Era's muse

HANDBOOK

New Era's Museums: STEAM teaching Environments for Secondary School Education

Summary

Collection of lesson scenarios based on STEAM concept and using museums as educational resource

Erasmus+ KA2 STRATEGIC PARTNERSHIP

PROJEKT NO 2019-1-SE01-KA201-060604

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About the project:

Technology is improving every day and becoming a vital part of our lives; It is everywhere, from grocery to an Institute of Technology. While most of us are afraid and unwilling to grasp new technological advancements there is no debating that as the "digital natives" of a "digital society" we have to promote our digital skills. As a matter of fact, according to the employment data released by the EU, today's jobs are mainly in the field of Technology and in a broader scale Science Engineering and Maths. Lack of those skills will most probably mean unemployment for youngsters in the future. Specifically, youngsters' STEAM skills must be promoted to match with the competitive labour market's needs and demands. Thus, it is the schools' responsibility to help their pupils acquire those skills to be happy and motivated individuals whose future employ abilities are more likely to happen. Accordingly, our main objective is to enable high school pupils to acquire STEAM skills by enhancing and modernising the existing STEM curricula with an e- resource pack including mini MOOCs, report and a handbook (digitally available) mainly to foster students' creativity and motivation and the development of skills to respond to the Europe 2020.

The main target audience of the Project is pupils, more specifically 15-year-olds, pupils with learning difficulties, who are the lowest Stem achievers according to the survey made at partner schools. The senior pupils (as they will experience the transition to the university /business world soon) and female pupils (lack of females in Stem fields) are the other focus groups. Although our project aims to study one of the very same topics of the school educational projects, it will take different approaches to clarify the matter ; Era's Muse will get its supplementary e-resource pack for Stem Curriculum Enhancement through scenarios and their material sets co-created by school teachers, researchers, It and material developers, methodology authors, youth workers, museum employees, and associated academicians. We need technology to survive in a modern social world, yet overreliance on technology is becoming socially devastating. It leads to the feelings of isolation and depression. While promoting the stem particularly the digital skills of all participants (employees, teachers, pupils…etc) on one hand, we aim to develop especially pupils' sense of belonging and their intergenerational and intercultural skills. One of the most fundamental components to provide pupils with a sense of belonging will probably be cultural heritage; that's why museums, the caretakers of

cultural heritage, give us the context. Museums are the real-life teaching and learning STEAM environments.

The aim of the project was to produce a supplementary resource pack for STEAM Curriculum Enhancement including a report of the existence of STEAM Curriculum in partner countries. The report summarises surveys, focus group discussions and interviews, desk research, data analysis, swot analysis regarding the existing stem curriculum.

The project proposes to produce several Mini MOOCs, training programmes on STEAM methodology and the guidelines of the best practices. Moreover, the project aims to promote basic digital skills and to enhance museums as teaching environments. It also includes assessment tools, assignments, and final projects. We strive to innovatively create ICT-based materials and didactic methods for STEAM teaching to be applied into formal (school) and non-formal (museum) lifelong learning settings. As a long-term benefit, we expect to provide strong evidence and inspiration for informal and nonformal learning environments to support formal learning more systematically

Partners

This project is a partnership with a Museum in Barcelona, four high schools from Sicily, Turkey, France and Sweden and three NGOs: one from Sweden and one from Italy and a Distance and e-Learning Association from Lithuania

Our partners:

Östra Gymnasiet -high school, Sweden – the coordinator

Östra Gymnasium is a municipal high school in Skogås (Huddinge municipality) which opened in 2003. We have about 850 students who come from different elementary schools throughout the Stockholm area. We offer five programs and a total of 38 educational pathways in economics, nature, society, technology, electricity and energy and technical college. The school's

keywords - Results - Individual - Communication Our goal is to help each student achieve the best possible results. All students should be respected as individuals - both in studies and in personal development. Through communication, you reach better results. This applies not only to students and teachers but also between them. Pedagogy Traditional teacher-led teaching is the starting point, but with a variation of course. Each student also gets a Chromebook as a help in the studies during his time at Östra.

Manisa Sosyal Bilimler Lisesi - **high school, Turkey**

Manisa Sosyal Bilimler Lisesi (Manisa Social Sciences High School), founded in 2011, is a general state high school with an extra year devoted to only language learning and project making. Our school is included in the schools which offer IB (International Baccalaureate) Degree which fundamentally requires CLIL and language competences.

The school has been designed according to the European Union norms; It aims to grow up capable individuals with a broad perspective, national and universal values, the ability to analyse the individual and social needs and to reach solutions with the ability to collaborate and communicate , with the linguistic competence in three languages, and with the capability of project making as an active citizenship and a future policymaker.

Liceo Cannizzaro - **high school, Italy**

The Public Scientific high school "S. Cannizzaro", founded in 1923 and located in a residential area very populated, is the oldest scientific high school in Palermo. The town, regional capital of Sicily, is a historical place where anyone can see the blend of various cultures of foreign people that conquered the island.

The school offers a syllabus which allows students a balanced education both in linguistic-historical-philosophical and scientific fields. The school has 1750 students aged from 13/14 to 18/19 and 158 staff members. Considering the different cultural and economic backgrounds students come from, the school activates some strategies to control and solve pupils' special educational needs which can refer to both socio-cultural disadvantages and learning difficulties. Many students come from medium-high standard families, and some belong to immigrant families. The school activates procedures and strategies to survey, monitor and respond, with a flexible and effective organization, to the special educational pupils' needs, whether related to socio-cultural disadvantage, linguistic, learning difficulties (BES) or specific disorders of learning (DSA). Different criteria are used to ensure equal learning opportunities for each student, enhancing their peculiarities and considering "the diversity" an opportunity for collective growth. The school tries also to boost the students' education by organising special training activities that sometimes end with experiences of cultural exchange in European countries.

Lycée Louis Jouvet de Taverny - high school, France

Lycée Louis Jouvet de Taverny has 1500 students, 130 teachers and 50 staff personal. It offers general courses, technological ones and professional fields too. There are apprentices' students of higher education like senior technician's certificates in different fields. The professional sections are very important and attractive with 450 students. This area is based on technical knowledge in electricity, administration, social and health program. The students are aged between 15 and around 20 years old. In the other part, our school offers several classes with different projects especially European class which insist in language appropriation and opening in European culture (lecture in English, journeys, certifications etc). There are also an innovating class which is based on digital work, cognitive science and opening to professional area in collaboration spirit. And the last specific class based on cognitive science and work on personal development (memorization, attention, concentration). The school created different spaces to learn and innovate in education with a recording studio (digital TV ; digital radio), rooms which are configured in order to develop groups collaboration (writing boards on the walls, acoustic dividing walls etc). The teachers are highly trained and educated in different fields (cognitive sciences, English learning, media-information and digital literacy, cultural subjects (arts history, dramatic art), science programs (digital, computer science, engineering). to work on team, collaborate and innovate for our students.

Museu de L'Hospitalet - Ajuntament de L'Hospitalet - Spain

Museu de L'Hospitalet is a local museum, part of the city council L'Hospitalet de Llobregat. As part of the major isIs a public body an Located in the city of L'Hospitalet de Llobregat, the museum it is an administrative unit, attached to the Department of Education and Culture of the City of L'Hospitalet. This was inaugurated in 1972 at the Casa España, the headquarters of the Museum. In addition, the Museu de l'Hospitalet has cultural facilities as L'Harmonia-Espai d'Art, which serves as an exhibition center (both temporary and permanent expositions) and Can Riera-Espai de Memòria, where the offices of the workers of the Museum and the Heritage Service of the city are. The Hospitalet Museum (MDLH) is registered with number 77 in the Museum Registry of the Generalitat de Catalunya. MDLH belongs to the Network of Local Museums of the Diputació de Barcelona and to the Network of Museums of History and Monuments of Catalonia Mission The MdLH is the people' museum of L'Hospitalet de Llobregat and proposes to share their stories and lifestyles through innovative and participatory experiences around their heritage and memory. The mission is to manage the cultural heritage of L'Hospitalet through the conservation, research, dissemination and exhibition of the documentary heritage, furniture and building of the city, showing the past, the present and the future of the city. Vision MdLH wants to become the leader of the museums of society in Catalonia, with an innovative and inclusive style that serves all the communities in the preservation of their heritage. The MdLH aims to become a hub of attraction that motivates the participation of the associations and people of L'Hospitalet de Llobregat city

with the will to build a future based on the awareness of a collective urban identity. Values a) Respect and safeguard of the heritage through its transmission and use b) Social return of culture and heritage c) Social justice d) Equity e) Social and community participation f) Tolerance g) Interculturality h) Respect for human rights i) Professionalism, continuous improvement, ethics in consonance with good professional practices Areas of activity: There is 4 important departments at the museum: Curatorial Department (Exhibition and events) Strategic Planning and Projects, Collection care (conservation and documentation) Educational services The permanent human group of the museum is based on 8 stable workers: the Director, 2 specialist managers and 3 management's assistant and 2 caretakers. Moreover, the museum has the help of different externals contracts that offer punctual solution for Call 2019 Round 1 KA2 - Cooperation for innovation and the exchange of good practices KA201 - Strategic Partnerships for school education FormId KA201-83FB901E Deadline (Brussels Time) 26 Mar 2019 12:00:00 EN 50 / 238 activities and projects (security, cleaning, buildings maintenance). Finally, the MdlH has right now 3 unpaid apprentices doing some practices as a part of their master/degree education.

Lithuanian Association on Distance and e-Learning (LieDM association) - NGO-Lithuania (https://liedm.net/en/)

Lithuanian Association of Distance and e-Learning (LieDM association) unites Lithuanian science, study, and education organisations, which implement online and technology-enhanced teaching and learning. It was established in 2010 based on agreements of 25 stakeholder - member institutions. Since then, 51 members act as active members within the association including schools, VET, adult learning, higher education, colleges, VET training centres of budget organisations in Lithuania, and companies. The association maintains and develops the activities of LieDM network, makes use of its possibilities and services that are implemented centrally. LieDM association operates in the Lithuanian Republic. The main aim of LieDM association s to develop technology-enhanced learning through a professional collaboration of organisations (including distance and e-learning) in Lithuania.

Associazione PalermoScienza- NGO-Italy (https://www.palermoscienza.it)

PALERMOSCIENZA, The Association was founded in 2009 with the intent to promote the growth of science communication and young people outside of formal structures, organizing events since its establishment, dissemination and communication of scientific and technological innovation, by linking the expertise of various local and creating a network of partnerships with research institutes (INAFAstronomical Observatory of Palermo, INGV), institutions (University of Palermo, CNR - Area of Palermo), government (Province Regional Palermo, Sicily Region - Department of Education and Training), enterprises (ARCA Consortium, Consortium Ticonzero, Snap, Futurantica). The Association, in the current configuration, consists of 20 members, with

scientific training, able to propose concepts and key processes in education, as workshop creating interdisciplinary working groups open to the world is not purely scientific.

Elpis Association- NGO- Sweden (https://asselpis.com/)

Elpis Association is a non-profit organisation of Västerås with focus on meeting the demands of young people with special needs and of underprivileged youth. Elpis Association is aiming for the development of the community through educational, cultural, and social activities to improve the organization and to serve the civil society. Elpis makes all these possible by identifying and promoting values, offering education and training and re-training in order to support labor market insertion of young people and adults. Elpis offers motivational courses and activities to engage the young people in school's life and to avoid dropping-out of school. Elpis offers many workshops to promote entrepreneurial initiative and to help people to achieve the skills needed on the marketplace. For teachers and pedagogical staff, Elpis creates educational frameworks in IT and develop STEAM activities in collaboration with Stockholm University, Mälardalen University, Arbetsförmedlingen, museums , theaters, art institutions , ABB-Company, schools and high schools.

So, What is STEAM or STEM?

by Palermoscienza

It is an interdisciplinary way to teach (scientific) subjects: STEAM activities involve them in **complex projects that require the application of skills and knowledge from all of them at once**, which is closer to how they use their abilities in their life and will use one day in real jobs.

