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

O1 The GSO4SCHOOL

Framework and Master Plan

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Short Description: This deliverable presents an outline of the actions to be implemented by the members of the consortium, in order to fulfil the project's goals, as well as the results of the survey that the consortium undertook in order to define the needs of the target group and the pedagogical principles upon which the project is based.

This document presents the framework under which the GSO4SCHOOL will operate based on the existing and proposed approaches. During the project lifetime this document will be updated according to the findings from the implementation activities in order to conclude with a final version concerning the proposed GSO4SCHOOL approach.

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1. The GSO4SCHOOL approach to interdisciplinary teaching of Science and Opera

1.1 State of the art for the pedagogical concept

GSO4SCHOOL aims to enhance teachers' professional development by providing them with an alternative approach to implementing creative and innovative science and arts education practices in schools.

For the purposes of achieving the goals set by GSO4SCHOOL, existing pedagogical approaches representing the state of the art in STEAM are further developed through the rationale of Design Thinking. The Global Science Opera (GSO) initiative crystallized as a good practice in the CREAT-IT project (http://creatit-project.eu/). The practice was then implemented as a demonstration of the CREATIONS project (http://creations-project.eu/), and provided a focus for research in the Norwegian Research Council's iSCOPE project. Each year, a GSO production has been implemented thus far (2015-2020).

The interdisciplinary[1] environment enabled through interaction of science and arts education represents a specific approach to creativity which we detail in this document. This approach to creativity in the classroom constitutes a strong advantage towards enhancing STEM education and, thus, addressing inequality in science learning. In recent years the trend is to include the "A" in STE(A)M education, thus placing a strong focus on interdisciplinarity (UNESCO, 1986, Klein, 2006). By doing so, the project will foster the development of school students' interest, participation, motivation and performance in science while simultaneously aiming for a quality process in the arts. We argue that the "quality of the experience" is often more influential than the "content that is taught". So, the engagement of school students in developing their own performances based on scientific concepts and experiencing the whole procedure supported by their teachers, is key to success. Moreover, GSO4SCHOOL's framework promotes the acquisition of 21st century skills (including social and emotional intelligence skills, teamwork, critical thinking, creativity, soft skills and entrepreneurial skills) (OECD 2015), science (analytical thinking, inquiry-based learning) and culture and the arts (performing arts of the disciplines music, drama, visual arts).

[1] GSO4SCHOOL is based on an understanding of an interdisciplinary educational environment as one which uphold a balance between the different disciplines involved in its framework (STEAM) (UNESCO, 1986; Klein, 2006). However, we are aware of the potential for deeper and more profound relations between the disciplines: a transdisciplinary educational environment for STEAM would imply a blurring of the boundaries between the various disciplines. While we as of yet are unable to conceptualize how this may be enacted in practice, taking small steps towards transdisciplinarity is an area which the Global Science Opera has been aiming to achieve since its inception. Correspondingly, the GSO4SCHOOL project will aim to take small steps in this direction (see Ben-Horin, Chappell, Halstead & Espeland, 2017).

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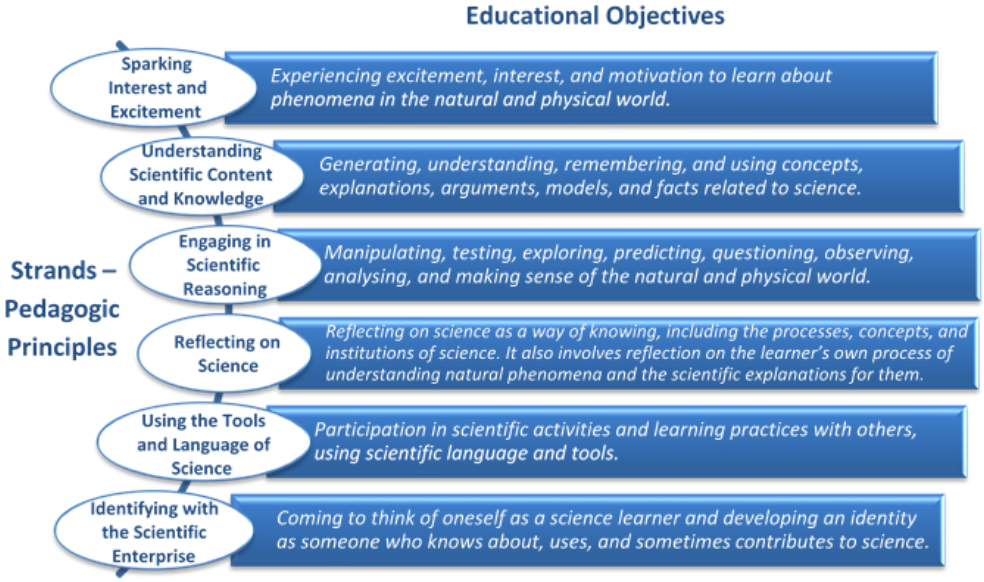

Figure 1: *The main Pedagogic Principles and the Educational Objectives for the design and implementation of GSO4SCHOOL activities for involving students in Research and Innovation process.*

Creative STEAM education is the main context within which GSO4SCHOOL project will be developed. In figure 2 (below), **arts education philosophy and methods** are positioned as a **"holder" within which creative STEM education (as opposed to all STEM education) is being nurtured, grown or "encultured" via arts practice (STEAM).** As we move in towards the centre of the graph, we can see that one of the main drivers for GSO4SCHOOL creativity is **possibility thinking** for all involved. This means being able to ask "what if" and "as if" questions:

- what if I/we choose to explore this scientific question rather than that one…?
- what if I/we use this arts approach to help me explore my question...?
- how can I/we imagine this as if I were…?
- what happens if I as student collaborate with that artist as if I…?

This will be strongly encouraged in the way the GSO4SCHOOL pedagogic principles are ultimately employed in order to help learners and adult professionals imagine new ideas in STEM education; to shift from "what is" to new possibilities of "what might be". As we move in another layer towards the centre of the graph, we can see four key defining features of GSO4SCHOOL classroom environments. These are the **4Ps** of engagement in creative STEM education (Craft, 2011):

- **pluralities:** opportunities for students and teachers to experiment with many different places, activities, personal identities, and people
- **possibilities:** opportunities for possibility thinking, transitioning from what is to what might be, in open possibility spaces
- **participation:** opportunities for students and teachers to take action, make themselves visible on their own terms, and act as agents of change
- **playfulness:** opportunities for students and teachers to learn, create and self-create in emotionally rich, learning environments.

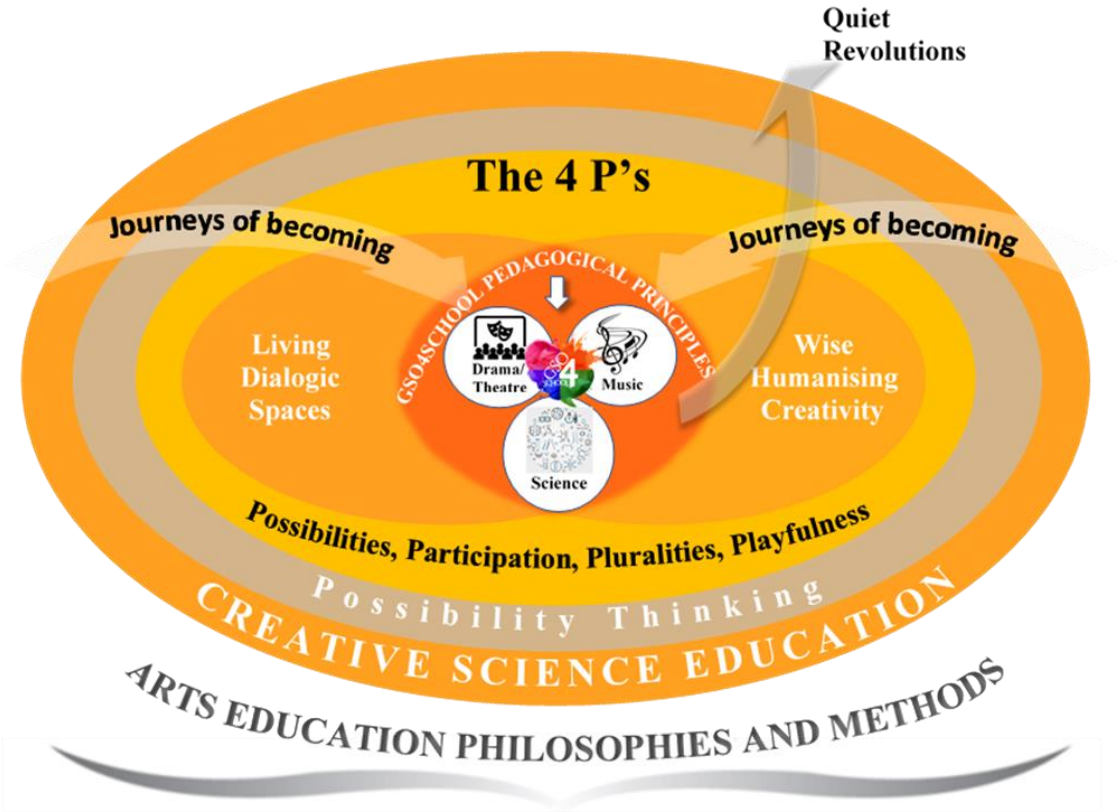

Figure 2: *The GSO4SCHOOL concept is based on the integration of arts into STEM activities, a living dialogic Space that promotes wise humanising creativity, simulating the ways in which subjects naturally connect in the real world*[2]

