspects of art (students will undergo a multi-disciplinary artistic process which demonstrates and deepens understanding, supporting discipline knowledge in both the science and arts educational disciplines).
- Developing a cross-country, multi-cultural spirit of friendship, cooperation and teamwork
- Digital competences and their social impacts

Connecting the science classroom with research infrastructures

Assessment During the "Moon Village" production, a number of schools in the countries in which the CREATIONS project is active (e.g. Spain, Norway, Greece) will be invited to take part in the CREATIONS evaluation process. This is scheduled to take part during the 2nd half of 2017. It is possible that 1-2 non-European countries will also be asked to take part so as to enhance	**Differentiation** *How can the activities be adapted to the needs of individual pupils?* This is up to the local teachers. GSO provides a framework which needs local adaptation. In the future, it will be possible to develop GSO's for a specific age group, with a tailor-made curriculum focus.	**Key Concepts and Terminology** **Science terminology:** Astronomy, Moon, Solar System, Space **Arts terminology:** 1) Aria: Solo song by one character. The plot's "action" is stopped to allow this character to express a certain emotion and inner feelings. 2) Duet: Two singers, preferably each singing their own verse followed by a section in which they sing together.

the global perspective of the evaluation.		3) Ensembles: Three or more singers 4) Choir: The choir can be used to "comment" during the other songs, or as simple choir pieces. 5) Overture: Instrumental (no voices) opening piece which sets the mood of the opera. 6) Interlude: Music performed between acts or scenes. 7) Recitative: "Spoken Song" which tells a story, and which propels the plot further by revealing action (what has taken place, what will take place, a secret, etc.). 8) Tableau– A dramatic activity in which a group of pupils are asked to physically construct an opera scene through body placement, facial expressions, and props 9) Various musical instruments
Session Objectives: During this scenario, students will Explore the ESA website, and learn about modern research concerning the Moon Village; Experience musical, visual design, drama techniques as tools for the opera; be introduced to pupils from other countries.		

Students will gain knowledge and experience with group-work in which various groups will create compositions, scenography, costumes for the Science Opera. The libretto should include key concepts connected to the scientific theme. Scientific models and figures can be of great inspiration to scenography, costumes and music.

Throughout the scenario, pupils will learn to make their own decisions during inquiry processes, make their own connections between questions, planning and evaluating evidence, and reflect on outcomes.

Learning activities in terms of CREATIONS Approach

IBSE Activity	Interaction with CREATIONS Features	Student	Teacher	Potential arts activity
Phase 1: **QUESTION:** students investigate a scientifically oriented question	Students pose, select, or are given a scientifically oriented question to investigate. *Balance and navigation* through *dialogue* aids teachers and students in creatively navigating educational tensions, including between open and structured approaches to IBSE. Questions may arise through *dialogue* between students' scientific knowledge and the scientific knowledge of professional scientists and science educators, or through *dialogue* with different ways of knowledge inspired by *interdisciplinarity* and personal, embodied learning. *Ethics and trusteeship* is an important consideration in experimental design and collaborative work, as well as in the initial choice of question.	Generate and writes down questions about the moon and solar system.	Introduces the topic of "Moon Village" by (for example) watching the European Space Agency's video. [2]	Begin cooperation with music/fine arts/drama/dance teacher(s). Examples: experimenting with various musical instruments and drama techniques.

[2] https://www.youtube.com/watch?v=amYK5voqLSk&feature=youtu.be

Phase 2: **EVIDENCE:** students give priority to evidence	Students determine or are guided to evidence/data, which may come from *individual, collaborative and communal activity* such as practical work, or from sources such as data from professional scientific activity. *Risk, immersion and play* is crucial in *empowering* pupils to generate, question and discuss evidence.	Students compare their ideas to existing evidence.	Guides students to relevant evidence.	Comparing artistic ideas to other art-works, especially school art works created by pupils. Give preference to art projects inspired by scientific phenomena.
Phase 3: **ANALYSE:** students analyse evidence	Students analyse evidence, using *dialogue* with each other and the teacher to support their developing understanding.	Students analyse evidence and make conclusions. This process is crucial to understanding the connection between scientific discovery and the artistic process.	Help students interpret the potential implications of the evidence for the students' own inquiry.	Begin creating and rehearsing the opera.
Phase 4: **EXPLAIN:** students formulate an explanation based on evidence	Students use evidence they have generated and analysed to consider *possibilities* for explanations that are original to them. They use argumentation and *dialogue* to decide on the relative merits of the explanations they formulate, *playing* with ideas.	Formulations of scientific explanations, and sharing ideas with GSO schools in other countries	Guide students in their consideration of possibilities.	Continued production of original material (music, etc.), and opera rehearsals, and awareness of what other GSO students are developing.

Phase 5: **CONNECT:** students connect explanations to scientific knowledge	Students connect their explanations with scientific knowledge, using *different ways of thinking and knowing* ('knowing that', 'knowing how', and 'knowing this') to relate their ideas to both disciplinary knowledge and to *interdisciplinary* knowledge to understand the origin of their ideas and reflect on the strength of their evidence and explanations in relation to the original question.	Formulating ideas in relation to discipline knowledge in a larger context, including how scientific and artistic ideas may cross-fertilize each other within the inquiry process.	Ensure scientific quality with regard to explanations	Continued rehearsals, costumes making. Rehearsals may take place with other countries at this stage.
Phase 6: **COMMUNICATE:** students communicate and justify explanation	Communication of *possibilities*, ideas and justifications through *dialogue* with other students, with science educators, and with professional scientists offer students the chance to test their new thinking and experience and be *immersed* in a key part of the scientific process. Such communication is crucial to an *ethical* approach to working scientifically.	Students communicate their knowledge and explore its ethical implications.	Supports the communication process and the opera performance logistics	Opera performance locally and online (streaming)
Phase 7: **REFLECT:** students reflect on the inquiry process and their learning	*Individual, collaborative and community-based* reflective *activity for change* both consolidates learning and enables students and teachers to balance educational tensions such as that between open-ended inquiry learning and the curriculum and assessment requirements of education.	Reflection process regarding scientific and artistic conclusions	Discuss the implications of a global collaboration with students	Reflection on the process, and collection of documentation of data from the GSO event to the extent possible / sharing

				experiences via social media.

6 Additional Information

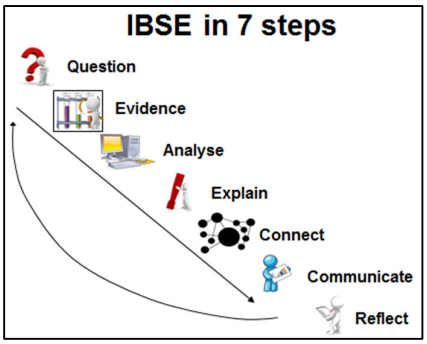
Website: www.globalscienceopera.com

7 Assessment

During the "Moon Village" production, schools will be invited to take part in the CREATIONS evaluation process (2nd half of 2017) for pupils (pre- and post) and teachers (post).

8 Possible Extension

The CREATIONS approach to inquiry has highlighted dialogue between science and the arts. Also, communal/community are a focal point. Within the scope of the GSO, it is possible to integrate these elements within the initiative's design to a greater extent. This entails bringing closer the various processes occurring in the different countries involved. Stergiopoulos (2015) has approached this by establishing a real-time interactive platform for music-making within the opera. The diagram above also expresses an attempt to unify a more homogenous process of "trading" between schools and across disciplines (Ben-Horin, 2015).



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