Add an A for the arts …. Even if it is a debated question

Some feel that allowing room for artistic expression in a project largely devoted to the scientific and technical side of knowledge is a dilution of its original purpose that only causes confusion and is ultimately less effective.

Others believe that STEAM is the highest form of interdisciplinary learning, and therefore it follows and expands the spirit of STEM organically.

With STEM alone, the risk is to encourage a form of binary thinking in students and raise them to believe that you can either be good at science or art, but not both, because they require different skill sets and have no connections between them.

With STEAM, students can discover unexpected links between the scientific and artistic sides of their school curriculum. A talented painter might realise that paint would not exist without chemistry and that understanding its components can improve an artist's choice and usage of materials; a musician might find an interest in the physics of sound—what makes a guitar's strings sound the way they do? How does the flow of air make a flute produce its music?

With the proper application of STEAM principles, the separation between science and the arts becomes a false problem, and that not only encourages creativity, critical thinking and problem solving, but also has consequences on the students' interests and future careers.

We are asked what is meant by "A" in STEAM : it is creativity, openness to new ideas against repetitiveness, in any branch of knowledge; it's the learning and use of all human languages, not limited to the mathematical one; It is what tells us something about man, his inner and outer life, his history, his values, his ideas; It's getting to know, getting excited.

In contemporary society I would say, as the philosopher H. Bergson (who recognized at the base of existence a creative and free life force) had already said, reacting to the rampant positivism, that the more science grows the more it feels the need for a "supplement of soul" and the "mechanical demands a mystique".

STEAM is **the hottest new keyword** of today's education.

Is it something really new?

Here is Galileo Galilei, (1564 - 1642), an Italian astronomer, physicist and engineer, sometimes described as a polymath. Galileo has been called the "father" of observational astronomy, modern physics, the scientific method, and modern science. He was educated, particularly in logic (philosophy), he also studied design, fine art, and, in 1588, obtained the position of instructor in the Accademia delle Arti del Disegno in Florence.

Maybe, the first STEAM project could be two lectures **On the Shape, Location, and Size of Dante's Inferno** in an attempt to propose a rigorous cosmological model of Dante's hell, upon invitation by the Florentine Academy.

Is it an impossible mission to match Literature and Math?

Being inspired by the artistic tradition of the city and the works of the Renaissance artists, Galileo acquired an **aesthetic mentality.** He represented the **Renaissance culture**, with a **Human-Centred-Design**: the humanistic side (meanings and purposes) and the scientific one (methodology) blend and become concrete and real through the ethic and smart use of the tools given by technology.

What about History and Geography in a STEAM curriculum? Are they Science?

Of course, even if they are Social Sciences. So they are right in a fusion of Science and Art and they blend different subjects in an extraordinary way.

In the created miniMOOCs it is shown how History and Geography can be integrated in a STEAM curriculum and how they can contribute to enhancing the development of knowledge and skills.

In this perspective, it was very useful to take in account the lesson of the Touching History methodology, developed especially by the British Museum director Neil Mac Gregor, who wrote "A History of the World in 100 Objects"

The necessity of a STEAM curriculum

by Elpis Association

STEAM (science, technology, engineering, art and mathematics) is a very popular concept in our day's education. This is an interdisciplinary project-based learning to apply the different subjects taught in complex projects that require transversal knowledge from all these subjects. STEAM education begins in the USA as a demand for skilled manpower on the labor market. Adding

art between science and technology empowers the pupils with freedom to have a creative mindset, critical thinking, and personal expression.

A STEAM curriculum supports the development of a convertible and versatile professionals for an evolving workplace. The concept is a multidisciplinary approach to develop models for industry, business, and education. This curriculum is pioneering and is based on team-work, on inter/intra/multidisciplinary problem solving through mentoring, research projects, and different partnerships outside schools. This model for education has the purpose to include all students by offering everyone the opportunity to express and develop according to their innate abilities. In addition, this model offers the possibility of a comprehensive understanding of the subjects taught, the application-exploration but also the extension of knowledge in new contexts. The foster of creativity is desired in the industry and business context to encourage the kind visionary innovations able to solve complex solutions.

As the report relieves, there is not any STEAM curriculum in our partner countries. There are some activities that encourage a cross-disciplinary approach but without a long-term purpose, and they are used only in a restricted educational context. Outside the schools, NGOs propose a lot of STEAM activities, in concordance with subjects taught in schools and labour market demands, but the weakness is that most of the activities are after school time and the threat is that many students can not attend.

Students' opinions about STEAM activities with Elpis Association:

> " I am interested in design and this activity give me the possibility to learn how to make 3D models, how to animate them , how to code them and how to integrate them in a context" Alessandro (15)

> "I am interested in Robotics and I am very happy to participate in this project and to create my own robot. It was challenging, engaging and emotional as well. I learn to code, to use my physics that I hated before , to plan and design a context for my robot. It was amazing" Johnathan (16)

> "I am interested in history and art. This activity makes me understand some moral principles and how they were used(abused) at that time and make reciprocity with our time. I used my maths knowledge to make calculations and I understood how useful they are outside the maths tests." Tyra (15)

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National Report of Steam Curriculum

Turkey

2019-2022

Manisa Sosyal Bilimler Lisesi

Turkey

1- How is STEAM taught in Turkey ?

Is STEAM curriculum integrated in formal education in my country? And how?

First of all, there is not an applicable STEAM curriculum designed according to Turkey's realities and needs today but education authorities support STEAM education and state that it should be aimed that student will gain an interdisciplinary perspective on Science, Technology, Engineering, Art and Mathematics and also gain skills such as inquiry, conducting research, esthetical perspective and product development.

All basic disciplines have their own national curriculums: although science and mathematics curriculum give importance to achievement of the interaction between science, technology and society, STEAM integration and engineering skills aren't given importance in these curricula.

According to the STEAM Education Action Plan led by the Ministry of National Education, it is highly recommended that new education programs with STEAM vision must be launched at schools. However, we cannot say that there is a cooperation with school administrations for the evaluation of applications and training which may be put into a national STEAM curriculum.

Is it only in/non-formal education?

It is generally in non-formal education. As for its adaptation in formal education we can say that instead of a direct revision of the curriculum, the ministry has begun a step by step update in curriculum for STEAM education; firstly, exciting activities (coding, robotics, maker etc) have been included often as extra-curricular (mainly after- school) activities.

There is also a science applications course that has been available as an elective course in all levels of secondary school since 2012-2013. The outcome of this course also serves for STEAM education.

However, for the adaptation of STEAM education, the course content load of Science and Mathematics courses in primary and secondary schools should be decreased so that there will be enough time for STEAM activities and the centralised examination system should be updated accordingly. Students' inquiry, researching, developing products and inventing skills should be assessed and evaluated instead.

2- Example(s) of good practice that can be shared

1) "The Young Inventors Design Future: Science, Technology, Engineering and Mathematics (STEM)" : It was a research activity done in another school. (Baran, Canbazoğlu-Bilici, & Mesutoğlu,

2015). In this activity, students were asked to design a STEM spot according to the scenario given to them, which will be shown on television. Students designed STEM spots with story boards. It is accepted that students improved their knowledge and skills about technology and computers in this STEM activity.

2) " Fatih Project " : Within that project Ministry of Education provided the schools with interactive boards, tablets and Educational Informatics Network (EBA) contents. Those are the course material and tools which are very likely to contribute greatly to the STEAM education activities. It is thought that FATIH Project and EBA set a suitable ground for STEAM education

3) " Science Festival" : Each year our school holds a science festival . That science festival both helps students gain questioning, inquiry researching, product development and invention skills and the projects created for the festival serve as steam resources for future uses.

3- A SWOT analysis of one good practice

Action: " Fatih Project " : The Ministry of Education's providing the schools with interactive boards, tablets and Educational Informatics Network (EBA) contents.

The **objective** of this project is to help students and staff gain digital skills while fulfilling several educational goals. Designed activities through this project aim and facilitate media literacy, creative thinking, science applications, intelligence games, informatics applications and software, mathematical applications, communication technologies and research methods

STRENGTHS	WEAKNESSES
Providing an environment to students independent from time and space for STEAM education, Supporting STEAM education by using digital multimedia laboratory materials. Providing equal opportunities in STEAM education for children at socioeconomically low and high background Helping students learn with lesson activities based on questioning, researching, product development and inventing.	Teachers have not got necessary digital skills to use smart boards efficiently. All the digital tools offered with that project detract students from the real world. Students are becoming more passive just audience of their own teaching and learning process . That project makes students write less ;they are losing their ability to express themselves. Students can easily reach information therefore they do not force their brains to work. That digital environment also reduces the interaction between students and teachers.

OPPORTUNITIES	**THREATS**
As there are several multimedia (audio-visual aids) to support teaching, it enables permanent learning for students. It saves time for both teachers and students ; Teachers and students do not have to spend time writing instructions and questions on the board. They can have more time for extra activities	It has been observed that the Fatih Project is far from achieving social equality in some means ; it has started to establish a specific (single) market with supplements and by-products, and it is effective on economic transformation by increasing the technology-based education expenditure of families. In terms of educational transformation, it is determined that it has questionable effects in a pedagogic and professional sense Students use their tablets and smart boards for playing games ; their use of digital tools for that purpose increases the technology addiction.

National Report of Steam Curriculum

France

2019-2020

LPO Louis Jouvet – Taverny – France

Anne CHIAMA, Frédéric GUILLERAY, Ervan ROUSSEIL, Marine ROBINI

1- How is STEAM taught in France ?

Is STEAM curriculum integrated in formal education in my country? And how?

There is no mention of STEAM skills in the whole French curriculum in high school.

Each discipline has its own curriculum, which is defined by the Ministère de l'Education Nationale and is valid for the entire, with very little cross-disciplinary contents in the curricula. The following examples show that some skills can be considered in several disciplines as STEAM skills, but they are never specifically identified as STEAM skills.

STEAM skills in the French curriculum for high schools	
Discipline	***Skills***
Mathematics	• research, experimentation • producing data models • using mathematics languages and different models of visualisation • demonstration and reasoning skills • calculation • communicating the demonstration and the results
Economic and social sciences, History and Geography	• building a demonstration, developing reasoning skills based on disciplinary knowledge and on documents' analytical study • language skills, both written and verbal
Numerical and digital Sciences	• using digital datas and several numerical languages • analysis of new digital practices and habits ; workshops on their consequences on societies, individuals, on arts and other disciplines • oral and written argumentation
Education to medias and information resources	• developing research and analysis skills • using several information and documentation tools • developing personal curiosity • oral and written argumentation • abilities to participate to workshops

B. Is it only in/non-formal education?

French curricula however indicate cross-skills which can be taught in every discipline.

These transverse skills include information search, written and verbal argumentation, problem solving, oral presentations, group work, documents analysis, building of critical thinking.
In France, STEAM skills are part of informal education. They can be taught through the implementation of interdisciplinary projects, which are driven within each school by the teaching teams. This type of project depends on the will of the teaching and managing teams : these projects have to be organised with specific schedules and payment plans for the teachers, because they are not part of the ministerial curricula.
Traditionally and culturally in the French education system, teachers aren't used to be part of a team, especially in secondary schools: French teachers in high school are supposed to teach their lessons, to participate to the life of the class (meetings with the families, teacher's conferences); but transdisciplinary and cross-disciplinary lessons are not part of the curricula and of the teaching culture in high school. Besides, there is no time set aside in timetables to bring teams together, nor is there often any space in the schools, such as meeting rooms. It is therefore often difficult to build interdisciplinary projects for these reasons. And the success of such projects depends only on the motivation of the supporting teachers and the support of the school management.

2- Example(s) of good practice that can be shared

Within Lycée Louis Jouvet - Taverny, several teachers have been driving transdisciplinary projects since a few years, which mobilise some STEAM skills in an informal way. In our school, there is a specific project culture. Not all projects are based on STEAM skills, but this dynamic is quite particular in the French educational landscape. It is due to self-motivated teachers and committed managing teams.
We have projects around the implementation of contributions from research in cognitive sciences, European dynamics and we won a call for projects with the French space agency (CNES). This allowed students to build scientific experiments and to test them directly in weightlessness.