We then come closer to the heart of the GSO4SCHOOL graph (Figure 2) and find the **initiatives that following the Pedagogical Principles,** a **living dialogic space** (LDS) that promotes **wise humanising creativity** (WHC). The WHC that is being sought in GSO4SCHOOL is not an individual activity: it occurs in **collaboration** with fellow students, teachers and other adult professionals (artists, researchers, science experts, entrepreneurs, parents, policy makers – within the Framework of the project). These individual and collaborative creative activities form part of a wider web of ethically-guided communal interaction geared towards both helping children and teachers exercise their creative capacities in a STEAM context. Alongside and integrated with WHC, is LDS. LDS is at the heart of the GSO4SCHOOL graph because its methods (participation, emancipation, working bottom-up, debate and difference, openness to action, partiality, and acknowledging embodied and verbal modes of knowing) are fundamental to enabling WHC to emerge. Chappell et al. (2012) have evidenced the importance of dialogue at the heart of engaged, creative learning in the arts and it is this kind of dialogue that has been highlighted and applied within the GSO4SCHOOL approach. This dialogue acknowledges and allows for conflict and irreconcilable difference. Indeed, facilitating open discussion of the problems pupils are facing in understanding scientific concepts and in solving scientific problems is key to a pedagogy which acknowledges their values, needs and expectations as citizens of the European Society.

These synthesized layers of support GSO4SCHOOL' **pedagogic principles**. Hence the connector in the image between WHC and LDS, comprised of students' activities.

[2] This approach is based on the framework of CREAT-IT project (http://creatit-project.eu) and its update from the CREATIONS project (http://creations-project.eu/) as well as the Stories of Tomorrow project (http://www.storiesoftomorrow.eu/).

So, **via these processes the GSO4SCHOOL project will contribute to developing creative young minds with deep knowledge in creative STEAM teaching pedagogies:** students and teachers are creating wisely and humanely, with cyclical developments occurring between their creativity and their identity. As they **generate new ideas,** they are developing or **'becoming' themselves**. Slowly, small changes accumulate to contribute to "**journeys of becoming**" (shown developing across the layers in (Figure 2). These individual journeys accumulate together, embedded within an ethical awareness of the impact of creative actions on the group. Through this process small-scale creative changes or "**quiet revolutions"** can take place for the group as a whole (shown as emerging from the heart of the project's activities).

Ideas generated through **individual, collaborative and communal activities** have a capacity to contribute to engagement and change. The layer of communal engagement is particularly important in terms of the societal level of the Responsible Research and Innovation, and the idea that innovators need to be mutually responsive within and beyond their communities. Communal engagement (Chappell, 2008) acknowledges that when working creatively, people exist in groups with shared identities which shape their ideas and thinking and which may be challenged by the thinking of other groups and others within their own group. This raises ethical questions which need consideration if these challenges are to be overcome (Craft, Claxton and Gardner, 2008) and people are to be genuinely engaged in scientific debates and questions via education.

Of vital importance to nurturing **empowerment and agency, dialogue, individual, collaborative and communal activities for change** and **ethics and trusteeship** are two more GSO4SCHOOL principles which resonate with the way the scientific issues and research outcomes are communicated to the students. The first is the importance of rigorous **Discipline knowledge.** This implies knowledge of the STEAM disciplines but it is also resonates with the idea that there are different ways of knowing in the world, alongside those prioritised within the scientific realm which scientists must engage with in order to generate conversations between their ideas and those of the "public" in order that a shared dialogue can be ongoing rather than a one-way conversation. The second is the promotion of the idea of **professional wisdom.** At its heart, the GSO4SCHOOL concept values the idea that teachers bring a wealth of often intuitive teaching and discipline knowledge and expertise; they cannot be viewed as "information deliverers". It is their professional wisdom that can make the STEAM learning process creative and can engage children and young people in a meaningful way.

In the framework of the project we are aiming to initiate an informed debate regarding collaboration between Art and STEM at curricular level in schools.

Today, the disciplines continue to be perceived as intrinsically different and separate, both pedagogically and culturally. In GSO4SCHOOL we will **combine Science with Arts** and assess it through the proposed approach, which **pushes the boundaries of subject interconnection in schools**, while simultaneously providing a vehicle for creative STEM education, the acquisition of skills and opening new spaces for genuine enjoyment while learning. In fact, there is an unparalleled level of connection between these two disciplines. As Wenham (1998, pg.61) states, "there is and always has been significant common ground between art and science, encompassing not only issues of mutual concern but also modes of enquiry." If we accept that artists and scientists (amongst others) are searching for understanding and meaning, then this is our first common bond between the two disciplines, and our starting point. Deckert (2001, pg.125) says science is "usually seen as rational and analytical and art often considered subjective and emotional." With perceptions of art and science so diametrically opposed in our society, it is necessary to be clear about their commonalities and where opportunities for meaningful collaboration exist.

Prior to designing and developing such an experiment, we have identified five main categories of commonality between STEM and Art. This is essential to ensure authenticity in our approach and appropriate justification for implementing the project in and with schools. The five categories are: modes of inquiry; fields of study; experimentation; creativity and imagination; aesthetic experience and artistic attitude. The GSO4SCHOOL approach brings together all these characteristics in an integrated activity in a way which constitutes a natural learning environment for young students.

STEAM should be used as a mean to support students to better understand concepts and processes. It provides multiple alternatives for problem-solving while exploring multiple modes of inquiry. **STEAM, as an integrator of different fields of study**, from different grade levels and multiple expertise areas, largely benefits from artistic views of specific models while freely embracing students' preconceived imagination and enabling their own creativity while experimenting with their own research and ideas.

Often the artistic materialization is a powerful tool to support the design specifications of complex experiments. An example is the research efforts in the field of space exploration, related to possible manned missions to the Moon in order to develop the Moon Village (an already existing ESA vision as well as a GSO production in 2018 that was inspired by the ESA vision). Besides being appealing to the audience in general, artistic views help scientists, engineers and other professionals grasp the difficulties and challenges to be faced as a consequence of that vision's ambitions of bringing humans to the Moon.

GSO4SCHOOL will put forward the adoption of a STEAM curriculum that requires a shift in the paradigm of national policies in schools in the involved countries. It requires the implementation of a deep structural and organizational change encompassing the design of a roadmap towards STEAM as a model for science education. It requires several steps in different levels:

- **School level:** Understand the school culture and infrastructure as well as the local community environment, its strengths and opportunities, existing obstacles and threats,
- **Classroom level:** Particularize findings to each grade level taking into consideration the specific needs of each age group of students,
- **Teacher's level:** Teachers from the different disciplines involved in each level should have the opportunity to participate in team-building activities, while significant professional development support (culture of cooperation, innovative pedagogical approaches, ICT skills) is needed,
- **Student's level:** provide multiple opportunities for self-development of each student by enabling autonomous creation of their own journey

A specific curriculum encompassing these items can then be designed.

a) Start by focusing on the integration of the science subjects into a STEAM approach by using the Big Ideas of Science approach (Based on the document "Working with Big Ideas of Science Education", edited by Wynne Harlen in 2015)[3].
b) Foster horizontal, vertical and diagonal collaboration between teachers (different subjects and grade levels, including collaboration opportunities in the same subject domain and throughout different subject domains),
c) Aiming for deeper learning by following the five main categories of commonality between STEM and Art,
d) Contextualize students' learning experiences and localize them by integrating examples from within the school community that can be addressed, studied, explored in the framework of projects.

[3] https://www.interacademies.org/26703/Working-with-Big-Ideas-of-Science-Education

e) Create the context for students' creativity to emerge by offering opportunities to further develop their ideas providing enough freedom for them to explore their vision on certain topics, learn by trying to materialize their own theories and foreseen solutions with the inclusion of artistic expression.

The GSO4SCHOOL concept is envisioning STEAM as an aggregator of topics that are **delivered to students in an interdisciplinary and contextualized format using a strong visual and artistic component will promote a much deeper understanding of the project/problem being addressed by students.** The whole process needs to be facilitated and accompanied by teachers that must assume the role of travel companions. All subjects must be aggregated under a project umbrella and curriculum content delivered in an interdisciplinary and relevant way. The use of the STEAM approach will ensure not only the acquisition of the specific skills but also the increase understanding of all the relevant content knowledge and a much more effective practice. The methodology does not impose an increase in classroom time, on the contrary. If teachers work as a team and operate in a coherent way lots of time can be saved. The experience will facilitate a deeper learning for students involved and a much more meaningful teaching experience for the teachers as well. The GSO4SCHOOL will aim to integrate and demonstrate three main components for the successful development of STEAM curricula:

- Alignment with local, regional initiatives and national strategies and objectives with special focus on multidisciplinary learning and project-based approach;
- Curricula reform for STEM with a STEAM approach including real-world applications, inquiry-based and ICT-enriched learning, collaborative practices, with a whole school approach focus and the use of extra-curricular activities in order to deliver the wider range of skills that drive innovation and creativity and nurture forward-looking skills, including entrepreneurship skills;
- Focus on innovative teachers' professional development programmes in related pedagogies with multidisciplinary approaches.

