

Scenarios and Scenes of Opera for STEAM Creative Learning. Workshop Global Science Opera with Experiences for Classroom Implementation

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Abstract. The Scientific Opera into classroom promote creativity and STEM knowledge (sciences, technology, engineering and mathematics) together with Art. Scientist Opera scenarios make up an interdisciplinary work, mobilize and educate in emotions, train communication and language skills, and develop scientist subjects in today's society [1] with IBSE (Inquiry Based Science Education) methodology [2].

The Opera gathers diverse forms of artistic expression: opera's script, the social context, scenic proposals, instrumentation, choreography, choirs, recitative text, musical composition, musical interpretation and song, dance, costume design, scenic pictures, whose presence is evident; and also allows teachers to introduce to innovative ways to conduct their science classrooms.

Creations Project [3] achieve the goal to promote new strategies and methodologies to guide the student's creative learning [4] process in the curricular context and involving around 30 countries of the world in Global Science Opera, GSO [5]. It's one of the projects Scientix Community [6].

The workshop is focused on STEM subject present in previous operas GSO editions: *Skylight* in 2015 International Year of Light, *Ghost Particles* that make up the universe in 2016, *Moon Village* to survive Earth in 2017, *One Ocean* saving the seas in the process of realization in 2018.

Keywords. Arts, Community for science, Creative learning, cross-disciplinary, IBSE, STEM curriculum, Science education, Science Opera.

1. Introduction. Opera into classroom

Opera is a play incorporating the elements singing, acting, dancing, costuming, pictures, body expression. The Scientific Opera into classroom promote creativity and STEM knowledge (sciences, technology, engineering and mathematics) together with Art.

Several studies and numerous opinions of important artists from Hemingway, Marisa Meyer (former CEO of Yahoo), also the creators of MediaLab from MIT, or Frank Gehry the architect Guggenheim, support the counterintuitive idea that limits trigger creativity [7-8].

The workshop "experiences for classroom implementation of the STEAM Opera" offer teachers continuous training, reference activities, dramatization exercises, provide art resources, knowledge Creations Project. Under this perspective contents won't be only the goal of the class work but also the tool and the way to enhance multiple skills and the multiple intelligence types. of those who are our students today, and tomorrow European citizens. Questions that students pose to themselves are the principal thread of STEM contents and concepts with creative scenarios. In this way classrooms changed into labs to experience emotions and space that surrounds us, and enhance communication skills starting. We assisted students in building knowledge by de use of bodily expressions Verbal and non-verbal communication and individual uncertainty lead them to assertiveness, because creative work enhances the validity of all contributions; disruptive participation could be a value in our classrooms. Creations Project established a pan-European network, with the objective of building a Global Science Opera each year. Creations provide teachers training and resources (Figure 1).

The incorporation of professionals specialized in artistic disciplines, the participation of image, sound and technology technicians (Figure 2), recognized researchers, management organizations and Universities collaboration give wings to the classrooms beyond classical borders. Art and Science are sometimes far away. The combination of these two areas can enhance cross-disciplinary thinking and raise students' interest in both

STEM and art subjects. No borders, no frontiers in knowledge with STEAM activity.



Figure 1. Training activity Creations Summer School. 2015



Figure 2. Technical assembly work. 2017

2. STEM approximation through the elements of the Opera

Opera is essentially a play in which music and song predominate instead of spoken. This singing is combined with the other theatrical elements of drama, dancing, costumes, sets, staging, lighting, title, libretto, musical composition, "recitative", "aria", argument, social context, scenic proposals, instrumentation, choreography, choirs, expression of emotions (Figure 3).

Nevertheless STEM contents are present throughout the History of the Opera. Among the

most unique and ancient find The Elements, published around 1713, with allegorical characters such as Air, Water, Fire, Earth, Time and Aurora.



Figure 3. Ghost Particles performance. 2016

2.1. The Moon presence into the Opera elements

We propose as main workshop objective acquiring resources to prepare the draft of a scientific Opera. In this section we provide evidence of STEM topics in operas containing the Moon as a protagonist in some one element cited previously that we can identify on the development of the plot.