As a specific example, we can present the "**Digital project**" which has been lead for 4 years by a biology and natural sciences teacher and a history and geography teacher:

- **Public**: a dozen of pupils between 14 and 15 ("classe de 2nde" : 1st grade in high school), split into small groups.
- **Aim**: building a video game and a webpage on the theme of "Discovery of the so called "New World" and scientific discoveries" ; all of the contents are written and presented in English.
- **Organisation**: each group works on a character related to the theme (an important scientist, a sailor) and presents a short biography after a few researches on the internet (using institutional websites such as Museum's web pages or the French National Library -

Bibliothèque Nationale de France). After the oral presentation, the groups vote for the most convincing character they will work on the entire scholar year.
The groups work on the chosen character with an internal organisation, within each group is responsible for 1 topic : 1 group for the researches, controlling the relevance of the information gathered by other groups about the character and his time ; 1 group for the game design ; 1 group for the web design ; 1 group for the schedule.
Each group works on every part of the project (research, game and web design), but each group is a point of contact for 1 topic.

- During the scholar year: the entire class group presents the website and the game during the "Journée Portes ouvertes" (open school day) to other pupils, in march. At the end of the year, the links to the website and the game are shared on the school's website.

During the **Digital project**, the following STEAM skills have been improved:

- research abilities to choose the character and to collect some data
- work on historical and scientific contents, linked to the history, geography and natural sciences curricula
- developing the personal curiosity with new ways for research and documentation, linked to scientific contents which have been studied during class lessons
- innovation skills to create some digital contents and to present the character's life on numeric supports such as the web page and the video game
- experimentations with digital tools: BYOT initiatives and use of digital tools such as management and game software, online resources, and web design
- coworking and brainstorming with oral presentations and written contents
- increasing the pupils' autonomy with the task's management
- work on languages' skills, both written and oral.

3- A SWOT analysis of one good practice

Action : creation of social solidarity economy enterprises in the classroom.

The **objective** of this action is to empower students by making them actors in an entrepreneurial, collective and socially useful project.
Through the creation of an association, a cooperative or a mutual fund, the students can develop many skills. They can also appropriate and give meaning to the values of equality, cooperation and solidarity.
This experience allows students to understand the economic and professional world around them, within sight of their academic and professional orientation.
Examples of project 2019-2020 :

- *Association creating a downloadable escape game for hospitalised children*
- *Association raising awareness of urban pollution among primary school children*

- *Association promoting sports competitions to collect donations in favour of battered and excised women in Africa*

	Helpful *to achieve the project*	**Harmful** *to achieve the project*
Internal origin *(attributes of the organisation)*	**STRENGTHS** **Motivation :** students create their own structure around projects that makes sense to them. They are motivated to spend time on their project. **Responsability :** each student within the company must take on responsibilities. They choose a president, a treasurer, a secretary, a communication manager, etc. Everyone has things to do for the project. Decisions are taken collectively within the fictitious company. **Interdisciplinarity :** all the teachers in the teaching team can intervene at different times during the project, according to their expertise. **Development of many skills :** based on an initial observation, they must devise innovative and solidarity responses based on cooperation and social utility. They must then create a company : either an association, a cooperative or a mutual. As a result, they develop both STEAM skills and social-behavioural skills.	**WEAKNESSES** **Training :** it is not easy for teaching teams to supervise such projects. It takes time to support students and help them build their projects. Teachers are not trained for this. Sometimes it can be improvised. **Financing :** some projects require money. It is therefore necessary to convince the institution to participate in the financing of projects, which is not easy because budgets are tight. As a result, students have to look for sponsors to help them, with the possibility of finding nothing.
xternal origin	**OPPORTUNITIES**	**THREATS**

(attributes of the environment)	**Partnership :** there is a national association whose objective is to promote the social and solidarity economy in education. There are correspondents in each academy to help teachers set up projects. Their intervention is free of charge.	**Time slot :** no time slot in the programs. It depends a lot on the goodwill of the headteacher. **Teacher remuneration :** no official remuneration, it depends on the goodwill of the headteacher.

National Report of Steam Curriculum

Italy

2019-2020

Liceo Scientifico Statale S.Cannizzaro – Palermo – Italy

Roberta Accardi , Renata Colomba

PalermoScienza-non formal perspective

Valeria Grecu, Elena Pariza

1- How is STEAM taught in Italy ?

Is STEAM curriculum integrated in formal education in my country? And how?

There is no mention of STEAM skills in the whole Italian *curriculum* in high school. Each discipline has its own *curriculum*, with very little cross-disciplinary contents. Some skills can be considered in several disciplines as STEAM skills, but they are never specifically identified as STEAM skills. Italian *curricula* however indicate cross-skills which can be taught in every discipline. These transverse skills include information search, written and verbal argumentation, problem solving, oral presentations, group work, documents analysis, building of critical thinking. Traditionally and culturally in the Italian education system, teachers aren't used to be part of a team, especially in secondary schools: Italian teachers in high school are supposed to teach their lessons, to participate to the life of the class (meetings with the families, teacher's conferences); but transdisciplinary and cross-disciplinary lessons are not part of the *curricula* and of the teaching culture.

Is it only in/non-formal education?

In Italy, STEAM skills are part of informal education. They can be taught through the implementation of interdisciplinary projects, which are driven within each school by the teaching teams. Since 2015 the "Alternanza scuola-lavoro (School-work interchange)", now renamed "Percorso per le competenze trasversali e l'Orientamento (Pathway for transversal skills and Orientation)" has been introduced as a compulsory activity for all type of high schools during the last 3 years (15-18 aged students), in accordance with the new Skills Agenda for Europe adopted by the Commission on June 2016. It's a kind of innovative teaching method, based on the key Competences, considered as a combination of knowledge, skills and attitudes appropriate to the context. Through practical experiences students strengthen the competences and the soft skills which all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment. Students improve the knowledge acquired at school, they become aware of their attitudes in order to undertake their future studies or make better career choices, find quality jobs and improve their life chances. The PCTO consists of projects run together by schools and agencies (such as Universities, companies, societies, clubs, etc.) based on new methodologies such as learning-by-doing e situated-learning that give to the students the opportunity to understand different aspects of the labour world. These kinds of projects are carried out outside the daily school timetable, and they have to be organised with specific schedules and payment plans. However, the funds for the projects are very low and teachers are not obliged to do them. Therefore, many teachers are very sceptics and the success of such projects depends only on the motivation of the supporting teachers.

2- Example(s) of good practice that can be shared

1. **Architecture and civic culture** (Timeline: school year 2018-19)

Description: The project aimed at regaining values and knowledge that are fundamental for our culture and our territory. The students attended some workshops of technological design to learn and carry on an architectural project to set the constructive contents and foresee the performances, by using surveys, simulations, plans, real and digital models, instruments of digital representation. Above all, the students learnt the main techniques of physical and virtual representation necessary to the realization of scale models of architectural projects

The focus of the project is the knowledge of an architectural structure situated in an area which becomes a laboratory where it is possible to understand the historical, cultural, social stratification of the students' hometown and the relation between the quality of the architecture and the urban space both from the virtuous and the problematic side. The students have the opportunity to learn new expressive-graphic forms thanks to the use of the AUTOCAD program.

Objectives:

- To develop skills which can be used in various contexts such as the labour market, by accepting responsibilities during training and team work in order to solve problems.
- To Strengthen relationships skills, self-esteem, responsibility and respect of tasks and deadlines.
- To Strengthen the linguistic and IT skills throughout the learning process.

Target group: Students of the last three years.

2. **Through the ancient Gates of Palermo**

Description: The project aimed at creating a new, imaginative itinerary through the Ancient Gates which used to be the access to the city walls. Thanks to the innovative IT instruments, the visitors will be enabled to 'see again' the gates in all their old splendour, they will revive their stories, mysteries, symbols and their function which is nowadays totally forgotten.
The project was carried out in partnership with the U'Game association, to learn the use of the game design as a tool to a more creative and playful way for the fruition of the historical, artistic, and cultural heritage. A tour with an English-speaking guide will be available.

Objectives:

- To develop skills which can be used in various contexts such as the labour market, by accepting responsibilities during training and teamwork in order to solve problems.
- To develop skills of problem analysis and problem solving.

to develop creativity.

- To strengthen relationships skills, self-esteem, responsibility and respect of tasks and deadlines, to Strengthen the linguistic and IT skills through the learning process.

Target group: Students of the last three years.

3. Climate Changes

Description : The project aims at improving students' Knowledge and awareness of the climate changes and their effects nowadays and in the future. Through a playful-didactic pathway, students discover the amazing world of meteorology and geology, and they enrich the specific lexicon of being able to communicate for scientific purpose. They use the knowledge acquired during the curricular lessons and then they create workshops for a public exhibition, in partnership with the association Palermoscienza. This kind of experience boosts the dialogue between school-university-associations, in a perspective of common planning.

Objectives:

- To develop skills which can be used in various contexts such as the labour market, by accepting responsibilities during training and teamwork in order to solve problems,
- To develop skills of problem analysis and problem solving.

to develop creativity,
To strengthen relationships skills, self-esteem, responsibility and respect of tasks and deadlines, to Strengthen the linguistic and IT skills through the learning process.

Target group: Students of the last three years.

3- A SWOT analysis of one good practice

STRENGTHS	WEAKNESSES
Providing an environment to students independent from time and space for STEAM education, Supporting STEAM education by using digital app and curricular information. Providing equal opportunities in STEAM education for children at socioeconomically low and high background. Help students learn through activities based on questioning, researching, problem solving and connection with real life. Also, they develop both STEAM skills and social-behavioural skills.	It is not easy for teaching teams to supervise such projects because it takes time to support students and help them to build activities.
OPPORTUNITIES	THREATS
Teachers of mathematics, physics and art work together at different times during the project.	No time slot in the programs. It depends a lot on the goodwill of the headteacher. Students use their tablets and smart boards for playing games; their use of digital tools for that purpose increases the technology addiction.

Non formal perspective

2- Example(s) of good practice that can be shared

1. Measure for Measure

This activity is developed on two parallel tracks introducing two different method virtual and real-life to measure a building. We chose an important architectural structure, Palermo Cathedral, as a laboratory where it is possible to test different points of view, to measure its size using different measure unit to calculate, for example, its volume and to include it in urban space in which it is.

2. Science in Paint

We use a painting to observe the relationship between art and science. Today, we get used to a neat split of disciplines, science and humanistic disciplines and inside science ones too. This is a cultural heritage from nineteenth century knowledge. But if we stop to think about it, artists were also little scientists, because to paint light, to draw depth, they had knowledge of physics and chemistry such that they could represent reality in an almost truthful way.

3- A SWOT analysis of one good practice

Science in Paint

The objective of this activity is to help students to understand how to apply curriculum learning in real life and to improve their skill to observe and don't take anything for granted.

STRENGTHS	WEAKNESSES
Providing an environment to students independent from time and space for STEAM education, Supporting STEAM education by using digital app and curricular information. Providing equal opportunities in STEAM education for children at socioeconomically low and high background. Help students learn through activities based on questioning, researching, problem solving and connection with real life. Also, they develop both STEAM skills and social-behavioural skills. Interdisciplinarity: teachers of mathematics and physics and art work together at different times during the project.	It is not easy for teaching teams to supervise such projects because it takes time to support students and help them to build activities.
OPPORTUNITIES	**THREATS**
Teachers of mathematics, physics and art work together at different times during the project.	No time slot in the programs. It depends a lot on the goodwill of the headteacher. Students use their tablets and smart boards for playing games; their use of digital tools for that purpose increases the technology addiction.

National Report of Steam Curriculum Sweden from non-formal perspective

2019-2020

Elpis Association – Sweden

1- How is STEAM taught in Sweden?

Is STEAM curriculum integrated in formal education in my country? And how?

Sweden education mirrors the rapid changes in society. Sweden has one of the highest levels of internet use for education purposes. The students learn how to find trustworthy information on the internet using credibility criteria. They learn to validate and to investigate the veracity of information on the Internet under their ordinary classes.