1.2 The GSO4SCHOOL Approach

To reach the full potential of the above-mentioned pedagogical principles, 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 3).

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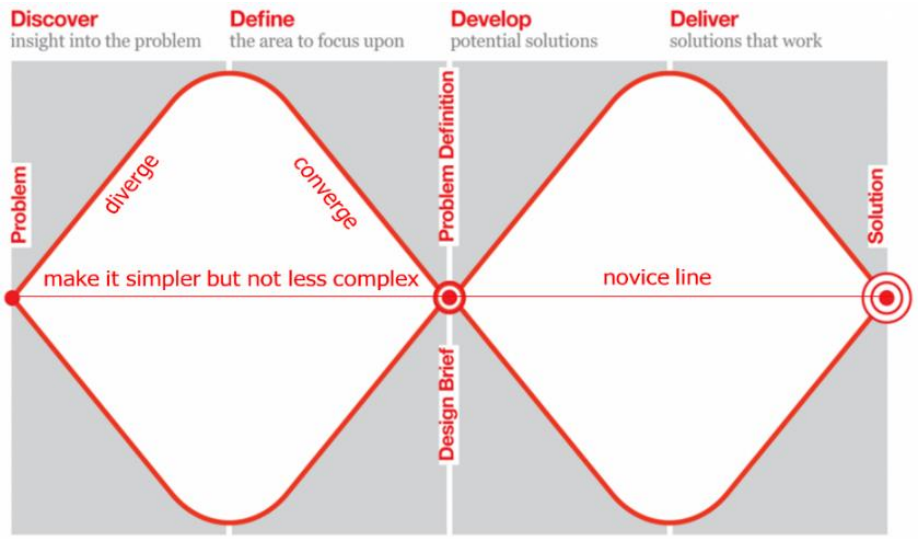

Figure 3: *The Double Diamond model of the British Design Council*[4]

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.

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

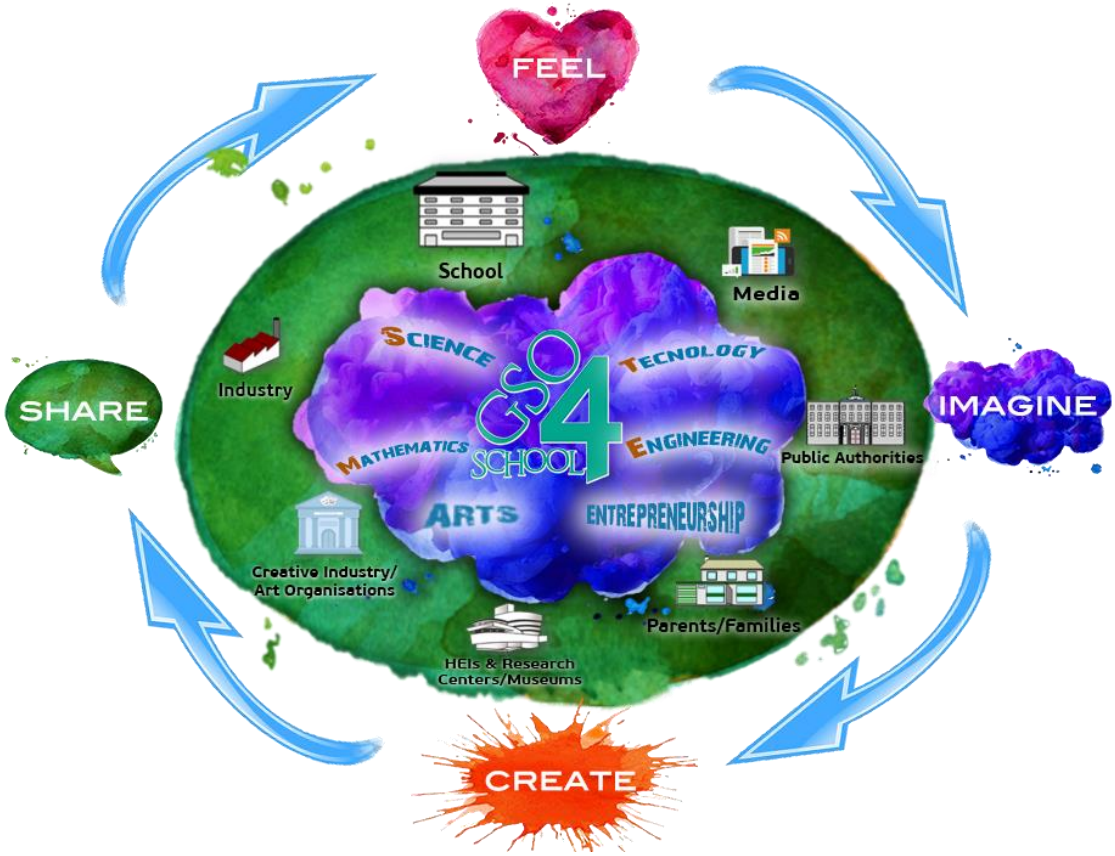

Figure 4: *The **GSO4SCHOOL** Approach. Each school will follow the respective **guidelines and material (IO2) according to the setting in which it is operating**. Specific scenarios of use, will be provided by the **GSO4SCHOOL** partners (**through the material that will be developed**) in order to 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 – IO3)** 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 (IO3)** 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 (see chapter 4)**.*

The above-mentioned model guides students to develop their projects following the updated four - phase process:

- **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.

1.2.1 The FEEL, IMAGINE, CREATE, SHARE Approach

The approach of FEEL, IMAGINE, CREATE and SHARE builds empathy in children, for them to engage as active participants in their communities. It redefines failure as prototyping and gives them the confidence to be innovative and find creative solutions for problems that bother them. Children become change makers. Teachers are able to experience the capabilities of their own children as they listen to their voices and ideas. Feel gets children to empathize and engage with a problem, they imagine a solution and do the act of change. Through sharing their story, they inspire others. So, this model provides a structured, yet flexible curriculum to teach and assess key 21st century skills and science (STEAM) education.

1.2.1.1 The FEEL Phase

We are all part of society, which we influence and are influenced by, whether we choose to participate actively or not. 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 being 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 todays´ challenges, encouraging students to explore good solutions.

Another aspect that is strongly advised by the approach at this stage, is to integrate the ecological sustainability into the project. By doing so, both on a practical and on a thematic level, the aim is to provide students with awareness, knowledge and healthy attitudes they can add to their 21st century educational toolboxes. This way they can meet a future they might fear, feeling empowered (Green, 2016) and armed with an "I can!"-mindset, positive realism, critical thinking and a versatile creativity (Gudipati & Sethi, 2016).

The topics for the creative work are scientific at their core, and it is important to collect correct information, not only through second-hand written sources, but through first-hand interviews and experiences if possible. It is important to continuously check the scientific facts being presented. This process of ensuring accountability is inspired by the **Inquiry Based Science Education** (IBSE). This is achieved through their active participation in activities that make sense to the students, chiefly due to the fact that they are largely initiated by those students. Students understand in-depth the scientific concepts

through their own perception of the world that surrounds them and through their own experiences and reflective processes.

An essential part of the GSO4SCHOOL creative process is to practice democracy through collaboration. All students´ voices should be heard through the process, all ideas should surface, and the best one will be democratically voted forward. This is a practical approach towards using your voice in a society of which you are a member.

At the end of the FEEL-phase the group collectively defines the challenge on which you will focus your attention.

1.2.1.2 The IMAGINE Phase

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 themselves into the unpredictable process of creativity. Instead of taking and sharing control, this phase is about a willingness to loose 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 of the stories!

The practice emerges out of a balance of respect, autonomy, collaboration, play and design; or in laymen-terms: "flow" (Metha & Henriksen, 2019). This is where innovation is born, when ideas are put into action. (Where creativity challenges and *"art provokes us to consider what it means to be human" (Graham, 2020).)*

The imagination celebrates possibilities (Craft, 2011): opportunities for learners to engage in possibility thinking, making the transition from what is to what might be. It also provides opportunities for learners to engage and experiment with a multitude of places, activities, personal identities, and people. The classroom should be a safe place with room for playfulness, where there are opportunities for learners to learn, create and self-create as active and connected players in their emotionally rich, virtual and actual play-worlds of gaming, social networking and own content. GSO4SCHOOL also works actively towards a

democratic participation with opportunities for learners to join in, take action, have their voice heard, make themselves visible on their own terms, and act as agents of change in their lives and beyond.

