The Global Science Opera Leverage students' participation and engagement in science through art practices

O2 The GSO4SCHOOL

Learning Science Through Theatre Tutorial

GSO4SCHOOL has been funded within the framework of the European Union Erasmus+ programme

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Short Description:

Learning Science Through Theatre (LSTT – www.lstt.eu) brings together science and art inquiry. Students learn science in a creative way while implementing a theatrical performance related to scientific concepts.

This tutorial guides you on how to realise activities and prepare a theatrical scene or/and a full performance.

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1. The GSO4SCHOOL Approach

To reach the full potential of the pedagogical principles that are presented in the project's pedagogical framework (http://gso4school.eu/gso4school-framework/), the GSO4SCHOOL project will use the **Design Thinking methodology** in order to bring innovative and entrepreneurial aspects into the science and art disciplines. The idea is to combine the design thinking methods in order to integrate into the formal, informal and non-formal settings the aspects of "ideas become reality". **Design Thinking is a design methodology that provides a solution-based approach to solving problems.** It is useful in tackling complex problems that are unknown, by understanding the human needs involved, by re-framing the problem in human-centric ways, by creating many ideas in brainstorming sessions, and by adopting a hands-on approach in prototyping and testing. Design Thinking is in line with the proposed steps that GSO4SCHOOL will follow during the project, which are inspired by the OSOS Open Schooling Model, namely **Feel**, **Imagine**, **Create** and **Share**. They are in alignment with the Discover, Define, Develop and Deliver steps of the Double Diamond model of Design Thinking (see Figure 1).

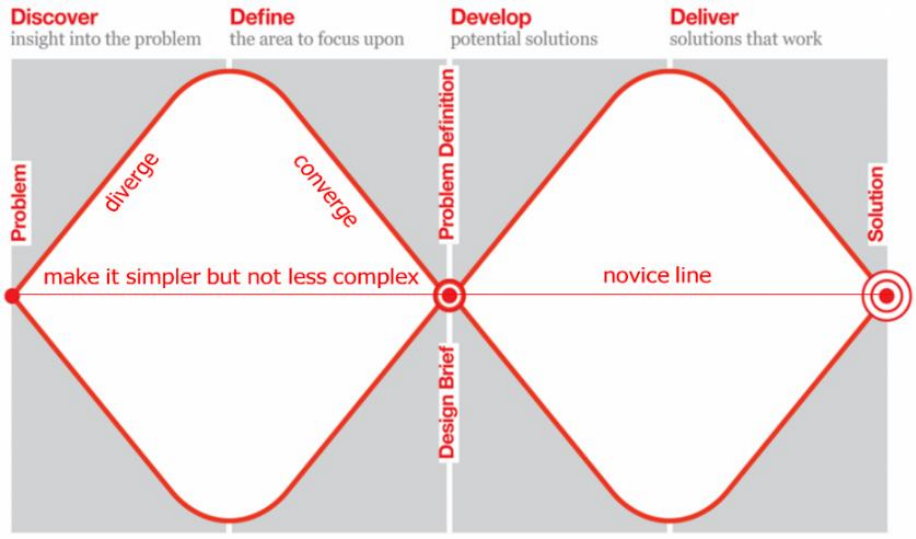

Figure 1: *The Double Diamond model of the British Design Council*[1]

GSO4SCHOOL will act as a facility, as a meeting place. It's a place between science, art and the society to connect all the stakeholders and draw ideas that will be realized with a common purpose, the well-being of the local/national/international community. It will **FEEL** societal needs, will explore and **IMAGINE** novel solutions for the future so to **CREATE** these within the school and **SHARE** it with the community. It's a facility designed to generate new ideas in an open and collaborative environment, to promote experimental innovation and rapid prototyping for art/science-related projects.

[1] Design Council, figure retrieved in September 2019 from https://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond

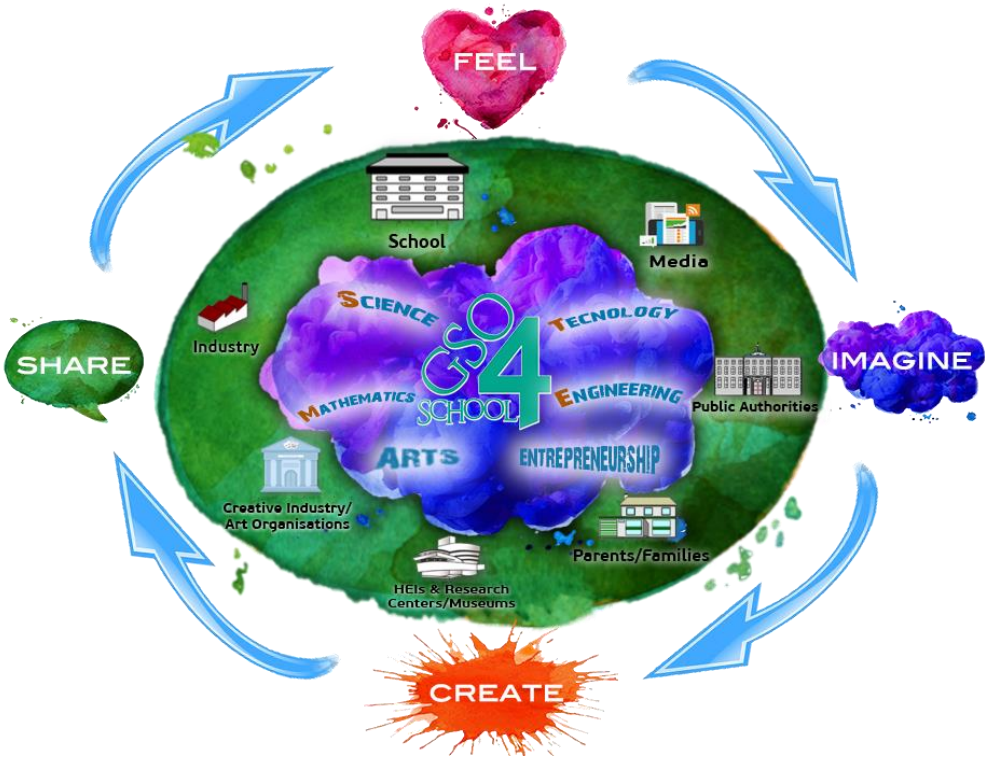

Figure 2: *The **GSO4SCHOOL** Approach. Each school will follow the respective **guidelines and material (http://gso4school.eu/how-to-gso/) according to the setting in which it is operating**. Specific scenarios of use, will be provided by the **GSO4SCHOOL** partners (**through the material that will be developed**) in order to show case how the proposed initiative could be realized and at the same time a **support mechanism** will be provided by the project partners **(National Coordinators)** in order to support all the needed implementation activities. The schools will collaborate with **each other as well as with** Stakeholders during **the implementation phase** in order to identify the local/national/international needs and develop their own real-life STEAM projects to provide solutions **through the development of Science Operas**. The latter will follow the Feel, Imagine, Create and Share approach (integrating design thinking and entrepreneurship elements). The impact of each activity will be assessed through the provided **GSO4SCHOOL Assessment Methodology and Tools**.*

The above-mentioned model guides students to develop their projects following the updated four - phase process (following the Open Schooling Model and Roadmap - https://portal.opendiscoveryspace.eu/sites/default/files/u34111/osos_roadmap-book-engl-all.pdf):

- **FEEL:** Students identify problems in their classrooms, schools, and communities. Students observe problems and try to engage with those who are affected, discuss their thoughts in groups, and vote on ideas.
- **IMAGINE:** Students envision and develop creative solutions that can be replicated easily, reach the maximum number of people, generate change, and make a quick impact.
- **CREATE:** Students collaborate in classroom in order to develop a plan of action to effect change. This includes planning, implementing, and later recording the process.
- **SHARE:** Students submit their work to GSO4SCHOOL through the development of specific scenes that will be integrated in the rest of the GSO production. At local level they could share their work with

their classmates and students of the school, as well as with parents and external stakeholders and are encouraged to do so with other schools in the community and local media.

2. "Learning Science Through Theatre" (LSTT)

2.1 Some words about the activity

LSTT brings together science and art inquiry. Students learn science in a creative way while implementing a theatrical performance related to scientific concepts.

In LSTT, students comprehend scientific concepts and phenomena, develop a spirit of cooperation and teamwork, actively participate in the negotiation of scientific concepts and develop creative and critical thinking skills. Furthermore, by participating in dissemination activities and entrepreneurial actions for the promotion and support of their theatrical performance, they contribute to further bridging school with society and develop their own social and entrepreneurial skills.

Finally, one of the main aims of the activity is to motivate an increasing number of teachers and students to join an educational community that cooperates through exchanges of opinions, materials and best practices for science teaching and learning during and following the action's implementation.