The Swedish curriculum promotes STEAM subjects like natural-science, social-science, art, math, and technology. The main purpose of these subjects is to use concepts, models, and theory to describe and explain real-life phenomena and events, to make connections with nature and society. Moreover, all these subjects have practical, problem-solving, and reflective activities connected with social questions in different areas such as: energy, medical treatment, economical, digital and technological development etc. But the concept STEAM is not mentioned in the Swedish curriculum and there are no cross-disciplinary approach, activities, or projects, or if this exists (in the subjects mentioned before) is not evident for students and teachers.

Another positive aspect in Swedish education is that the councils provide each student with a laptop starting from the 7th grade and free Wi-Fi in schools.

Is it only in/non-formal education?

Sweden's educational system encourages the teacher to extend the education outside the classroom, to engage other organisations to participate in education and to create a unity between formal and nonformal education. Extra-curricular activities such as sport, exploratory trips, museums activities are represented in the educational system.

To take the students outside the classes and create interactive lessons in museums or outdoors activities is not an easy task. To compensate for the lack of time for transdisciplinary activities in schools, there are workers in non-formal education with good competences in different fields of learning activities. Some of them work directly with students, other create material, methods and instruct the teachers to create transdisciplinary activities, develop Project Based or Inquiry Based Learning, to create interactive lessons. The workers in non-formal education create a learning concept where they integrate aspects from art to facilitate understanding and inclusion in fields of society, technology, science, maths.

A priority in this concept is to enhance the teachers' and students' motivation to use real-life problems and to modulate them from STEAM perspective. In this way the students have a larger perspective over the things they learn in school and will intuit new job opportunities very easily.

Another aspect is that enhancing the STEAM concept makes the students understand the connections between subjects, giving them the opportunity to explore the different aspects of the subjects taught as a real-life task.

2- Example(s) of good practice that can be shared

Elpis schedules different after school activities in the STEAM field like robotics, programming, AR/VR coding, apps for the phone or activities in cooperation with museums, art galleries and other organisations.

1. Creating VR games (4 weeks)

Objects:

- Learning to code using blocks or Python ,
- Develop skills like cooperation, initiative, problem analyse and solving, creativity

Target group: people from 5 to 20 years old.

Description: During 4 weeks people learn the basics of VR programming and develop their own game.

2. **Creating website (4 weeks**) :

Objects:

- Learning HTML coding
- Develop skills like cooperation, initiative, problem analyse and solving, creativity, entrepreneurial

Target group : people from 15 to 20 years old

3- A SWOT analysis of one good practice

Action : 3D coding -game / storytelling

The **objective** of this action is to help students to develop digital skills, making them competitive in the labor market. Designed activities facilitate creative thinking, science simulation, applied mathematics, media literacy, communication and create a motivational environment to fulfil the learning's purpose.

STRENGTHS	WEAKNESSES
	The activities are after school time

Give opportunities to students to learn independently, find information, create interactive presentations, develop media literacy and digital skills. Preparation for futures jobs' opportunities Develop imagination and coding skills.	
OPPORTUNITIES Providing a motivational learning environment and software Provide equal opportunities for learning and teaching.	**THREATS** Many students could not attend after school for different reasons like they live far away, very exhausted, and have a lot of homework for the next day.

National Report of Steam Curriculum Sweden

2019-2020

Östra Gymnasiet, Stockholm

Iriana Martínez Camuñas and Mihaela Chivoiu

1- How is STEAM taught in Sweden?

A. Is STEAM curriculum integrated in formal education in my country? And how?

There is no mention of STEAM skills in the whole Swedish curriculum in high school. Each discipline has its own curriculum, which is defined by the Swedish National Agency for Education and is valid for the entire, with very little cross-disciplinary contents in the curricula. The following examples show that some skills can be considered in several disciplines as STEAM skills, but they are never specifically identified as STEAM skills.

STEAM skills in the Swedish curriculum for high schools	
Discipline	***Skills***
Mathematics	• research, experimentation • producing data models • using mathematics languages and different models of visualisation • demonstration and reasoning skills • calculation • communicating the demonstration and the results
Natural Science	• interdisciplinary • critically evaluate and take a stand on issues that have a scientific content. • science and digital technology
Technic	• identify and analyse technical solutions based on effectiveness and function; • identify problems and needs that can be solved with technology and develop proposals for solutions; • use the concepts and forms of expression of the field of technology; • evaluate the consequences of different technology choices for individuals, society and the environment, and • analyse the driving forces behind technology development and how technology has changed over time.

B. Is it only in/non-formal education?

Swedish curricula however indicate cross-skills which can be taught in every discipline.

These transverse skills include information search, written and verbal argumentation, problem solving, oral presentations, group work, documents analysis, building of critical thinking.
In Sweden, STEAM skills are part of informal education. It depends on the school, the teaching teams, and the teachers. This type of project depends on the will of the teaching and managing teams: these projects must be organised with specific schedules because they are not part of the curricula.
Traditionally and culturally in the Swedish education system, teachers are used to be part of a team at all levels. In some schools their working methods require that teachers work together implementing interdisciplinary projects, and in that case the schedule it's adjusted to it. And the success of such projects depends only on the motivation of the supporting teachers and the support of the school management.

2- Example(s) of good practice that can be shared

In Östra Gymnasiet, Huddinge city, Sweden, several teachers have been driving interdisciplinary projects based on STEAM skills, within the managing teams. Not all projects are based on STEAM skills, but this dynamic is quite particular in the Swedish educational landscape.

An example of this is the project "The giants of science- their lives and actions". The students get acquainted with several of the really big names in the history of science, such as Marie Curie, Newton and Galileo Galilei. The subjects are mainly history, Swedish, and science. The students are divided into groups. Each group will be assigned one of the giants of science. They will receive material with sources about the "giants". From the material handed out, they choose one or two situations that the group dramatises and prepare to play on stage in the aula for the other groups and teachers.

The following STEAM skills has been taught:

- Problem-Solving.
- Communication.
- Creativity.
- Collaboration.
- Critical Thinking.

3- A SWOT analysis of one good practice

STRENGTHS	WEAKNESSES
Dramatisation leads to good experiences and creativity. Knowledge about the history of science in a fun way! Makes the students develop collaboration skills and use their imagination. The students enjoy the variety of working methods. The school has an Aula that can be used for such projects.	Not all students are comfortable in dramatising. Not so many digital tools were used in this project (except in the research part). Not all teachers have the time to be part of such projects.
OPPORTUNITIES	**THREATS**
The opportunity to use more digital tools. The students can choose more than one way of presenting their results. More good ideas should be promoted. More time for the teachers to plan together and implement such projects.	Scheduling can be an obstacle if it's not adjusted to this kind of projects. The time for every subject is limited.

Chapter II

Trainings

Introduction

During the project, there were many training sessions for a better understanding of the concept of STEAM, the relation between school and museum, STEAM activities in museums, understanding the concept of MiniMOOc and how this can be integrated in classroom teaching.

C1 training was organised by Palermoscienza (Italy) to share some best practices on how STEAM could be taught at schools. C2 training focused on the use of virtual learning platforms and other technologies and were organised virtually (due to COVID-19, see their coherent description below). C3-C5 trainings aimed at testing various STEAM lesson scenarios with school children and finalising them in miniMOOCs

Teacher virtual teacher trainings on how to use Moodle and ICT

The C2 teacher trainings were organised online due to COVID-19 restrictions. The aim of these trainings was to train the teachers and project partners on the use of virtual learning platform Moodle (which is one of the most popular learning platforms) so that they later could prepare the miniMOOCS in VLE Moodle. The Moodle virtual learning platform was selected as it was one of the most popular virtual learning environments which is an open source platform and can be easily adapted for the needs of different partners.

The trainers of the C2 training were dr. Estela Daukšienė (estela.dauksiene@liedm.net) and Vida Žvinienė (v.zviniene@liedm.net) from LieDM Association and Vytautas Magnus University, who both are the experts in online teaching and training.

The learning outcomes of the trainings:

- Develop ICT based teaching materials and adapt them to national context;
- To create Moodle course by uploading learning materials, structuring courses, and providing learners with learning tasks
- To jointly collaborate in international course development in the different STEM areas

After the training teachers and project partners were able to create, upload and update learning materials in Moodle virtual learning platform, designing online lessons that help in STEAM subjects that would be enriched with museum resources.

Duration of virtual training

Learning time required by teachers participating in the training consisted of 40 hours - 16 hours of synchronous meetings with theoretical incepts, practical explanations and consultations and 24 hours of practice, implementing activities between and after synchronous meetings (based on video recordings and tutorials, guiding the practice activities).

Organisation of virtual training

All virtual training took place online at Erasmuse virtual learning platform (https://erasmuse.liedm.net/course/view.php?id=2). Adobe connect (https://ac.vdu.lt/liedm) videoconferencing tool was used for synchronous meetings with teachers /consultants. There were 8 synchronous meetings of 2 hours each, where the following topics were presented:

Training topics:

1. Introduction and training aims. Moodle accounts and dashboard. Moodle Course creation
2. Changing Moodle course format and updating course information.
3. Upload different types of resources in Moodle. Moodle resources: Page, Link, File, Book, Label, other.
4. Preparing activities for learners in Moodle: What are the steps? what kind of activities are possible? Moodle activities presented: Assignment, Forum, chat, feedback, e-voting, lesson, workshop, tests, other.
5. Moodle badges as a motivation tool. How to prepare and issue.
6. Open educational resources and licensing. Creative commons licences.
7. Open course development. Stages for mini-MOOC. Creating a course collaboratively.

The recording of each synchronous meeting was prepared and shared in the Moodle platform for participants to review later. After the last synchronous meeting all tasks have to be submitted in Moodle by participating teachers. Asynchronous consultations were available in the Moodle forum. Teacher assignments included:

- creating an account in Moodle and introducing yourself for other teachers using Moodle forum and Padlet;
- requesting a self-training course in Moodle and planning its structure;
- adapting course setting and uploading learning materials of different topics and in different formats;
- creating a lesson plan for the subject using museum resources;

- peer review of lesson plan of your colleagues (other training participants) based on the provided assessment criteria;
- creation of groups for mini-MOOC development and collaboration.

Further use of virtual learning platform, used in the training

In general Moodle as a virtual learning platform may be used for online or blended teaching. This project teachers were trained and used this platform for creating mini-MOOCs which include different scenarios and examples of STEAM subjects using museum resources. The created miniMOOCs as virtual or blended course examples are accessible in the project platform for all users. Thus every teacher may access these resources in Erasmuse virtual learning platform using guest login or creating a login with its social network account. Steps to see Erasmuse miniMOOCs in Moodle:

1. go to https://erasmuse.liedm.net
2. Click on Erasmus miniMOOCs
3. Click on selected miniMOOC title
4. Select "login as guest" and browse the selected courses as examples of virtual courses or use the prepared resources for you face to face STEAM classes.

The next part of this chapter presents a collection of lesson scenarios developed by teachers during the training; they included using any kind of museum as a resource and STEAM education concept.

A greenhouse

By Elpis-Sweden

Age +14

Subjects: Science, Engineering

Purpose:

- to understand how to apply STEAM to real-life situation
- use museum patrimonial to understand the subject's taught
- to develop a deeper understanding through learning by doing

Lesson 1: **Social Science** time 100min-**Investigation-Object based learning**

Immersion in history by visiting a museum of history and discuss about peoples' work during the history. We discover that during all times the people work the land to provide their food. We learn what and how people eat in middle age.

Organization: group of students. Discuss by comparation the food in our days and the food in – middle age. Group 1. -pour people in our time in that time, Who are and who were these people Group 2: people of average social status now and then. Who are and who were these people Group 3- Rich people, now and then. Who are/were these people.

Results: posters

Assessment: per assessment

Lection 2: **Biology:-Learning by doing** -creating greenhouse in a jar and explore how the plants can be adapted in different condition and create an ecosystem**. Time 80min**

Students create a small greenhouse in jar. Explore different kind of plants from different region of world.