1.2.1.3 The CREATE Phase

In this phase, **CREATE**, students will need to develop and to apply their solutions, what they have imagine 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 have to implement their ideas, interact with external stakeholders to ask for support and guidance and also be creative to find solution while they are implementing. It is very important to note that the proposed solutions have to be based on scientific evidences and research results (coming as input from the Feel Phase). Students have to be engaged in experimentations and data analysis to provide optimum solutions. Close cooperation with the local communities in necessary.

Creativity can take place in solitude. But many times, the best ideas are a result of a joint effort. Collaboration in the creative process requires dialogue and respect for each others competences. STEAM-education is not a competition between disciplines, but a practice where we complement each other through our respective approaches. One person´s idea may be good, but a combination of several people ideas will be tested through conversation, tried through experiments and grow stronger because of it. “The core of STEAM then is not about just STEM or the arts. STEAM learning is about richly integrating subject matters in transdisciplinary ways that engage people in creativity, problem-solving, and project- or problem- based learning, in issues of real-world impact” (Henriksen, Metha & Metha, 2019).

Chappell (Chappell, Craft, Rolfe & Jobbins, 2012) explains how we are influenced in the creative process by the actual process itself, of how we collaborate with others, - even with the creation we are making. She calls this the “journey of becoming” (see also section 1.1): when we are both “making and being made” at the same time. It is a reciprocal relationship between a creation and it´s creator(s), where one can experience personal changes when creating, by expressing and developing one's own voice, either by one self or with others, and by actively using the imagination to embody ideas (Robberstad, 2017). Ultimately, embodying the creative process first shaping your identity. This theory of Wise Humanizing Creativity (WHC)(Chappell, Pender, Swinford & Ford, 2016) observes creativity’s fundamental humanizing potential, but Chappell has evolved her theory into (posthumanizing) Creativity (Chappell, 2018). Here she emphasizes the importance of ethically driven creativity, which recognizes interaction with other non-human co-creators (ibid.) by asking “how can we be less arrogant as humans; how might we de-center our human perspective? ... How can we step out of our humanness and see how we interact with all the other sort of players or actants... whether that is technology, nature, animals, objects? How can we take a more dispersed view of our existence and the creative process in relation to that?” (Metha, Henriksen & Deep-Play Research Group, 2019).

This might sound a bit theoretical. Let us use the interaction with the space surrounding the creative process as an example. Imagine yourself creating (and performing) a dance outside in the woods or on a mountain. Will the surroundings affect your (and your students´) artistic expression? In what ways? If you

are working with a scientific topic like the natural force of gravity, will this affect your choreography? If you are addressing plastic waste in the oceans, will this influence your choice of materials in the set-design or costumes? We are truly a part of this world and we should embrace this through our teaching and our practical actions.

WHC is a state of learning where individual and collaborative creative activities, as part of a wider web of ethically-guided communal interaction, gear towards both helping children and young people become more creative scientists and assisting teachers in becoming more creative in how they teach science.
Finally, this is the phase where collaboration between schools can be more meaningful, with each school contributing to each other's progress and to the creation of a powerful international Global Science Opera.

1.2.1.4 The SHARE Phase

Sharing through showing is in some ways a commitment for the students to be active community-participants. By sharing a local take on a local and/or global issue, “pupils value that which matters for the community, as part of the “meaning of our opera”” (Ben-Horin et al., 2017).

This in turn is connected to Responsible Research and Innovation (RRI). Over the last decades many efforts have tried to reduce the distance between science and society, leading to a European wide approach in Horizon 2020 called Responsible Research and Innovation. RRI seeks to bring issues related to research and innovation into the open, to anticipate their consequences, and to involve society in discussing how science and technology can help create the kind of world and society we want for generations to come. Initiatives as the GSO as well as Learning Science Through Theater (www.lstt.eu) help us to build a more inclusive, smart and sustainable society that focuses on the grand challenges that we face nowadays and to investigate people’s and students’ needs, values and expectations of future society (Smyrnaiou et al., 2017).
The publication of the "Science Education for Responsible Citizenship" report brings science education to the top of educational goals, but also answer to a significant question: “How could science education play an important role to address societal challenges and how can all the stakeholders open schools to society?”. The school science teaching needs to become more engaging, based on inquiry based and problem-solving methods and designed to meet the interests of young people. We also have to establish a new way of thinking, as science education should be an essential component of a learning continuum not only in classroom, but also for all, from pre- school to active engaged citizenship.

Young people have to be interested in societal challenges and find creative solutions. Open Schools to Open Societies means that nowadays schools work as ecosystems (Sotiriou et al. 2017), which not only produce knowledge but also link this knowledge to real world and real needs. Moreover, collaboration between formal, nonformal and informal educational providers, enterprises, industries and civil society should be enhanced to ensure relevant and meaningful engagement of all societal actors with science.

Another aspect of sharing can occur in all four phases: the collaboration with other students in other countries. This can be both a cultural, social, scientific and creative cooperation. This approach is rewarding on many levels: from practicing language-skills and expanding ones cultural understanding to

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complimenting each other practically in the creation of a scene. For example, you may choose to have part of the scientific preparatory input kick-off together, you may even choose to collaborate in the creative process. Or one group may compose and perform a song, the other group may choreograph and dance to it. And of course, when the scene is finished, you can show it to each other. It is peace-work in practice to make friends in other countries!

The output of this procedure (theatrical scene, music composed and played, eco-designed costumes and set, choreographed dance, etc.) might become part of a much larger, international arena, on the macro-level (see Chapter 3): It may become a scene in the Global Science Opera, which is performed and live-streamed across all continents on the Internet. Being able to showcase their creation to a global audience can be quite an experience for young students. Some might find it scary, some are in awe, some are proud to represent their country and culture, and most students think it is great fun!

An important part of sharing is to reflect and evaluate. It is in this phase that a deep evaluation of the whole process can be made. Not only to ask what others might have learned from my artistic expression through collecting evidence from the audience and colleagues, but what have I learned through this process.

The creative process in GSO4SCHOOL is a collective creative experience, we learn from and with each other. Allow the students time to reflect on their own process through self-assessment: what they have learned, both scientifically, artistically, socially etc. Taking the time to process what I have been through, my thoughts and feelings, as well as the practical and intellectual learning-outcome. It is all valuable parts of the learning-process, as it solidifies the new knowledge.

Feedback from the audience can be beneficial as advice for possible later productions. Active audience-participation is also a valuable part of the Responsible Research and Innovation-strategy (RRI), emphasized as a goal by the EU (European Commission, 2015), which celebrates research with and through the public, instead of on the public.

GSO4SCHOOL offers a timeline of steps, in Chapter 3 of this document, regarding the full scale-duration of the GSO implementation practice. It is evident that STEAM approaches play a significant role in the developing and delivering the foreseen concept in the science classroom. A series of different forms of implementation material following the above structure will enhance this necessity as part of IO2.

2. The GSO4SCHOOL Survey on teachers' needs

2.1 Adopt to the teachers needs

In order to adopt the scopes of the project in real educational needs, a survey has been conducted. The need for conducting a survey, addressed the necessity for collecting the interest of participating teachers as well as to define the educational content tailored to the educational need's ways of science and art teaching in each country.

2.2 The questionnaire and content

The questionnaire consisted of eleven questions of which four were aimed at collecting personal opinion answers with free text, four with answers in the form of Likert scale and three short text helped refining the answers.

More specifically the three categories of questions can be described as follows:

- the four free text questions concerned competences and barriers. The first two questions were aimed at developing competences that govern the teaching of concepts of Science through the practices of Global Science Opera, while the latter two were concerned with highlighting the difficulties of applying them into classroom and their possible ways of dealing with them.
- The four Likert scale questions concerned both the collection of data on teachers' experience in inquiry-based innovative classroom practices and the degree of difficulty teachers face in this endeavor.
- the three short-text questions were intended to determine school classrooms where problems of implementation were identified. The determination of classes also helps to locate precisely the points which require further adaptation practices need to be designed in Intellectual Output 2 of the project.

2.3 The results

This chapter analyses the survey results

Out of a total number of 27 participants, the survey-results, according to country, are distributed as follows:

- Greece - 10 participants
- Italy - 5 participants
- Norway - 5 participants
- Portugal - 5 participants
- Cyprus - 2 participants

Depending on the profile of the educational communities they serve, some teachers support either any grade of the educational compass (from primary to secondary education) or grades that come across lower and upper secondary classes. Therefore, in terms of grades in school a general classification can be issued as follows:

- Primary Education (Portugal-1, Norway-3, Greece-3, Cyprus-2)
- Secondary Education (Portugal-2, Norway-2, Greece-6, Italy-5, Cyprus-1)
- All / Unclassified (Greece 1, Norway-1, Norway/China -1, Cyprus-1)

In the following Figures are illustrated the distribution of the teachers according to the education level they serve as well as the country that the come from.