2.2. STEM in the Opera with the Moon

The Moon is an astronomical body that orbits planet Earth and is Earth's only permanent natural satellite. It is the fifth-largest natural satellite in the Solar System and also is the reference subject in poetry, novel, cinema, painting, and through the Opera.

In the study of the Moon presence in different Operas, we will refer the year, the composer, the type of Opera with meaning within the social context, and the scientific content specifying, if possible, the moment in which we can find it in the referenced version.

- 1777, Josep Haydn. *Il mondo della luna*. Singspiel. Opera bufa. The title, *Il mondo de la lluna*, offers singular arias (*O lucente moon*). We find astronomy contents [9] focus on Moon (min 6), the description (min 11:03), presentation a avant-garde artefact telescope (min 12:50), physical laws (min 58:45).
- 1791. Wolfgang Amadeus Mozart. In *The Magic flut*, a folkloric and popular drama, the Moon is present with *The Queen of the night* [10].

- 1831 Vincenzo Bellin. Norma, drama, with a prayer to the goddess Luna asking for peace and help against the evil of the druids in (min :24) [11].
- 1875. Charles Offenbach, *Le Voyage dans la Lune*, bufa, inspired by the Earth and the Moon by Jules Verne; present an Astronomical Observatory (min 28:) [12].
- 2008. Kaija Saariaho, drama. History and Society. The life of the Marchioness Émilie du Châtelet (1706-1749), mathematician, physicist and lover of Voltaire reveal personality of a scientific woman and nobility in the eighteenth century, and her letters to Voltaire inspire the argument of the Opera Emilie. An example is Scene VIII developing contents: the orbit of the moon, the gravity, the ebb and flow of the tides and more [13].

3. Global Science Opera experiences. Creations Project

Creations is a project funded by the European Union. The goal is to develop creative approaches based on art for an engaging young people in science classroom.

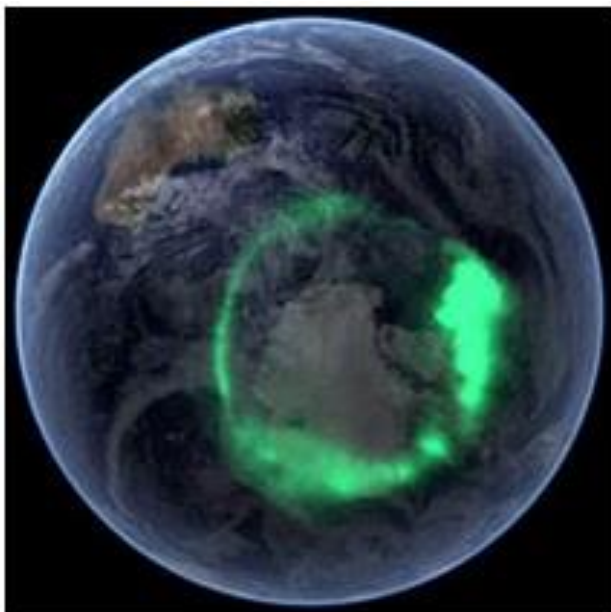


Figure 4. Earth observation from Moon. NASA's ceded image and HOU collaboration

First proposal, Skylight, focused around the celebration of the international year of light. Second edition worked with the support of CERN. More other International Organizations

are added every year providing different kind of resources (Figure 4).



Figure 5. Webinar Oceanographic Institute of Malaga

Schools, universities, scientists, teachers, artists and students are engaged in a collaborative work. Scientix Community provides resources facilitating interaction among the participants; the webinar, an online conference (Figure 5), amplifies the information channels, brings the experience of researchers to the students and provides the added value of the interaction.



Figure 6. Global Science Opera productions

Global Science Opera productions [14] are Skylight in 2015, Ghost particles that make up the universe in 2016, Moon Village to survive Earth in 2017, One Ocean in 2018 saving the seas (Figure 6).



Figure 7. Primary and Secondary students

Summarizing, we have the opportunity educate a new generation of scientifically literate European citizens while they develop artistic skills, and inspiring young people to choose for science and technology careers (Figure 7).

4. Acknowledgements

The author thanks all students, teachers, schools (Madrid, Barcelone, Bilbao, Valencia, Málaga) research and university institutions, for their active participation in each edition GSO, Creations management team, and Scientix Community for promote collaborative actions for Science Education in Europe.

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