Resources : https://www.instructables.com/Greenhouse-in-a-Jar/

Lesson product: greenhouse, leaflets with information about the plants in the greenhouse

Lection 3: **Engineering-Problem based learning - time 100 min**

Students have to create good condition in their greenhouse, for this they have to have a a certain temperature and to maintain certain humidity conditions favorable to the plants. In this case they must have an instrument to measure the temperature and humidity every day. The problem : how to find if the plants good conditions for development: temperature and humidity -Creating an application to measure the temperature and humidity in the greenhouse

Organization : group of 4 students

Material : Arduino kit

Resources: https://create.arduino.cc/projecthub/MisterBotBreak/how-to-use-temperature-and-humidity-dht-sensors-9e5975

Birds

by Östra Gymnasiet-Sweden

Age: 15-18

Subjects: Science, Mathematics, Engineering

Purpose:

- to work interdisciplinary
- develop a larger understanding about the factors that interact in an ecosystem
- Visit a Bird exposition

Lesson 1: Preparation 50 min

Group activity: each group has a field of interest and discusses the question they will investigate.

Lesson 1-2 Biology

Investigation

Time: 100 min

Lesson 1: Students visit a Birds Exposition. Aim:
learn about birds and their habitat Activities:

Work group: each group choose a climate zone and observe and describe birds and their roll in this ecosystem

Students records the birds' sounds

Each group creates a poster or a film with the information they found.

Assessment: peer -assessment

Lesson3 : Mathematics

Statistics Analyse

Time 100 min

Aim: using geometry to calculate frequency, amplitude, and period of a wave of sound. Using the records students make a spectrum analyse using https://academo.org/demos/spectrum-analyzer/

Resources: https://www.khanacademy.org/science/high-school-physics/x2a2d643227022488:waves/introduction-to-sound/v/sound-properties-amplitudeperiod-frequency-wavelength

Tools: geogebra, desmos

Assessment: formative assessment

Lesson 4: Technology

Engineering: creating a radio frequency detector

Time 100min

Material: Arduino kit

Resource: https://www.youtube.com/watch?v=COoxTmtR-rQ

Assessment: groups work

HISTORY BETWEEN LITERATURE AND IMAGE

by Liceo Scientifico Statale S.Cannizzaro , Palermo – Italy

The aim of this project, with the avail of a STEAM methodology, is the recovery of basic values for our culture and our territory.

At the core of the project are laboratory activities of architectural technological design, through surveys, simulations, drawings, real and digital models, as well as through the use of digital representation tools.

Products: Publication (multimedia presentation, paper map, multimedia object).

Age: Secondary School students

Requirements:

- knowledge of the historical period the analysed city monument dates back from

- knowledge of the survey technique

- knowledge of scale representation

Human resources: teachers of Italian, English, Art & Design, History, Math and with the aid of external experts (engineers and architects)

Evaluation: not only the product, but also the production process will be evaluated. Lab-work method.

STEP 1 – **ENGAGE**

Introduction and project presentation. Scheduled time: 1 hour.

Methodology and tools: brainstorming, guided conversation. Use of PADLET. The forum will start from a picture (showing either a single building in evident disrepair, or a street, a city area in need of a restoration plan...) and from a question like: "How aware are we of the importance of our architectural and artistic heritage as a fundamental social, cultural and economic resource?"

STEP 2 - **EXPLORE**

Project planning – Tasks and roles setting. Scheduled time: 2 hours.

Examination of documents, plans and pictures of the buildings to restore, which will be uploaded by the teacher in the Gallery section.

In this step, tasks may be assigned to students through Workshop. For example: data collection (historical period of the building, style, geographical location, measurements and quartering, functions etc.) and subsequent pair-work review of the assigned activity. The assignments will be carried out and then handed in.

STEP 3 - **EXPLAIN**

Definition of the basic idea of the project work. Scheduled time: 6 hours

- Selection and collection of the materials provided (historical notes, surveys, simulations, drawings, real and digital models);
- Study of the main techniques of physical and virtual representation that are functional to the creation of architectural projects;
- From planimetry to AUTOCAD and the formulation of new intended use;
- Study of spatial perspective, man-environment relations and the concepts of: territory, locationing, scale, spatial diffusion, mobility, relation, place awareness... and instruments: geographical maps, geographical IT systems, images, statistical data, subjective sources.

Mini-Mooc formula (with a theoretical section for the teachers and EVOTING quiz for the ongoing evaluation).

STEP 4 – **EXTEND**

Project examination, definition, team formation, task assignment, (if possible excursions and guided tours) concerning the activity recording. Scheduled time: 12 hours.

1st assignment:

Create a multimedia product about the chosen historical building to be restored, for which you imagined a new intended use.

2nd assignment

Relate one page of your project to the glossary

- Objectives, steps to follow, evaluation and criteria.

OBJECTIVES to evaluate
Observe: the student is able to identify data and to make relevant observations;
Participate: the student is able to share actions that are aimed at a common interest and to involve the other members of the team.
Be flexible: the student can fine-tune his point of view, adapting himself to new contexts and/or issues related to the evolution of the situations, without losing consistency with the initial plan.
Take on responsibilities: the student is able to take on responsibilities within the different levels of reality in which he is involved, contributing to the solution of personal as well as collective problems.
Make decisions: the student is able to make sensible decisions after carefully considering the different aspects of the problem to examine. He/She is also aware of the responsibilities connected to the decisions made.
Responsible fruition of the artistic heritage, also aimed at its safeguard and promotion
Production of multimedia projects
Project managing
Recognize the essential features of the socio-economic system for the active job-seeking activity in the local and global context

Methods: group work and lab work, guided discussion (**Q**uestion and **A**nswer Forum)

Tools: paper and multimedia documents (Folder – Gallery), multimedia technology and software.

Partial products: creation of maps and other material illustrating the partial outcome (emerging of new ideas).

Creation of the final multimedia product.

N.B. The starting date, as well as the end date, will be set via Calendar. A message will be sent 3 days before the beginning of the activity.

STEP 5 – **EVALUATE**

Presentation and report. Scheduled time: 3 hours

Assignment: create a report about the development and production of your work concerning the recovery of the historical building for which you imagined a new intended use.

N.B. The starting date, as well as the end date, will be set via Calendar. A message will be sent 3 days before the beginning of the activity.

Completed product: multimedia product (video) containing all the collected and created material.

PRODUCT EVALUATION
Completeness, relevance, organization. The product contains all the parts and information useful and relevant to the development of the task, which are clearly connected.
Accuracy. The product has been carefully executed and accurately completed.
PROCESS EVALUATION
Correct timing
Precision and skilful use of tools and technology
Searching for and managing information
EVALUATION: REPORTING, OVERCOMING CRITICAL ISSUES, LANGUAGE
Communicating and sharing experiences and knowledge
Use of technical-professional specialised language

Soap Operas

by **Manisa Sosyal Bilimler Lisesi**

Relevant Disciplines	English, Science, Technology, Engineering, Art, Maths
Title	Soap Operas
Age of students	15+
Teaching time	90'
Online teaching material	https://padlet.com
Resources used	https://www.classicfm.com/discover-music/periods-genres/opera/why-tv-soap-operas-so-called/ https://www.youtube.com/watch?v=qgUf9hlTnnU&feature=emb_title https://www.gettyimages.co.uk/detail/news-photo/susan-bickley-as-marcellina-richard-wiegold-as-dr-bartolo-news-photo/539578516

Integration into the curriculum

The English language curriculum includes reading texts. Soap Operas can be included in the English lessons as a reading task. It will give the students the opportunity to improve their reading skills.

The follow up activities fit also into the curriculums of Technology, Maths, Chemistry and Engineering as the content covers online applications (padlet, presentations...etc), some calculations, some workshops to learn about chemical substances and make soaps. The relevant activities also fit into the Art curriculum as the students will be asked to make soaps in different styles (similar to the soaps exhibited in the Barber's Museum by Manisa Social Sciences High School).

Aim of the scenario

Students will be able to comprehend the origin of the soap operas (Why are they called soap operas?). Students will be able to explain that soap operas take their origin from operas and soap manufacturers as radio dramas were sponsored by soap manufacturers. They will also link soap operas within operas – using their themes and topics - and watching soap manufacturers' ads they will be able to make their own soaps – using Chemistry, Maths, Engineering , Technology and Art. Students will develop their skills in those school subjects .

Learning Teaching Styles

Collaborative learning

Peer learning

Student centred learning

Open-Source Learning

Skills Promoted

During the lesson students will develop critical thinking, communication, collaboration, and creativity. They will use Information, Media and Technology skills and Language skills

Activities

Title of activity	Procedure	Time
Introduction	Students watch some parts from soap operas and need to guess what 's next https://www.youtube.com/watch?v=qgUf9hlTnnU&feature=emb_title	10’
Main part	Students are divided into 5 groups Each group discusses the soap operas – the general characteristics of the genre; the reasons why they are called soap operas - and write short notes on Padlet. https://padlet.com Students can analyse the pieces from soap operas online. Each group presents their ideas to the rest of the class within posters, mind maps (relevant applications) .	35’
	Students remain in their groups. Each group makes a survey to check if they are right with their ideas. https://www.classicfm.com/discover-music/periods-genres/opera/why-tv-soap-operas-so-called/ https://www.gettyimages.co.uk/detail/news-photo/susan-bickley-as-marcellina-richard-wiegold-as-dr-bartolo-news-photo/539578516 Students have workshops. Their task is to study the chemical substances to make soap. Making necessary calculations (using the right quantities of each) they make soap in different shapes. After finishing the soaps they will be put into the Barber's Museum next to the others.	35’

Assessment Scale (to be filled by teachers and students)

Rate the scenario on a scale of 1-5. 5 means the most.

Level of difficulty: 1 2 3 4 5

Depth of knowledge provided : 1 2 3 4 5

Creativity of the title : 1 2 3 4 5

Availability of the online materials and resources used: 1 2 3 4 5

The relevancy of the scenario with the curriculum : 1 2 3 4 5

Efficiency of the learning teaching styles : 1 2 3 4 5

Practicality of the activities : 1 2 3 4 5

Answer the questions.

I did not like when _____

I liked it the best when _____

My suggestion (s) to improve the scenario is/ are _____

Tick the checklist.

- The class atmosphere was positive.
- The activities were well planned and their instructions were easy to follow.
- The participants (teacher and students) were actively involved in all phases of the scenario.
- The participants used intensive technology and language.
- The workshop was well- organised.
- The scenario was used within different disciplines.
- The aims of the lesson were fulfilled: it could promote various skills.
- The materials, resources and activities provided students' understanding of the topic.
- The museums' materials have been used.

Measure for Measure

By Palermoscienza- Italy

This is a training activity with teachers that highlights how STEAM can be used outside classroom.

Summary

Measure for measure, is a real-life activity and its focus is the knowledge of relation between us and buildings around us, and how it is possible to understand their size using our body at first guess. For this activity it is chosen an important architectural structure, Palermo Cathedral, like a laboratory where it is possible to test different points of view, to measure its size using different measure unit to calculate, for example, its volume and to include it in urban space in which it is.

This activity will help students to understand how to apply curriculum learning in real life.

This activity is developed on two parallel tracks introducing two different method virtual and real-life to measure a building. We chose an important architectural structure, Palermo Cathedral, as a laboratory where it is possible to test different points of view, to measure its size using different measure unit to calculate, for example, its volume and to include it in urban space in which it is.

One is real, **Man is a measure (mètron) of all things,** is a real-life activity and its focus of this activity is the knowledge of relation between us and buildings around us, and how we can understand their size using our body at first guess.

The other is virtual, **38°N 15°E… where are we?** and its focus is the knowledge of informatic tools, like Google Earth Pro to measure size and height of buildings.

We aspect students develop some skill like:

Citizenship skills

critical and innovative thinking, collaboration, communication, technology literacy, respect for diversity and multiculturalism, learning autonomy, initiative and entrepreneurship, openness to lifelong learning, respect and development of professional values and ethics, active and effective insertion in the community/school community and/or professional school environment, nurturing an educational environment centered on values and democratic relationships

Interdisciplinary skills

Methodological

- being able to make interconnections between art and science

- Being able to observe surrounding environment
- Become increasingly curious about the world around them and feel empowered to change it for the better

Linguistic and communicative area

- Read and interpret texts and instructions
- Being able to explain process and development of own project

Scientific, technological,* engineering*, art and mathematic area

Learning how to use school knowledge in reality and in informal context
Identifying the data of the phenomena observed for the construction of a model
Appling STEAM learning to solve real-world problems through hands-on learning activities and creative design.