Figure 5: *Nine (9) teachers distributed in* ***Primary Education***

Figure 6: *Fifteen (15) teachers distributed in* ***Secondary Education***

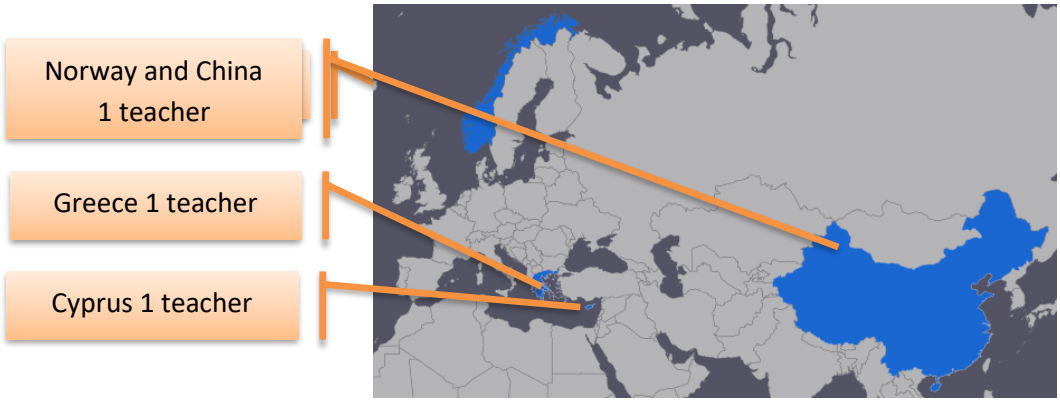


Figure 7: *Three (3) teachers distributed all levels of* ***Education***

More specifically:
Three teachers (one in Portugal and two in Norway) are teaching in Late Primary and Lower Secondary schools while seven teachers (three in Greece, two in Italy, two in Portugal) are teaching in lower secondary only. Five teachers (three in Greece, one in Norway, one in Cyprus) are teaching Primary only. Six teachers are teaching in Upper Secondary only (three in Greece, two in Italy, one in Portugal). Two teachers (from Italy and Portugal) are working with all Secondary classes while four participants are not teaching in a specific school grade (one in Greece, one in Norway, one in Norway/China, one in Cyprus).

The following figure (8) describes the teachers' teaching fields:

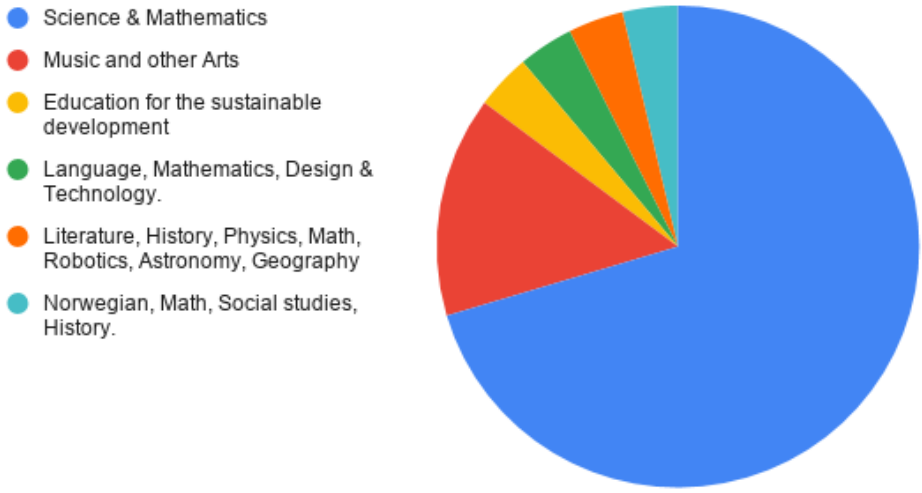


Figure 8: *Teachers' teaching field*

Concerning the preferences of the teachers in terms of the GSO theme and content, it is evident that Physics, Astrophysics, Chemistry, Biology and Mathematics are the first five disciplines that teachers prefer as the themes for the future GSO productions.

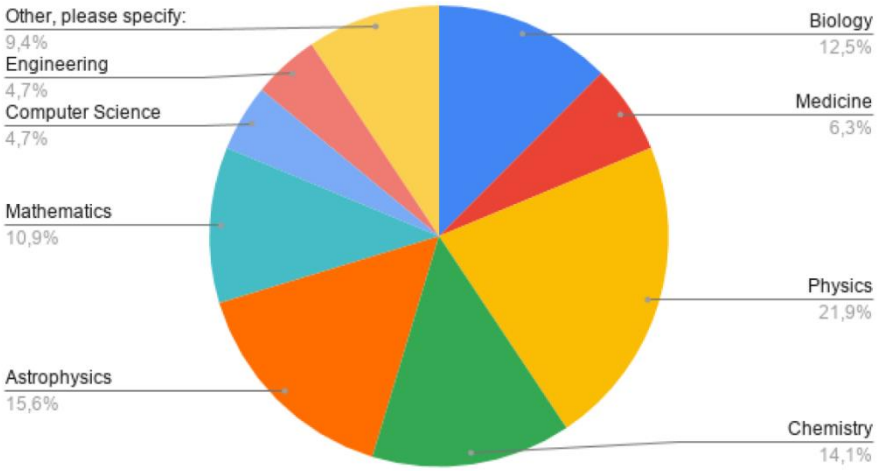


Figure 9: *Teachers' preferences for future productions*

As an additional choice for preferred discipline that was freely specified by the survey participants as "Other", teachers mentioned: Environmental sciences, Cosmology, Geology, Earth Sciences, Astronomy, Food science and Geography.

3. The GSO4SCHOOL Master Plan

This chapter describes the project's Master Plan following the GSO4SCHOOL Framework (Chapter 1).

GSO4SCHOOL's vision is to contribute to the development of the creative classroom of tomorrow, in which science education and arts education are taught within a single creative environment while integrating other disciplines such as entrepreneurship and design thinking.

To achieve this, the **GSO4SCHOOL** project places schools at the heart of real-life inquiry, inspired by real-life questions by employing pupils' own cultural initiatives as natural gateways to knowledge creation within formal, informal and non-formal educational environments, and will design and implement an EU level action to promote STEAM approach to facilitate the development of an Innovation culture. An Innovation culture imports external ideas that challenge internal views and beliefs and, in turn, exports its students – and their assets – to the community it serves. Such an engaging environment makes a vital contribution to its community's well-being: student projects meet real needs in the community outside of school, they are presented publicly, and draw upon local expertise and experience. The school environment fosters learner independence – and interdependence – through collaboration, mentoring, and through providing opportunities for learners to understand and interrogate their place in the world. An Innovation Culture recognises the important part that students can play as peer enquirers / researchers, and welcomes their active involvement.

The Global Science Opera (GSO - https://globalscienceopera.com/), which is the context for the GSO4SCHOOL vision, is realised towards this direction.

School students (thus far from 38 countries around the globe) are engaged in interdisciplinary activities utilising art approaches to understand scientific real-life issue (e.g. gravity, earthquakes, environment, energy) with the aim of developing a performance aimed at raising awareness as well as activating and motivating local and international communities. During this "journey" students and teachers collaborate with scientists, artists, parents, local authorities, enterprises, NGOs and communicate with large research infrastructures that provide them with all the needed resources (e.g. virtual visits to CERN), within a co-creation procedure. All these actors aim to collaborate in real-time, creating a global network through the use of advanced technologies (e.g. virtual platforms, videoconferences) in such a way so that any task of the performance (e.g. stage action, music, movement etc.) is distributed in more than two places at synchronous (at the same time) and asynchronous manners.