Find more information about the activity:

- **About the activity**
- **Detailed ways of implementing**
- **Material (Informative material, Warm up exercises, workshops, videos)**
- **How to implement LSTT virtually**

2.2 Learning Objectives

The main aim of the Learning Science Through Theatre (LSTT) activity is to give the opportunity to primary and high school students to stage a play and dramatize scientific concepts and knowledge from the material being taught in schools.

The LSTT's domain specific objectives are to:

- Get students interested in science and research through theatrical play
- Teach students how to develop a theatrical script, relevant to a scientific topic
- Initiate the development of a theatrical performance by students, regarding a scientific topic
- Initiate contact between students and other professionals (for example directors and musicians)
- Bring schools closer to local community
- Engage parents and the general public into schools' happenings and events
- Build National-wide student networks
- Open the school to the community and involve all the stakeholders.

Towards attaining these objectives, peripheral aims are formed addressing students' needs to:

- develop understanding about scientific inquiry
- develop abilities necessary to do scientific inquiry
- identify questions and concepts that guide scientific investigations
- design and conduct theatrical scripts relevant to scientific concepts and issues
- use technology to improve investigations, communications and the development of theatrical
- performances and videos
- formulate and revise scientific scripts exploiting creativity and imagination
- recognize, analyze and imagine alternative explanations and models
- communicate a scientific argument or issue in a creative way
- develop lifelong learning skills
- develop attitudes befitting a scientific ethos
- link with science and society in a personal context

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The LSTT aims at the enhancement of the students' cognitive involvement, their representation of scientific content using their cognitive processes, the students' involvement using their bodies or gestures, their emotional involvement, the social interaction and communication between them, the use of past experiences and the creation of new ones based on sociopolitical and historical framework and on beliefs and behaviors, their brain, body and emotion coordination and finally the holistic use of their personality and their motives. As a result, students manage to constructively build on each other's ideas, enhance their learning of scientific concepts, co-create and perform theatrical plays.

2.3 Available partnership opportunities

Here are some partnership opportunities you should consider in your development:

Parents	Supporting, as externals, the students' performances in the various steps that will follow, either by offering their expertise if relative to the thematics/scenery demands or by personally attending the final events to cheer the effort.
Local businesses	Contribute by offering assets (either financial or in other material forms needed)
Local authorities	Supporting the whole process and disseminating the project to the local community for raising the awareness and contribute to the search for financial support
NGOs	Contribute by supporting with specific activities, e.g. Art NGO by providing artists, Science NGO by providing researcher.
Artists	Professional artists will have the chance to support the development and the staging of the play thus apprenticing the young students to the artistic aspects of the chosen thematic
Researches	Researchers are entrusted to spark the youngs' excitement in the chosen scientific concept. Furthermore, they will ensure the validness of the scientific elements of the play and offer valuable help to the development of the script
Research institutes	Will offer a place for informal education that is complementary needed and targeted to the success of the performance. Will also engage students in the inquiry processes of researching.

2.4 Recommended resources

There are no financial resources needed actually. Students will develop all the needed costumes, scenery etc. If they need financial contribution, they could have the support of the local authorities and/or businesses as it was already support them in the last years (since 2014). For human resources, teachers usually realise this activity during their lessons or 2 extra hours per week for at least 8 weeks. This is

usually within their project-based activities. Communication with professionals will be realized in person at schools, but also online. They will need an internet connect to connect with the organisers in specific time-frames for the support, PCs to prepare any possible presentation that they would like to involved in the performance.

2.5 Needed Materials

2.5.1 What you will need?

Material for scenery, costumes, laptop, video editing tools, musical instruments, teleconference platform

2.5.2 Where will the learning take place?

The preparatory activities will take place mostly in the classroom, but also at local community organizations, such as a city hall, a local police department, etc. Preparation will also take place at students' homes, with the contribution of their parents. Communication with professionals will be realized in person at schools, but also online. The final event will take place in a conference hall of a school or a public authority, but also at a Science Center and Technology Museum. Finally, participations with video recorded theatre performances could be a proper way in order to share it online.

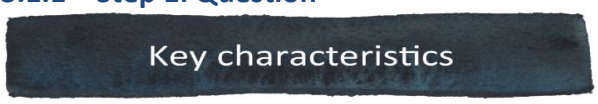
2.5.3 Technology?

Computer and internet access and an online platform to facilitate communication with professionals as well as communication between students in case of a virtual event.