Using of materials and tools to experiment, explore and collect data

Man is a measure (mètron) of all things

Engage: We want to measure something, and we don't have a meter (30 minutes).

Objective for students: to understand that their steps are a possible solution of problem.

What happens: Involvement of students in discussion to understand how to resolve the problem. The role of teacher is that of "facilitator" (help with some tips without to give instructions to follow, like "can we use ourselves? Can we use something that has a relationship with length? What do you think about this?")

Methodology: Students work in group

Where: Activity outdoor

Explore: **the measure of Cathedral sides** (30 minutes)

Objective for students: to measure Cathedral sides to calculate perimeter end its area.

What happens: After chosen the unit of measurement, one of students set a walking rhythm and begin to walk along the sides of the building counting (after the student set rhythm, everyone continues on its own). At the end every student will have record steps numbers of each side.

Methodology: individual job

Where: Activity outdoor

Explain: Units of measure and spreadsheet (120 minutes)

Objective: to understand the importance of having a shared and unique unit of measure and why the rhythm of steps is the right choose

What happens:

- Step 1**:** involvement of students in discussion to understand how to resolve the problem to have an unique unit of measure and why it is important. Sharing what they did before.
- Step 2**:** involvement of students in discussion on why they used the rhythm of their steps to measure building sides and if they know other rhythms
- Step 3: to introduce the concept of homogeneous quantities
- Step 4: to introduce spreadsheet and their use
- Step 5: to introduce statistical quantities (mean, median, mode)

Methodology: Students work in group and individually

Where: Activity at school and outdoor

Elaborate: measure of perimeter Cathedral and correct description of activities

Objective: learning to use spreadsheet and to describe in right way activities

What happens:

- Step 1**:** to convert steps in meter
- Step 2**:** to share the same on-line spreadsheet **and to insert** data in it and to describe activity
- Step 3: calculate media and compare with real measure of sides of Cathedral

Methodology: Students work in group and individually

Where: Activity at school and at home

Extend: We want to measure height of a building and we could not use a meter.

Objective: to measure the height of one of bell towers of Cathedral

What happens:

- Step 1**:** Involvement of students in the choose of right tool
- Step 2**:** building of a quadrant
- Step 3: measuring of bell tower

Methodology: Students work individually

Where: Activity at school and outdoor

38°N 15°E… where are we?

Engage: **We want to measure something using Google Earth** (30 minutes)

Objective for students: helping students to improve their use of technology in informed and aware way.

What happens:

- Step 1: download Google Earth Pro app.
- Step 2: involvement students to test it and try to make some measurements of distances and heights of buildings using the ruler function (the app is very intuitive).

Methodology: Students work in group or individually

Where: Activity at school

Explore: **space and measure** (60 minutes)

Objective for students: to locate the building choose (in this case it is Palermo Cathedral) and measure its sides.

What happens:

- Step 1: Students use Google street view to locate the building, take a photo of the location so they have the contest in which the building is. They should take two photos, 3D photo and 2D one to look for the difference between them.
- Step 2: writing differences

Methodology: Students work in group

Where: Activity at school

Explain: how Google Earth works (60 min)

Objective: to understand difference between 2D and 3D photos and what it is possible measuring with Google Earth

What happens:

- Step 1**:** involvement of students in discussion what they have learned using Google Earth
- Step 2: comparison between 2D and 3D photo and explanation of difference between them. Teachers introduce first information about 2D and 3D photo, showing that the difference between them is their base unit (pixels for 2D and Polygons for 3D).

Methodology: Students work in group and individually

Where: Activity at school

Elaborate: correct description of activities (60 min)

Objective: learning to describe correctly activities

What happens:

- Step 1**:** creating a multimedia presentation
- Step 2**:** to share with classmate

Methodology: Students work in group

Where: Activity at school

Extend: We want to measure height of a building with Google Earth tool.

Objective: to measure the height of one of bell towers of Cathedral using App tool and a ruler

What happens:

- Step 1**:** to challenge students to measure elements of Cathedral that are at different heights, using Google earth tool and after a ruler on screen
- Step 2: involvement them in discussion in speculating why they are obtained different results
- Step 3: explain potentiality and limits of App.

Methodology: Students work individually

Where: Activity at school

Objectives

Interdisciplinary Objectives

- To develop skills which can be used in various contexts
- To get stronger relationships skills, self-esteem, responsibility and respect of tasks and deadlines
- To get stronger or develop ability to look for different solutions for a same problem
- To improve abilities to use different methods, languages and informatic instruments in reality
- To develop the use of technology in informed and aware way
- To get stronger skill to explain process and development of own project

STEAM Objectives

- To develop skills to recognize interconnections between science, technology, the arts, and maths
- To get confidence to express innovative and creative ideas

- To feel comfortable doing hands-on learning
- To get stronger work collaboratively with others
- To get stronger to use digital technologies

Target group: students of secondary school

Create a garden in your high school

by Louis Jouvet Taverny – France

Topic : Plan of a French formal garden

Subjects: maths, art, technology'

Age : 15+

Aims:

1. Discover the different types of gardens (French formal garden or « jardin à la française », English landscape garden or « jardin à l'anglaise ») and their characteristics.
2. Apprehend the symmetry and geometrical figures of French formal garden.
3. Realize the plan of a garden in the school (calculation of surface, realisation of a plan to scale, artistic proposal of organisation of the garden).

The activity focuses on the **STEAM following subjects**:

- **Art:** garden design, artistic proposal of a plan
- **Math**: approach to symmetries (axial and central), geometric shapes, perspective and harmony + area calculation of irregularly shaped polynomials
- **Technology**: use of satellite images (via Maps) to analyse a garden, carry out measurements and area calculations.

ICT are used to :

- Display satellite data in 3D (Versailles gardens)
- Carry out distance measurements
- Carry out surface calculations

The Primates

by Elpis-nonformal, Sweden

Target group: students 14+

Subjects: Science, Art and Technology

Purpose:

- discover the diversity of life
- discover the cultural heritage
- discover the cross-disciplinary education

Biology and IT: The order of primates

Aim's of the lesson:

- understand the biological inheritance
- understand the primates' social development
- understand the life environment of different types of primates

Activities: Students visit a Zoo.

Work group:

- the students observe and notice the environment, food, behaviour of the primates
- the students talk with zoo workers about the primates, make pictures and video
- students meet a scientist specialised in the life of primates and find more about them

Learning's product: a scientific report and a digital mini book with group's finding, pictures, and video.

Art: Social norms

Purpose:

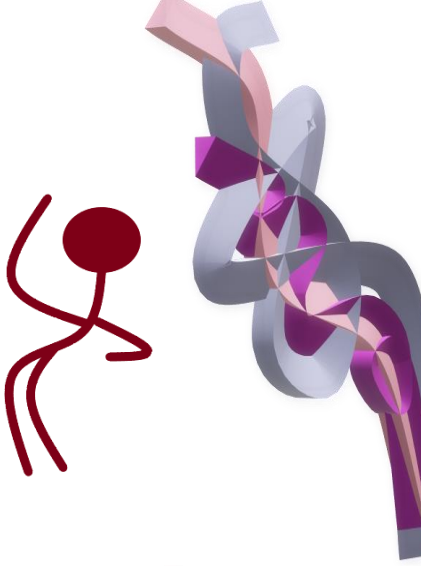
- to understand the power and the purpose of social norms
- to learn about Forum Theatre

Activity: workshop:

- discuss norms, social norms, rules, and laws with examples.
- Starting from the anecdote: five monkey and banana students create a Forum theatre

Resource: http://www.columbia.edu/~rim2114/publications/2015-McDonald-Crandall.pdf

Learning Product: Forum Theatre-social norms



The Dans

By Elpis-Sweden

Topic: Nonverbal communication through dans

Age :15+

Subjects: Art, IT

General Purpose:

- To understand the importance of cultural heritage
- To develop a cross disciplinarity understanding
- Learning about nonverbal communication, and how it works in different contexts

Activity 1 : non formal education

Time 50min

Aim's purpose: discover the importance of nonverbal communication

Workshop: nonverbal communication, discussions, and debates

- what it is
- how it works
- who can use it
- when it is used
- why it is used

Assessment: students' appreciation on menti.com

Activity 2: nonverbal communication in dans in different times and cultures

Activity's aim: learn about the narrative content of a painting: main message, subsidiary message, symbolism and analogies or references.

Time: 80 min

Work group: Students visit an art museum and study paintings the express dance and human movement

Students have questions about date of painting, author, main message, subsidiary message, symbols and a short interpretation from different perspective as historic (that time versus now time), geographical , cultural

Activity 3: ITC

Activity: students create their own animation (programming) or film (media) with topic **Dans as a nonverbal communication**

Assessment : peer assessment

Chapter III

Mini-MOOCs – Learning Scenarios

by ÖstraGymnasiet-Sweden, Lycée Louis Jouvet– France, Manisa Sosyal Bilimler Lisesi-Turkey, Liceo Cannizzaro-Italy, Elpis Association, Plermoscientza

MINI MOOC Science: Global warming and carbon dioxide effects

Manisa Sosyal Bilimler Lisesi-Turkey and Östra Gymnasiet-Sweden

Introduction: Global warming and carbon dioxide effects

Objectives

To understand climate change and carbon dioxide effects. Assignment suitable for high school students. Students will work in groups, 4-5 students in each.

Predicted time

- 10 minutes for the engage
- 2 hours for the explore and explain part
- 30-45 minutes for the extend part

Engage

To engage the students a photo of an installation in Copenhagen, at City Hall Square, in 2014 called Ice Watch will be presented. Twelve large blocks of ice that had calved from the Greenlandic ice sheet were harvested from a fjord outside Nuuk and brought to Copenhagen and presented in a clock formation. https://olafureliasson.net/archive/artwork/WEK109190/ice-watch.

Show movie about the installation https://www.youtube.com/watch?v=QpftaPHvrBc (2.40 min).

Let the students reflect with help of the questions. Discussion in smaller groups (4-5 students in each group). 5 minutes

- What is the purpose of the installation?

- What is causing the glaciers to melt?

Explore

- Show a movie as an introduction (16 minutes). The video focuses on the climate change issue and on issues connected to our lifestyle. It has three parts, including a description of the situation and analysis of the climate change issue today. The video closes on a hopeful note about what we can do to resolve the climate change issue in the future. The film is produced by Bifrost and the Nobel Museum in Stockholm. You will find this video: https://bifrostonline.org/a-sustainable-future/. The movie is optional depending on the time and the students previous knowledge.
- The students explore in groups (4-5 students in each) by watching related videos and reading articles about the topic to try to find out to later explain. Questions to be answered. 1 hour.
  - Is climate change the same as global warming?
  - How does carbon dioxide increase Earth's temperature?
  - How can we stop the carbon dioxide effects?

- Related videos, articles and reports about the topic.
  - Causes and effects of climate effects of climate change. Film and text.
    - https://www.nationalgeographic.com/environment/article/global-warming-solutions
  - Rising concentrations of carbon dioxide are warming the atmosphere.
    - https://earthobservatory.nasa.gov/features/CarbonCycle/page5.php
  - About the IPCC Climate change report.
    - https://www.nrdc.org/stories/ipcc-climate-change-report-why-it-matters-everyone-planet#sec-whatis
  - Greenhouse Effect
    - https://www.nrdc.org/stories/greenhouse-effect-101#consequences

- Press release: The Nobel Prize in Physics 2021.
  - https://www.nobelprize.org/prizes/physics/2021/press-release/

Explain

- The explain part the students present their results of the exploration part in groups (4-5 students in each) using for example power-points or a short film. 45 minutes for production. Questions to be answered (same as before in the Explore part):

1. Is climate change the same as global warming?
2. How does carbon dioxide increase Earth's temperature?
3. How can we stop the carbon dioxide effects?