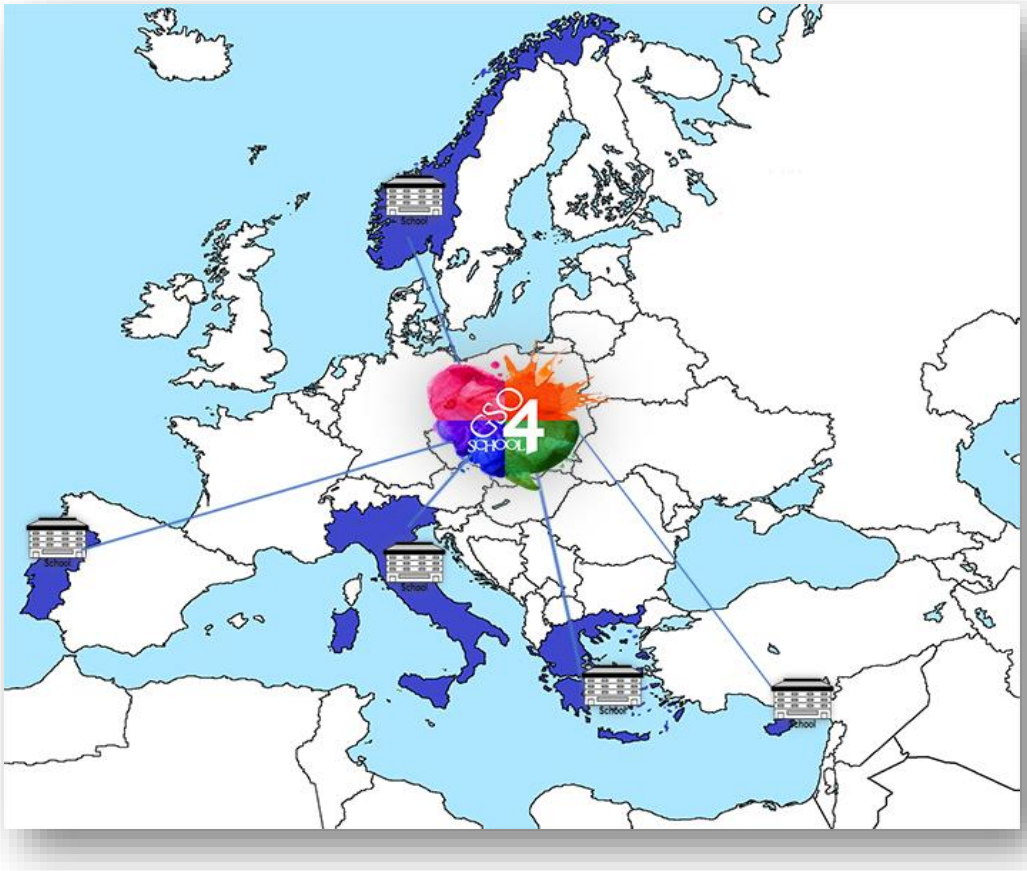
The Global Science Opera implementation practice over the years has proven its ability to adapt in a diversity of contexts depending on the theme and pedagogical scope. Putting all stages of implementation together from inspiration to reality, the sequence of steps that follow the line of process each year, fulfills the elements of problem-solving using design thinking as described in Chapter 1.

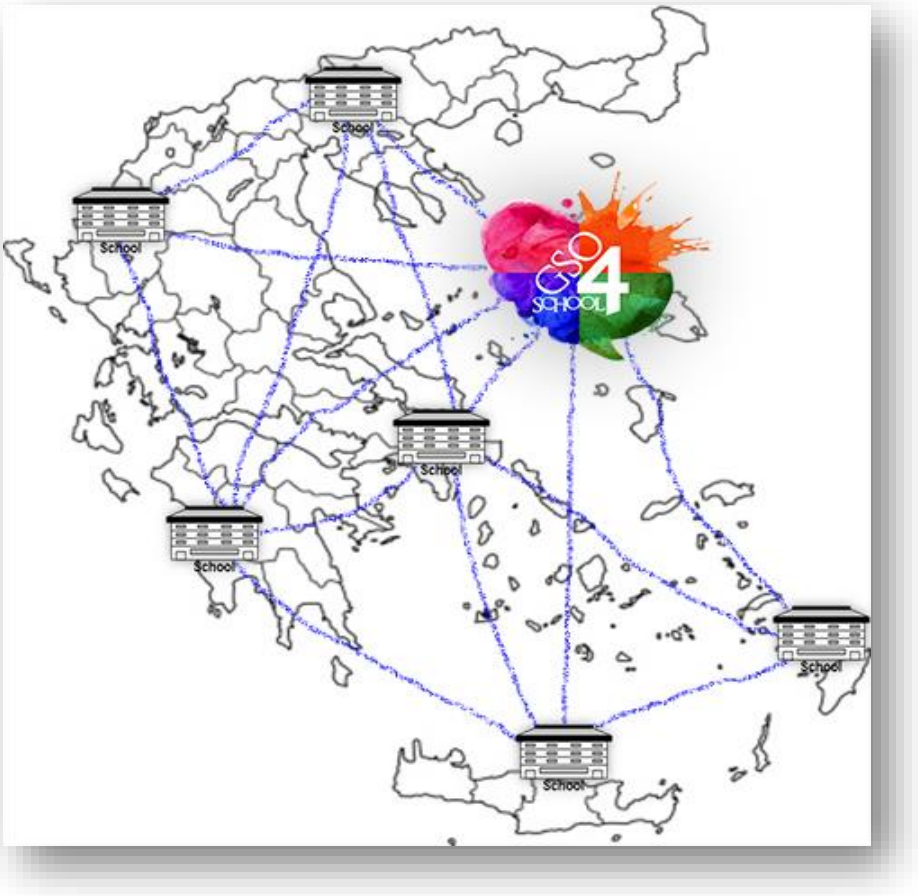
GSO4SCHOOL approach provides a section of practices that a school, teacher and students could follow according to their plan and time that are able to dedicate throughout a school year. There are two main categories of practices and activities that a school can choose: i) the Macroscopic and ii) the Microscopic.

3.1 Macroscopic implementation

The Macroscopic approach of implementing the GSO4SCHOOL activities is when a school is able to dedicate several hours within a year. This implementation approach will need a time frame of 4-5 months, with an average of 2 hours per week, in order to finalize it and the main aspect that characterize it, is the collaboration between school within the same or different countries.

The final output from this implementation approach will be a Science Opera Performance that will be the result from the collaboration between students from several schools from the same country and/or from the countries participating in the project (Norway, Greece, Portugal, Italy and Cyprus) as illustrated in the images below.





The macroscopic level should adopt all the aspects of the Feel, Imagine, Create and Share approach (see section 1.2.1).

3.2 Microscopic implementation

The Microscopic approach of implementing the GSO4SCHOOL activities is when a school is able to dedicate limited or several hours within a year. This is up to school to decide. Concerning the time that will be dedicated it could follow the form of 2 hours per week for several months or it could be limited to few hours within the classroom (e.g., 2-3 hours). The main aspect that characterize this implementation approach is that the school/classroom will implement its activities only within the school/classroom without collaborating with other schools.

The final output from this implementation approach could be a short performance or even only a scene from a Science Opera. It will not need to develop a full Science Opera Production but it will need to share the results with other stakeholders either within the school or with the local community.

The microscopic level should adopt all the aspects of the Feel, Imagine, Create and Share approach (see section 1.2.1).

3.3 Outline of the GSO4SCHOOL initial preparatory activities per country

In this section are presented an overview of the main activities that each country will undertake during the implementation period of the project. A detailed Implementation Plan will be prepared, based on the GSO4SCOOL Framework within the IO3 activities. In this each country will present the detailed implementation activities that will take place as well as the collaboration that will be realized between the participating schools.

Considering the current COVID-19 development, NUCLIO will also prepare a plan B for actions supporting the participation of schools to organize and perhaps materialize their participation in the GSO4SCHOOL's opera via online support and concretization of actions.

3.3.1 Greece

A GSO4SCHOOL national conference event (E2) will be organized in the framework of the project in order to motivate local teachers interested in GSO practices. Both Ellinogermaniki Agogi (EA) and Science View will foster teacher support of the teachers interested in the project through online webinars and workshops. EA will organize and host 3 International GSO4SCHOOL Summer training events described as "Short-term joint staff training events" on July 2021 and 2022. Teacher-training in each year's Summer School is supported by a especially dedicated website for registering and follow-up maintained by EA. Furthermore, EA will substantially contribute in the design of the teachers training material that will be used in the training procedure for teachers interested to participate in every national GSO event produced by the project. Following the fore mentioned GSO4SCHOOL pedagogy scheme, EA will supervise the engagement of teachers in the project throughout the school years. EA will finally organize and host the final GSO4SCHOOL Conference in Greece as the final Multiplier event of the project.

3.3.2 Portugal

NUCLIO will start by launching a call for schools inviting teachers to participate in the project. A national event will be organized involving the interested educators, and other relevant stakeholders that might be interested to enrich the experience of the development of the project such as education authorities, municipality representatives, families of the participating students, researchers etc. This even will have as the main objective the presentation of the project and to act as an invitation for participants to become pilots and/or partners of the project implementation phase. Following this event, we will offer to the pilot teachers the possibility to participate in an accredited training where all the pedagogical model, framework and the overall strategy will be shared. Teachers will have the possibility to co-create their ideas in collaboration with their colleagues and other members of the school, including and most importantly with students. NUCLIO will provide continuous support to the participating school, including on site organization of activities for the whole school community. NUCLIO will organize and support the construction of an international community of teachers participating in the GSO4SCHOOL as well as to engage them in the collaboration with the international GSO community. NUCLIO will also conduct a series of dissemination actions by participating in relevant events and making the necessary publicity about the project and the benefits for participating in it. NUCLIO will support all the pre and post evaluation efforts.

NUCLIO will also support educators willing to present applications to their participation in the project dedicated Summer Schools.
At an international level NUCLIO will disseminate the project actions in several international events.

3.3.3 Cyprus

Two GSO4SCHOOL national conferences (E3) will be organized in Cyprus in the framework of the project in order to motivate and engage local teachers interested in the project's practices and also to promote the products and work of the project as a whole. TPCT will be responsible for supporting the teachers interested in the project through online webinars and workshops. TPCT will thus coordinate and support at least 3 teachers in total (one per year of the project; those will be the participants in the GSO4SCHOOL Summer Schools) in the implementation of the GSO4SCHOOL practices in Cyprus. TPCT will also contribute to the design of the teachers training material that will be used and disseminate the project's progress and outcomes through its local and national network of collaborators.