3. Implementation phases

Below you may find a description of the implementation phases of the LSTT activity following the Feel, Imagine, Create and Share approach.

3.1.1 Step 1: 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.

Educators actions

The teacher chooses a chapter / module from the curriculum in which the students will be involved following the LSTT activity framework. Then, possibly on the occasion of a modern scientific subject related to this chapter, he begins a **dialogue with the students**, asking them questions. These questions will trigger a new round of questions from the students' side this time. At this point, the teacher should use these students' questions and come up with the subject that will eventually be explored and dramatized. Once the subject has been identified, **the teacher can use and implement experiential warm up exercises** both for the students to get acquainted with their body and with the rest members of the group as well as basic theatrical techniques. Some examples of exercises can be found below:

Students begin to move around under the instruction to continuously fill the gaps in space, without falling on each other. The moderator can stop the action and make corrections so that the space is always covered. As the group moves, the moderator gives the pace with the signal (1 → slow walking, 2 → faster ...)

The students gather in a circle and the moderator gives the instruction to choose a friend and an enemy but without letting them know. With his signal they start moving, trying to keep themselves constantly in between their enemy and their friend.

Examples can be found in the Theatrical Team Exercise Guide (see Links).

Students actions

At this stage students decide upon a basic, scientifically oriented question which they wish to explore through the LSTT activity. This happens in dialogue with the teacher.

Links

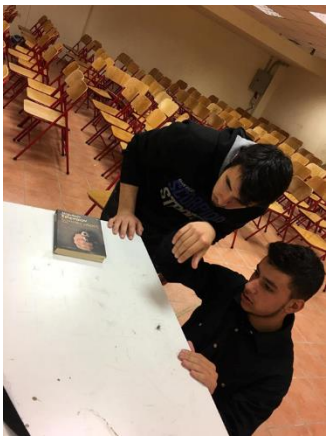
Icebreaker / Warmups
(http://www.scienceview.gr/wordpress/wp-content/uploads/2017/10/WARM_UPS_BOOKLET_V3-Copy.pdf)

3.1.2 Step 2: Evidence

Key characteristics

At this stage, individual and teamwork plays an important role, aiming at finding and gathering the **necessary information about the main inquiry question** that has been asked. It is also important to strengthen and **empower students to produce individual queries** and discuss the evidence they found in the various sources they sought to look for.

Educators actions



The teacher in this phase **ensures that all students have access to information** on the exploratory question, whether via the internet (eg. YouTube videos, information from scientifically valid websites, etc.) or through printed material books (e.g. from the school library). The main concern is to **coordinate the group of students in terms of searching and collecting the necessary information,** as well as aiding the search for information within the chosen topic. The information search process can be facilitated by the teacher by providing basic search guidelines (eg. suggested links to students, suggested subqueries to explore, providing search keywords for search engines, etc.)

Students actions

Students search the web for information on the question / topic they chose to explore. They can work both individually and collectively, exchanging key findings and information they have collected.

3.2.1 Step 1: Analyze

Key characteristics

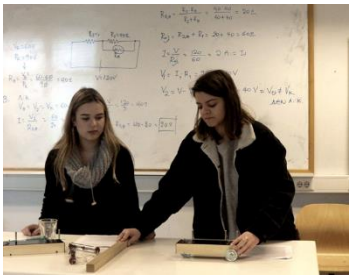
The main characteristic of this phase is the organization and analysis of the data collected during the previous phase of the exploratory process as well as the dialogue between the students to categorize the data.

Educators actions

The teacher functions more as a **facilitator of the process, and coordinates discussions** among students about the data collected. Also, encourages the creation of organized information models, and search rules / standards pursuant under which the data will be organized. To achieve this, the teacher can provide students with a **template** according to which they will categorize their data. He then encourages and coordinates the group of students to improvise and create a first version of the theatrical performance.

Students actions

At this stage, **students analyze and categorize the collected data** while identifying different models of organizing information. Then they make a first attempt to capture the idea and create the scenario on which their theatrical performance will be based. Essential role in this phase plays the **improvisation of students** as they attempt to set up a basic skeleton of their performance in a spontaneous way.

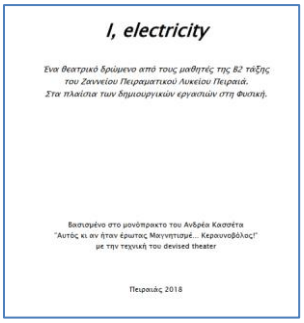


3.2.2 Step 2: Explain

Key characteristics

A key feature of this phase is the **dialogue between students** in order to extract and decide on the possible explanations and answers for the exploratory question that have been raised and which make sense to the pupils themselves.