Extend

The students will do an to study the effects of carbon dioxide on temperature. The results should be reported in the form of a laboratory report and should also explain the chemical reactions of the experiment. The experiment can also be used in the Engage part.

If you have more time: study sculptures affected by acid rain by doing an experiment with for example a limestone or marble and an appropriate acid to observe the effects easely. Sculptures made by metals and marble are affected by acid rain. The Statue of liberty is an example of this.

Link:https://www.acs.org/content/acs/en/pressroom/reactions/videos/2017/the-statue-of-libertys-true-colors.html

Evaluate

- The students will quiz for example in google forms about the subject.

Annex:

Instructions for experiment

Objectives

To understand climate change and conduct a scientific study. STEAM subject/subjects that it focuses on: biology, physics, mathematics, science. High School.

Materials

- 2 glass jars with caps
- 1 infrared lamp
- 2 globes
- 2 thermometers
- 4 effervescent tablets (eg C-vitamin)
- Room temperature water (approx. 6 dl per test round). Measuring cup
- Ruler
- Tape
- Timer
- Table for measured values (eg in Excell)

Before the experiment

1. What impact does carbon dioxide have on the climate? Discuss this before the experiment begins.
2. The teacher puts an effervescent tablet in a glass of water: reflect about the effect of the tablets. What are the bubbles?
3. Formulate a hypothesis

Procedure

1. Measure the same distance between the glass jars and the lamp (approx. 4 - 5 dm) and the distance between the jars (approx. 1 - 5 cm).
2. If necessary, fix the objects and the lamp. Can be done with tape.
2. It is important that the cans are exposed to exactly the same amount of light.
3. Fill the jars with the same amount of water in the two jars (approx. 2 - 3 dl).
4. Put 4 effervescent tablets in one jar. Let these dissolve. Air is lighter than carbon dioxide, but the cap should be put on anyway so that as much carbon dioxide as possible stays in the jar. Remember that the hole in the cap is not blocked while the tablets dissolve, so the air can escape.

5. Insert the thermometers into the holes on the caps, their ends in each globe and place the caps on the jars.
6. Wait until the temperatures in the jars have stabilized, it may take a few minutes.
7. Now the experiment can begin:
8. Note the starting temperatures
9. Turn on the "sun", i.e. turn on the light
10. Read the temperature every 30 seconds for 10 minutes
11. Someone keeps track of the timer
12. Someone reads the thermometers every 30 seconds
13. Someone enters the result in the tables on the computer to get the curves in the diagram: https://docs.google.com/spreadsheets/d/1op1BjaR84LlKLQeLdP1c-f_-Or-TznfGlvhvWa42QkU/edit?usp=sharing

Presentation

The results should be reported in the form of a laboratory report. Attach diagram.

Theme: The Game

By Elpis

Gamification

Subjects: mathematics, history, technology, art

Difficulty: medium to high

Time

Engage: game

Time: 40 min.

Organization: group of 3-4 students.

Each person in the group has 3 cards (black, red, yellow). The groups must put a card on the table to earn points. The idea with the group game is to promote collaboration and discussion in group to obtain the best result.

- **Red** is 4 point
- **Black** is -4 points
    - **In combination with red decrease the value of red by 2 points**
    - **In combination with yellow decrease the value of yellow 2 points**
- **Yellow** is 0 points, but:
    - **in combination with red, the value of red will decrease by 2 points**
    - **in combination with black, the value of black will increase by 2 points**

Ex: if first group put down red and the other yellow – the first group has 4-2 =2 points and the second group 0 points

The gain of points is like in the table:

	red	**yellow**	**black**
Red	4,4	2, 0	4 -4
Yellow	0,2	0,0	0,-2
Black	-4,2	-2,0	-4,-4

Explain (recommended time 60 min) :

The game theory and the mathematics behind this lecture

Game theory is the mathematical study of situations of conflict of interest. As such it is applicable not only to parlour games (hence its name), but also to military and economic situations, and, to a lesser extent, to situations in other social sciences. Game theory studies three general phases in the process of interaction: the choice of strategies, the formation of coalitions, and bargaining within coalitions.

As concerns ethics, game theory is useful as an arbitration technique for bargaining problems and, in distributive justice, for allocating the gains from cooperation. Conversely, it can be used to design rules (e.g., assignment of weights for voting in a parliament whose members represent constituencies of different sizes) so that normal play of a game will lead to a fair outcome.

Organization: groups of 4.

Activity 1 (30min**) : Review the mathematical concepts:**

The game has as ground some mathematical concepts from Probabilities such as:

- probability
- event
- independent event
- dependent event
- frequency

Find the definition of each of them.

Activity 2: (60 min),

Subjects: mathematics ,technology

- It is possible to find the strategy to be a win-win result.
- What mathematical reasoning do you use? .
- Is it possible to calculate the points in a win-win strategi? If yes analyse the win-win situation.
- How many possibilities are to combine the cards of the two groups?
- How many possibilities could be if there are 4 cards for each group?
- But if there are n cards in each group?

Activity 3: Feedback about Explain part -using

Explore (recommended time 30 min): Explore the ancient games-bellow there are described two games from ancient Greek

Resource:

https://www.getty.edu/education/college/ancient_rome_at_home/pdf/tali_tesserae_game.pdf

The games in humans' history-exploring the museums artefacts students notice the evolution of games in time.

According to archaeologists, games existed before the written history of the world being the oldest forms of social interaction between people. Through games, people use and develop their imagination, physical skills, or intellectual capacity. There are some common features of games as a set of rules, the elements of chance and fictions, established goals, competition, uncertain results, entertainment. Games reflect various images of society at a certain historical point. During the time, the games are related with social and cultural events, used as teaching tools or sign of a social status. Some games have religious significance, becoming religious rituals such as Senet or Balls Games developed by Mesoamerican indigenous, other games teach spiritual, ethical and social norms like Mansion of Happiness or Gyan Chauper , other are deigned to develop strategical thinking Shatranj, Go and later Chess etc More about games in time, here. If you want to know about the oldest game in history , here.

Activity 1 (30 min)

Experiment: Dice- The students explore the some ancient dice like Romans', Egyptians dice. They choose one type of dice and start the experiment

Method:

Throw 2 dice together 108 times.

Add the score each time.

Record the score in a table created in Excel. Start to create the at cell B2.

Draw a bar graph to illustrate the results.

Organization :Groups of 4-5 students

Activity 2: "Explore" the Game of the Future-15min

Use your imagination and knowledge about our society and tendency of evolution of our society and try to look in the future. 👁

Groups of 4-5 students discuss this topics:

- the game of the future
- what features of the future society mirror the games
- what skills are developed through these types of games
- do play we games in real life? can you find example? Identify the purpose, the rules, the strategies.
- **Task: create a video or a written document with groups reflection and results after discussion for activity 1 and 2.**

Extend (60 min)

This part is the non-formal part of the course where students are invited to leave their creativity free and to create their own game. The game should respect the game technique. The students create a context- a story, a plot, the rules of the game, the rules of interaction between participants, the objects of the game and use dice.

Organization: group of 4-6 students

Activity : Create the game

Design the context, the story and create your own game. For this there is a base that should be create: the name of the game, the story, the rules of the game, eventually -the characters, indicate the purpose of the game, the plot, challenges , the rules of interaction in the game, the target group.

Instrument: dice

Evaluation: (10 min).

PART 5 - EVALUATE (10 min.)

Students are provided with a self-evaluation questionnaire (attached below) to test themselves and the activity as well. The aim is to make the students able to express their general impression. Particularly, questions from 1 to 6 are related to what they learned; questions from 7 to 16 are related to the different skills developed; questions from 17 to 19 are related to the satisfaction and improvement suggested by the students.

The same aspects are checked by an evaluation grid based on the teacher observation (see atachemet in chapter 4).

Mathematics MINI MOOC: Statistics Lesson Scenario

The Lady with the Lamp

Östra Gymnasiet- Sweden

Theme: Statistics

Before the lesson: The students should have basic knowledge about Excel, google search, and English. Download for free the offline version of Gapminder, at gapminder.org

Material:

- Instructions for creating an excel file for animated bubbles presentation in Gapminder (annex3)
- Table to fill in the different types of statistical data collection. (annex4)
- Table with the victims during Crimean war and The Rose Diagram (annex1 and annex2)
- Links to the films
- Links to tutorials about Excel and Gapminder

Objectives:

- The purpose of the lesson is to understand the origin of statistics and the use of it in chronological order (both the original use and how it's used today, as a manipulation instrument.)
- The pupils will learn about the collecting of data and presentation of data in a chart or a diagram, that makes them more appealing for the extended public and make it have an impact that can generate a reaction, leading to bigger changes,progress...
- Students develop skills such as: ability to work in groups, the analytic ability, critical thinking towards misleading statistical material and its use nowadays in contrast to the good purpose of statistics use, improvement of digital skills and use of digital resources.

Timeframe: 3,5h-5h (depending on the activities chosen to perform and the level of prerequisite knowledge of the students).

Difficulty grade: Medium/High

Engage The students are divided in groups of 4-6 persons, for the entire activity (2').

Film of Hans Rosling about the development of civilization over the last 200 years (5')

Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC Four - YouTube

The students get the table with the Crimean war victims (annex1) and try to figure out what this is about (2'), and then the Rose Diagram (annex2) that explains the Table in a comprehensive manner (on paper or projected on the table, on their own computers, etc).

Group discussion about the importance of data presentation (3').

Explore Film about Florence Nightingale (4') *Florence Nightingale: Joy of Stats (3/6) - YouTube*

Group discussion about the use of statistics and the power of statistics (5').

Every group of students choose/decide a topic they want to collect a statistical material about and come up with a set of questions to inquire people in order to find out what they decided they want to know about. (max 3 questions). (15')

Explain Film about the types of collecting data and their applicability (8')

The students take notes. Those notes help them to collect their own statistic material (survey) and create a data presentation, also to answer to the worksheet that was dealt out (annex4)

Class discussion about the misleading questions when you want to interview people to collect data. (5')

The students look over their set of questions (from Explore moment) and eventually reformulate them after the knowledge/tips they got from the explaining film. (5')

The students carry out the survey and collect their data. (30')

The students present their data in a diagram of their choice, in Excel. (30')-Tutorials:
Excel Graph Tutorial | How To Make Graphs On Excel | Excel Tutorial For Beginners | Simplilearn - Bing video

How to Make a Bar Graph in Excel - Bing video

How To Make A Multiple Bar Graph In Excel - Bing video

Presentation of diagrams in class and feedback from colleagues and teachers. (10')

Elaborate

- Watch the video that contests the conclusions of Hans Rosling. (Roland Paulsen digs deeper in the interpretation of data correlated to the other influencing factors that can mislead) (12') *Better and better? A comment on Hans Rosling - YouTube*.
- Discuss in groups about the misleading statistics and its use in modern society. (5')
- Check Tutorial about Gapminder *Gapminder - step by step guide on Vimeo* (5'), a list of instructions about what an excel file should contain in order to run it through the Gapminder (annex3) and create an animated statistical presentation, offline. Gapminder.org/Resources/Tools/Bubble Chart. *How to use Gapminder Bubbles on Vimeo* (5')
- Create an animated statistic presentation in Gapminder offline, using your own set of data or a set of data that is extracted from a national statistical database, or just create presentations using the Gapminder database. (Gapminder.org/resources/Data/Download the data). (20'-100')

Evaluate:

Every group presents their film and gets feedback from colleagues and teachers. (15')

Reflection about the possibility of doing a valid statistic before and after the explanations and about the power of statistics in our society. (5-10')

Every teacher can create their own quiz test (formative), or ask for a report, a little film where the students are the actors that present and explain their statistical conclusions.

I used the worksheet, and the statistical data presentations for evaluation, also I create an evaluation form for my students to get feedback on my lesson, in order to improve it:

Please fill this form to give us some feedback about the workshop. Select with a cross the most appropriate answer, giving grades from 1 to 5, 1 is low accuracy and 5 is highly accurate.