3.3.4 Italy

CNR will contribute, together with the Greek partner Science View, to evaluating the project activities, by developing the following tools: the IO1 questionnaire, targeted to teachers; the methodology of the focus groups targeted to stakeholders potentially interested in participating in science operas, in order to detect skills and learning methods, competences, needs, at the beginning of the project; post-evaluation questionnaires for the teachers and students that took part to the project in order to ask them about the changes produced by the GSO4SCHOOL experience and gain feedback and advise, at the end of the project.

As for the pre-evaluation activities implementation at national level, CNR will send the IO1 questionnaire to 5 Italian teachers (translating contents from Italian to English, when needed) and will involve 10 persons in the focus groups during the GSO4School national conference event (E5), including e.g. teachers and school heads, but also artists, researchers, science communicators and other kinds of professionals. The GSO4School national conference event was organized in Rome - May 2020 - in order to motivate local teachers and stakeholders interested in GSO practices; the national event was part of a wider conference, fostering networking and cross-fertilization with other European projects and innovative didactic experiences at national/regional/local level.

CNR will involve at least 1 class in each of the 2 Science Opera pilots, during the 2nd and 3rd project year, and will support the teachers participating in the project through phone, email and face to face meetings.

For Italy, 1 Italian person per year - probably a CNR researcher - will take part in the summer schools on July 2021 and 2022. The participant will then train the teachers who will implement the Science Opera activities in the classrooms.

Moreover, CNR will contribute to IO2 by giving a feedback about the teachers training materials produced, and will collaborate with Science View in the evaluation reports.

Finally, CNR will contribute to 2 scientific publications in peer-reviewed journals.

3.3.5 Norway

HVL coordinates the Global Science Opera initiative and will ensure the close integration of GSO4SCHOOL products in that context. Annual GSO productions are planned performed in November of each year.

The two Norwegian partners are collaborating closely on the Norwegian effort in this project. HVL is the coordinator of the project, and Atheno is supporting this effort, especially in the development of the O2. Norway intended to invite all partners to an international conference in September 2020 which was postponed due to COVID19. HVL and Atheno are making an effort to collaborate with other, similar projects. Instead of the originally planned conference, HVL provided a lecture about GSO and GSO4SCHOOL at the online GHOU/GTTP online conference in August, 2020.

HVL is responsible for coordinating the development of Output 2: The Development of the GSO4SCHOOL Support Material. This toolbox of tutorials, teaching material, videos, examples and such, will be complemented over the course of the entire project period. Drawing on experience and evaluation from the summer-schools, the material will be continually improved and expanded.
Norway supports 3 summer-school participants each year. These participants will implement a GSO4SCHOOL-project at their respective local schools, document and evaluate their process, and thereby actively supporting the research-process in an RRI-effort. (Responsible Research and Innovation).

In December 2020, the Norwegian partner HVL hosted the GSO4SCHOOL workshop together with the GSO4SCHOOL partners. This event was part of a larger STEAM conference:
https://www.project-case.eu/case-conference/

4. Evaluation/ Impact Assessment

The assessment methodology will be based on the three central drivers of the project:

1. Strengthening the profile of teaching professions and widening teachers' abilities, skills, competencies.
2. Encouraging students' creative activities in the STEAM framework.
3. Developing sustainable communities of creative interdisciplinary educational practice.

The assessment methodology identifies how these aims are to be achieved and what indicators and instruments will be necessary to monitor their progress and impact. The aims will be carried out through a series of teachers' trainings (training workshops, mobility activities), training material (toolkits) and implementation activities (art-science integration pilots) in schools. Furthermore, the project will aim to motivate target groups, also through summer schools, to collaborate as communities of practice from participating countries.

Each driver carries its own set of desired outcomes:

1. **Strengthening the profile of teaching professions and widening teachers' abilities, skills, competencies.**
   - Strengthening Leadership in Education
     - Training activities are provided to develop teachers' skills so they can implement the proposed activities within their classroom and act as agents in their country.
     - Confidence is gained through a thorough understanding of art-science integration in theory and practice.
   - Making Careers More Attractive
     - Teaching is more enjoyable and satisfying.
     - Less stress.
     - Shared learning - connection with the lived world of students.
   - Enhancing Professional Development
     - Teachers and pre-service teachers will have the chance to participate in mobility activities and receive training on the project's methodology of employing Creative Science Agents through the online platform.
     - Widening of teaching capabilities – interdisciplinary problem solving, critical thinking, creative innovation, and art, media and technology skills.

2. **Encouraging scientific creativity in young people.**
   - Fostering 21st Century Skills
     - Creative inquiry approaches that are interdisciplinary, problem-based, collaborative, and use new media technology.
   - Designing Aesthetically-Minded Pedagogies
     - Qualitative as well as quantitative.
   - Encouraging Social Responsibility
     - Young people are creating wisely and humanely.

- Broadening out of scientific excellence to include responsibility and possibility thinking.

3. Developing sustainable communities of creative scientific education practice.

- Sharing Outputs with Peers.
  - A network of ambassadors is developed.
  - Media organisations in participating country will accept to promote the project's results to their audience.
  - Publication of peer reviewed journals and e-newsletters.
  - Organisation of national and international conferences.
- Developing a Common Framework for Introducing GSO4SCHOOL into the School Community.
  - A workable pedagogical methodology for designing, communicating and representing creative Science Education approaches in schools is developed.
  - Development of a list of required skills that articulate learning outcomes.
  - Articulation of an identity of unity in creative arts-infused science education.
- Developing Local and International Networks.
  - High and active participation in summer schools and GSO4SCHOOL pilots.
  - Acceptance of the GSO4SCHOOL methodology by the international community.
  - Use of the GSO4SCHOOL methods within local/regional authorities.
  - Primary teachers will elaborate activities in schools by utilizing the project's activities and, with students, they will be able to develop their own projects.

The project will follow a Results Oriented Monitoring (ROM) strategy tasked with assessing the attainment of the project's desired outcomes which form the basis of the assessment indicators. In particular, the ROM system will focus on projects' results and objectives through:

- continuous data collection (ongoing monitoring)
- mid-term revision
- final evaluation

During the project lifetime, the ROM system will focus on collecting and analyzing information on project progress and quality of the process, and on response by target groups to project activities. This internal evaluation process is based on peer review methodology and similar European projects. In order to implement the ROM system, data will be collected through the following quantitative and qualitative means; one is obligatory for all participating teachers and one (the questionnaire for students) is optional:

- **Pre- and post- activities questionnaires targeted at teachers participating in the project's summer schools**
- **Pre- and post- activities questionnaires targeted at students in secondary education (optional)**

For the Impact Assessment questionnaires to be used by the participating educators and students please refer to section 6.2 – Annex 2.

5. Conclusions

The individual characteristics of the teaching material should be adapted to the specific profiles of each teacher involved in the survey. Nevertheless, all teaching material will be based on the pedagogical framework outlined in this document by specifically following the four-step approach (FEEL, IMAGINE, CREATE, SHARE) proposed. Particular emphasis, in order to determine the content of the educational material that serves each country, should also be given to the preferences that teachers have set.

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7. Annexes

7.1 Annex 1: Results from the GSO4SCHOOL Survey

The full survey is depicted in the following page.