Educators actions


I, electricity

Ένα θεατρικό δρώμενο από τους μαθητές της Β2 τάξης
του Ζαννείου Πειραματικού Λυκείου Πειραιά,
Στα πλαίσια των δημιουργικών εργασιών στη Φυσική.

Βασισμένο στο μονόπρακτο του Ανδρέα Κασσέτα
"Αυτός κι αν ήταν έρωτας Μαγνητισμέ... Κεραυνοβόλος!"
με την τεχνική του devised theater

Πειραιάς 2018

The teacher acts as facilitator and process coordinator while identifying and correcting possible misconceptions of students about the interpretation of the data collected in the previous phase. Sample of scripts developed during this phase (in Greek):

Students actions

At this stage, **students collaborate and talk about making decisions about the basic explanations they will adopt to answer the question** they have asked and then proceed with the creation of their theatrical performance.

Links

Sample scripts in order students could get ideas can be found in the following link (in Greek):

http://lstt.eu/senaria/

3.3.1 Connect and develop

Key characteristics

A key feature of this phase is **interdisciplinarity,** as students conquer scientific concepts and knowledge interconnecting scientific knowledge with various forms of art.

Educators actions

The teacher takes full advantage of the possibilities offered by the **interdisciplinary approach of teaching, as it promotes the interconnection of various scientific themes with various forms of art** (theater, music, painting). To achieve this, a communication and consultation with **specialists in the field** is pursued (specialist scientist in science education, specialized director, musician, etc.). In addition, the teacher coordinates the corresponding groups of students who have undertaken to create the script, music, costumes, etc.)

Students actions

Students in this phase **explore the subject spherically and find interconnections with other fields, such as the arts** (theater, music, painting, etc.). They are divided into groups according to their interests, in order to design and implement a complete theatrical performance with scientific content related to the exploratory question / theme originally set. Thus, pupils are divided into groups of directing, music production, scenography and costumes, choreography, video production, sound and lighting, promotional activities. They use all their imagination and creativity to achieve the best possible result and produce the final products in each category. Collaboration exists both in between students belonging to the same group and pupils belonging to different groups, so that the results produced are consistent.

3.4.1 Step 1: Communicate and disseminate

Key characteristics

The main feature of this phase is the dimension of pupils' communication, both with their classmates and with special scientists and specialized artists. In addition, communication also involves the expression of scientific concepts and findings by pupils through their theatrical performance.

Educators actions

At this stage **the teacher encourages students to communicate with scientists and artists** so that students can express and communicate the findings of their exploratory process in the best possible way to the public through their theatrical performance. The teacher has previously taken care to arrange a special scientist's visit to the science and / or artistic session (director, musician, etc.) at the school for students to address their questions. Finally, the teacher, in conjunction with the organizers of the action, takes care to ensure a specific day for a rehearsal of the group of students. **Finally, the teacher is responsible for coordinating the final performance** of the pupils.

Students actions

Students in this phase **communicate with artists (directors, musicians etc.) and the scientist who may even visit the school to be consulted**. They ask them questions about various ways of improving the theatrical performance. In addition, both during their rehearsals and during their final theatrical performance, students communicate through their bodies and through various gestures scientific concepts and issues that they have explored throughout the exploratory process.

Links

Sample of performances could be found in the following link. These videos (in Greek) are recorded theatrical performances either in the school setting or during their live theatrical performances during the final event of each year.

http://lstt.eu/videos/

3.4.2 Step 2: Reflection

Key characteristics

The main feature of this phase is student reflection and assessment of the exploratory process and learning.

Educators actions

The teacher at this stage of the exploratory process, which is the last one, discusses with the students' group what went well and what not when the students' theatrical performance was implemented. **The teacher evaluates whether all students have been involved in the creative exploratory process and completes an observation form** provided by the organizers of the action, which helps in describing and assessing by the teacher both the course of student exploratory learning and the successful - or unsuccessful - elaboration of scientific meanings by students, through embodied learning, always in the context of the curriculum of the classroom in which students are studying.

Students actions

At this stage, **students** are evaluated **both by the judges (scientists and artists) of the final theatrical performance and by the audience of theatrical performance**. Then, after receiving their awards and distinctions, they discuss both with each other and with the teacher about the characteristics of the performance and the factors that contributed to the success or not of their final play.

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