School grades in which you teach	Country	Teaching field Please tell us what do you teach	In what scientific field would you like the next Global Science Opera to focus to? Global Science Opera addresses the intersection of Science and Creativity with emphasis on musical events and stage play. If you have already implemented, or wish to implement, actions with this approach, you can state your preference. (Multiple answers allowed)	In what scientific field would you like the next Global Science Opera to focus to? Global Science Opera addresses the intersection of Science and Creativity with emphasis on musical events and stage play. If you have already implemented, or wish to implement, actions with this approach, you can state your preference. (Multiple answers allowed) - Other, please specify:
All	Cyprus	Education for the sustainable development	Mathematics / Computer Science / Physics / Engineering / Other, please specify:	Environmental sciences
Fourth	Cyprus	Language, Mathematics, Design & Technology.	Mathematics / Computer Science / Engineering	
1st, 2nd, 3rd, 4th, 5th and 6th grade of primary school	Greece	Science, Mathematics, STEAM	Biology / Mathematics / Astrophysics / Physics / Other, please specify:	Cosmology
K10-112	Greece	Biology	Biology / Medicine	
Students aged from 12 to 15	Greece	Science Maths Chemistry Biology Geology	Other, please specify:	Geology Earth Sciences
Beginners, Medium level, Advanced level	Greece	Astronomy	Other, please specify:	Astronomy
Currently I'm teaching 6th graders	Greece	Literature, History, Physics, Math, Robotics, Astronomy, Geography	Astrophysics / Physics	
All grades of midle school	Greece	Physics, Chemistry, Geography	Physics	
6 (12-13 years old) 7 (13-14 years old) 8 (14-15 years old)	Greece	Physics Chemistry Biology Geography	Astrophysics / Physics / Chemistry	
10th, 11th, 12th grade	Greece	CHEMISTRY	Physics	
I teach chemistry lessons in all classes (three)	Greece	Chemistry	Chemistry	
6th	Greece	Physical Education, Robotics, Steam	Biology / Physics / Engineering	
11 to 14 years old	Italia	Math and science	Astrophysics / Computer Science	
scuola secondaria di primo grado	Italia	maths and science	Biology	
10th to 12th grade	Italy	Mathematics and Physics	Astrophysics / Physics	
First, second, third classes	Italy	Maths, physics	Mathematics / Astrophysics / Physics	
High school	Italy	Natural Science (Biology, Geology), Chemistry	Biology / Medicine / Chemistry	
5-7	Norway	I teach music and interdiciplinary projects.	Biology / Mathematics / Astrophysics / Physics / Chemistry	
6 grades	Norway	My fields are Norwegian, math, social studies, history.	Mathematics / Chemistry	
Students 18-20 years old	Norway	I'm teaching music and theatre. Mainly we do productions, but also theatre improv and choir.	Biology / Medicine	
5th, 6th and 7th grade	Norway	I primarily teach arts and crafts, and food and health. And I am currently studying English 1-7.	Chemistry / Other, please specify:	Food science
Currently, I am working on my Ph.D. research project and my participants are children in primary schools. I work therefore mainly with children from 9-11 years old, 3th-4th grades. Otherwise, I have experience in working with undergraduate students, and middle-high school students. From time to time, I teach in-service teachers.	Norway and China	Drama Education	Biology / Astrophysics / Medicine / Physics	
11th grade 7th grade	Portugal	Physics and Chemistry	Mathematics / Astrophysics / Physics / Chemistry	
10º and 11º degress (15-16 years)	Portugal	Physics and Chemistry	Astrophysics / Physics / Chemistry	
5 to 9 Grade students between 11 and 14 years old	Portugal	Physics And chemistry	Chemistry	
9th grade	Portugal	Physics and Chemistry	Physics	
3º Ciclo, Secundário.	Portugal	Geography	Other, please specify:	Geography

7.2 Annex 2: Impact Assessment Questionnaires

GSO4SCHOOL Questionnaire for educators
(to be filled **twice**: once pre-GSO4SCHOOL activities and once post the GSO4SCHOOL activities)

Your Institution/School:
Today's Date:

Your Gender: Male ☐ Female ☐ Prefer not to identify ☐
Your Date of Birth: __/__/____

In order for us to better understand what you think about your professional development, please answer the following questions:
Have you used any of the following creative techniques in your science teaching practice in the past six months? Please tick all that apply.

☐ Theatre

☐ Music

☐ Storytelling

☐ Other – please specify: _____

In what capacity are you involved in the implementation of creative scientific inquiry activities in your institution?

☐ Not involved at all

☐ Slightly involved

☐ Involved

☐ Very Involved

☐ Involved and leading/supporting other teachers to implement

Please indicate if you have digital skills in the following areas:

☐ Video editing

☐ Blogging

☐ Video production

☐ Social media video publishing (e.g., YouTube)

☐ Online photo blogging (e.g., Instagram)

For each of the following statements, please indicate how true you feel they are, using the following scale:

	- -	-	0	+	++
I understand what creative science inquiry is					
I understand the value of integrating art in science education					
I am confident in my ability to teach creative science inquiry					
I think the kind of creativity which is enabled through the integration of science and arts educations is important to teaching science					
Young learners think creativity and arts-integration are important to learning science					

Please rate how you agree with the following statements

	Strongly disagree	Disagree	Neither	Agree	Strongly Agree
Teaching is a stressful occupation					
Teaching is an enjoyable occupation					
Teaching is a satisfying occupation					
I am connected to my students' everyday lives					
Science education connects with the lives of young people					
Creative science education connects with the lives of young people					

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Please list any creative science inquiry professional development activities you have been involved with. Please rate how useful you found them on a scale of 1- 5, with 1 being not useful and 5 being very useful.

Professional Development Activity	1	2	3	4	5

Please rate your skill level in the following on a scale of 1-5 with 1 being unskilled and 5 being very skilled.

	1	2	3	4	5
Interdisciplinary problem solving (understanding and solving a problem using more than one discipline, e.g., using theatre and biology to address new medical technologies)					
Critical Thinking					
Artistic Skills					
Multimedia Skills					

Creativity					

Please rate the level of institutional support you have received with 1 being unsupported and 5 being very supported.

	1	2	3	4	5
Provided with experts in arts and humanities					
Support with curricula planning					
Support with time management					
Provision of materials and resources for creative science inquiry					

For each of the following statements, please indicate how true you feel they are, using the following scale:

	- -	-	0	+	++
Learners have been involved in activities that are interdisciplinary (understanding and solving a problem using more than one discipline, e.g., using theatre and biology to address new medical technologies)					
Learners have been involved in activities that are problem-based					
Learners have been involved in activities that are collaborative (e.g., they have worked together to solve a problem)					

Learners have been involved in activities that involve multimedia technology (e.g., video, internet, photography)					
Learners have been engaging in imaginative expression during science education					
Learners have demonstrated divergent thinking					
Learners are engaged by science education					
Learners enjoy science education					
Learners are connecting science to real world problems					
Learners are demonstrating responsible or ethical thinking					

Has you school participated in the Global Science Opera?

☐ Yes
☐ No
☐ Don't Know

Are you involved in a GSO4SCHOOL network (either online or physical)?

☐ Yes
☐ No
☐ Don't Know

Is your institution involved in the GSO4SCHOOL network?

☐ Yes
☐ No
☐ Don't Know

Has there been media coverage of the GSO4SCHOOL project in your country?

☐ Yes
☐ No
☐ Don't Know

If there has been media coverage of the GSO4SCHOOL project in your country, please indicate on which media platform it appeared:

☐ Television
☐ Newspaper
☐ Magazine
☐ Website
☐ Blog
☐ Radio
☐ Other, please specify: _____

Please indicate which GSO4SCHOOL events you have attended, if any:

☐ Conference
☐ Summer School
☐ Training Workshop
☐ Other, Please specify: _____

Have you developed your own project beyond the original pilot project?

☐ Yes
☐ No

If yes, please give details: -

_____
_____
_____
_____
_____
_____
_____
_____

GSO4SCHOOL Questionnaire for students - Secondary (optional)
(to be filled **twice**: once pre-GSO4SCHOOL activities and once post the GSO4SCHOOL activities)

Dear students,

Thank you for your participation! All questionnaires are part of a survey and the answers you give are highly confidential! Your teacher will not evaluate and will not rate you!

Your country:	_____
Today's Date:	_____
School grade:	_____
Gender	Male ☐ Female ☐
The month of your birth	_____
The year of your birth	_____
The first two letters of your mother's short name (e.g. AN for ANNE)	_____
The number of your home's address (e.g. 16 for home's address number 16)	_____
Name of your School	_____

In order for us to understand better what you think and what you feel about the science courses (Mathematics, Physics, Chemistry, Biology, Informatics) at school, please answer each of the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning science is interesting	☐	☐	☐	☐	☐
I'm curious about the science discoveries	☐	☐	☐	☐	☐
Science I learn, is related to my everyday life	☐	☐	☐	☐	☐
Learning science makes my life more meaningful	☐	☐	☐	☐	☐
I like learning science	☐	☐	☐	☐	☐
Exploring science and art together helps me in learning science creatively	☐	☐	☐	☐	☐
Exploring science and art together makes science more interesting	☐	☐	☐	☐	☐
Learning science will help me have a good job	☐	☐	☐	☐	☐
Understanding science will benefit me in my professional development	☐	☐	☐	☐	☐
I know that science will give an advantage to my future professional development	☐	☐	☐	☐	☐

I will use my problem solving skills in my professional career	☐	☐	☐	☐	☐
My career will include science	☐	☐	☐	☐	☐
I'm studying enough to learn science	☐	☐	☐	☐	☐
prepare myself good enough for the science exams and laboratories	☐	☐	☐	☐	☐
I make a lot of effort to learn science	☐	☐	☐	☐	☐
I dedicate a lot of time to learn science	☐	☐	☐	☐	☐
I use strategies to learn good enough science	☐	☐	☐	☐	☐
I think I can get very good mark in science	☐	☐	☐	☐	☐
I am sure I will go well to the science exam	☐	☐	☐	☐	☐
I believe that I can acquire knowledge and skills in science	☐	☐	☐	☐	☐
I am sure I understand science	☐	☐	☐	☐	☐
I am sure I will do well in the laboratory workshops and the activities of the science	☐	☐	☐	☐	☐
I'm interested in having a good mark in the science exams and laboratory workshops	☐	☐	☐	☐	☐
It is important to get a very good mark science	☐	☐	☐	☐	☐
I am concerned about the mark I will take in science	☐	☐	☐	☐	☐
Getting a good mark science is important to me	☐	☐	☐	☐	☐
I like to have better marks than my other classmates in the science exam	☐	☐	☐	☐	☐