Statement	1(no)	2(rarely)	3(balanced)	4(mostly)	5(yes)
About the topic Considering it was a math workshop, was the topic boring (1) or rather interesting (5)					
How was your working in groups? Did every participant have the chance to express him/herself?					

About the films/materials? Did you understand the films(5) or was it hard to understand the language (1)?					
About the instructions Were the verbal and written instructions clear?					
Do you feel happy with your **contribution t**o the workshop ?					
Are you satisfied with the new **knowledge** that accumulated through this workshop?					

Annex 1

TABLE 2

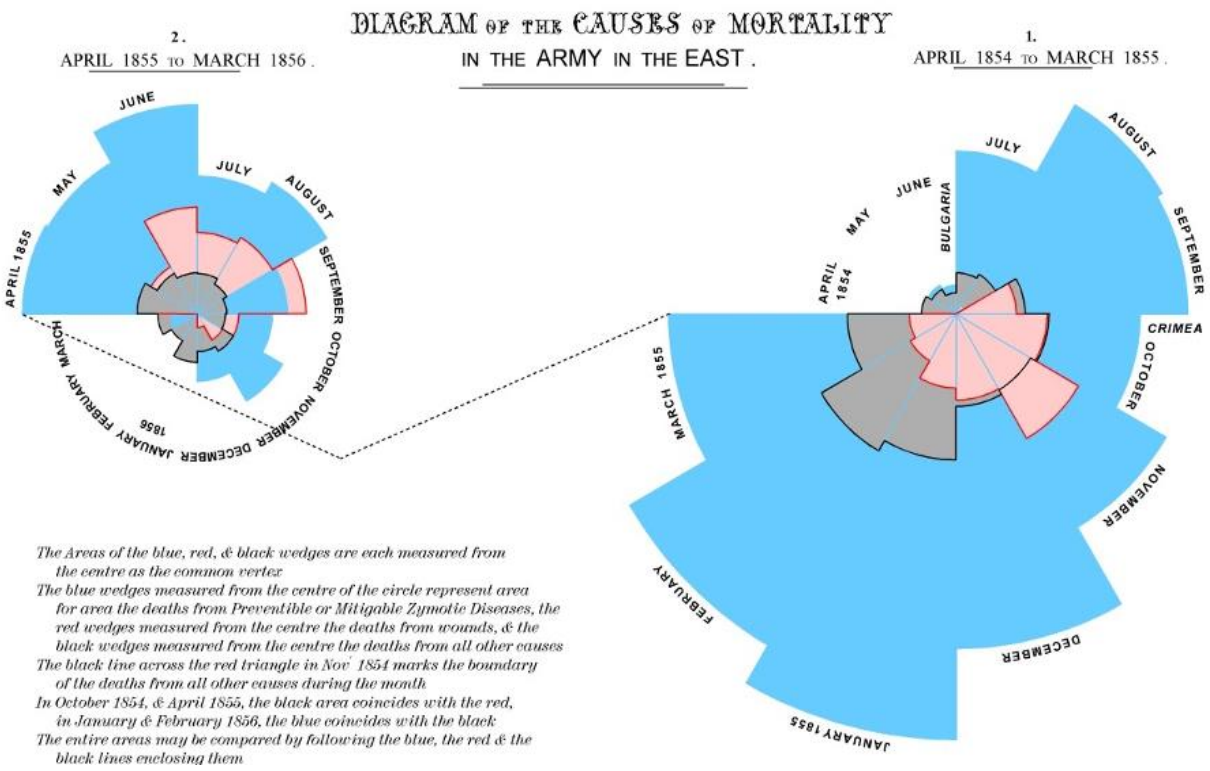
Table Showing the Estimated Average Monthly Strength of the Army; and the Deaths and Annual Rate of Mortality per 1,000 in each month, from April 1854, to March 1856 (inclusive), in the Hospitals of the Army in the East

Date	Estimated Average Monthly Strength of the Army	Deaths			Annual rate of Mortality per 1,000		
		Zymotic Diseases	Wounds and Injuries	All other Causes	Zymotic Diseases	Wounds and Injuries	All other Causes
1854							
April	8,571	1	–	5	1.4	–	7.0
May	23,333	12	–	9	6.2	–	4.6
June	28,333	11	–	6	4.7	–	2.5
July	28,722	359	–	23	150.0	–	9.6
August	30,246	828	1	30	328.5	.4	11.9
September	30,290	788	81	70	312.2	32.1	27.7
October	30,643	503	132	128	197.0	51.7	50.1
November	29,736	844	287	106	340.6	115.8	42.8
December	32,779	1,725	114	131	631.5	41.7	48.0
1855							
January	32,393	2,761	83	324	1022.8	30.7	120.0
February	30,919	2,120	42	361	822.8	16.3	140.1
March	30,107	1,205	32	172	480.3	12.8	68.6
April	32,252	477	48	57	177.5	17.9	21.2
May	35,473	508	49	37	171.8	16.6	12.5
June	38,863	802	209	31	247.6	64.5	9.6
July	42,647	382	134	33	107.5	37.7	9.3
August	44,614	483	164	25	129.9	44.1	6.7
September	47,751	189	276	20	47.5	69.4	5.0
October	46,852	128	53	18	32.8	13.6	4.6
November	37,853	178	33	32	56.4	10.5	10.1
December	43,217	91	18	28	25.3	5.0	7.8
1856							
January	44,212	42	2	48	11.4	.5	13.0
February	43,485	24	–	19	6.6	–	5.2
March	46,140	15	–	35	3.9	–	9.1

The Deaths under the heads of "Wounds and Injuries" comprise the following Causes: Luxatio, Sub-Luxatio, Vulnus Sclopitorum, Vulnus Incisum, Contusio, Fractura, Ambustio and Concussio-Cerebri.

Annex 2

http://www.Florence-Nightingale-Avenging-Angel.co.uk/Coxcomb.htm



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex
The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic Diseases, the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes
The black line across the red triangle in Nov' 1854 marks the boundary of the deaths from all other causes during the month
In October 1854, & April 1855, the black area coincides with the red, in January & February 1856, the blue coincides with the black
The entire areas may be compared by following the blue, the red & the black lines enclosing them

Annex 3- Instructions for the Excel file to be able to run it thru Gapminder.

1. *The file has 5 Columns. The statistic should contain 3 sets of correlated data for each group you compare.*
2. *First column contains the names of the groups you compare. Each group name repeats on the amount of lines that your database should have. For example if you want to show a monthly statistic for a one-year period, then you'll have 12 lines. The group names can be shown in alphabetical order, so there will be 12 lines with group1, then 12 lines with group2, 12 lines with group3 and so on.*
3. *The second column contains the time in the time format of your statistic. If it's years, then 1975, if weeks then 2012w13 (means year 2012 week 13). You write in the first cell the first date, in the second line the next date and then select those 2 cells and scroll down to fill in automatically the rest of the time cells. Do that for each group.*
4. *The third column contains the appropriate data, one of the three sets of data of your choice, the fourth column contains the second set, and the fifth column contains the third set of data. Of course everything in the corresponding time lines, and the numbers you got from your statistic database.*
5. *The top line of the file should contain the names of the column, ex A: Country, B: Dates, C: Corona cases, D: Vaccinated people, E: Mortality cases. The purpose of these names it's that you should choose later in your animation what shall be on the horizontal line, what on the vertical line and what should be the size of a ball.*
6. *When the excel file it's finished save it on your computer under a name you remember. Open the Gapminder page, and work under the offline version. Insert your own data, choose an excel file and insert it.*
7. *Set the time format and the time frame, choose which data set would be shown on horizontal, vertical and ball size. Play a little with that and evaluate which presentation would look the best. See the tutorials for help.*

Annex 4

Minimooc-The Lady with the lamp

Worksheet

Group: …….

Answer the questions below:

1. *Write a characteristic about every type of data collecting that was mentioned in the film.*
2. *Which one of the collecting data types was used for Covid-19 statistics?*
3. *What type is appropriate for those statistics that political parties' uses prior to elections?*
4. *What is a placebo question?*
5. *Who would benefit most from misleading statistics?*
6. *What tools can be used to mislead in statistics?*

Engineering MINI MOOC Lesson Scenario

Flying to the MOON

Lycée Louis Jouvet– France

Introduction : Fly me to the moon

This sequence highlights that behind the technical feat of going to the Moon, there is a lot of engineering and technology. It also develops several skills.

Knowledge :

- Apollo 11 mission

Skills

- Work together
- Make decisions as a group
- Make an explanatory diagram (or a stop motion video)
- Make an explanatory video
- Self-evaluation and peer evaluation

Engage: accident on the Moon (1h)

Objectives

During this phase, the objective is twofold:

- To become familiar with the theme of space travel from the Earth to the Moon
- To work on group decision making

Instructions for the task

Imagine an accident on the moon: the aim is to find the essential equipment to reach the mother rocket, by classifying 15 objects in order of importance (see Appendix 1: instruction sheet).

The exercise is done individually and then in groups. The different rankings are then compared.

Detailed sequence

Individual ranking: 10 minutes

Each participant, after having received the instruction sheet (Appendix 1), fills in a copy of the decision sheet (Appendix 2). During this phase, no exchange between the participants is allowed.

Collective ranking (30 minutes)

Participants meet to determine a collective ranking of the same elements, in subgroups of 5 to 6 people. Then they fill the column “Collective ranking”.

Explanation and scored results (20 minutes)

The facilitator gives the participants the criteria on which the N.A.S.A. experts based their ranking. Participants can then calculate the individual score and the collective score by counting the difference between the chosen rank and the NASA rank for each item. Then the total sum of the differences is made. The closer the score is to 0, the better the result.

During the debrief, two aspects can be discussed :

- Group Functioning
- Comparison of individual and group rankings

Example of questions for analyse of group Functioning

Did the subgroup and facilitator have a plan? (e.g., vital, useful, useless, etc.).

Did each participant have the opportunity to express him or herself?

Did each participant listen to the suggestions of others or did they try to impose their own list?

Was there leadership, conflict, or grouping within the subgroups?

How long did the various decisions take?

Did any of the subgroups adopt decision-making methods such as majority rule, give-and-take, or chance? Were they creative?

Comparison of individual and group rankings

In the majority of the cases, the subgroup performed better than the individuals in it. This is due to the elimination of errors through the exchange of knowledge between participants and to the group's creativity in finding original ways to use certain elements.

Explore: How did we get to the Moon? (1h)

Objectives

Understand that the success of the Apollo 11 mission to the Moon, and the safety of the astronauts, was based on engineering, ingenuity, and technology.

Instructions for the task

Materials available used for this activity come from the science museum of London.

Link: https://www.sciencemuseum.org.uk/objects-and-stories/technology-it-took-get-moon

Make a diagram showing the three different ways to go to the Moon imagined by the engineers. For each one, indicate what it implied at the engineering/technological level.

Depending on the level of the students and the time allotted, you can propose to make a diagram:

- animated on a presentation software
- on a large sheet of paper

If you have time: make a stop motion video instead of a diagram.

Explain: The technology it took to get to the moon (1h)

Objectives

Understand that the success of the Apollo 11 mission to the Moon, and the safety of the astronauts, was based on engineering, ingenuity and technology.

Instructions for the task

Materials available used for this activity come from the science museum of London and the following article: The Amazing Handmade Tech That Powered Apollo 11's Moon Voyage

The classroom must be divided in 5 groups, each being assigned one of the following topics :

- The spacesuits
- The lunar rover
- The parachutes
- The heat shield
- The computers

Each group has then 50 minutes to propose a short video in the format of a reportage presenting the technological and engineering advances implemented during the Apollo 11 mission.

Then all the reportages produced are viewed together.

An evaluation grid is provided to allow peer-to-peer evaluation during the presentation of each group

Extend (1h – Xh)

Participate to the moon camp challenge: https://mooncampchallenge.org

Objectives

Explore the extreme environment of space and understand how astronauts could live on the Moon.

Instructions for the task

Depending on the time allocated to this phase, it is possible to just wonder about the extreme conditions of the space environment and the constraints that this imposes on lunar colonists.

With more time, it is possible to get involved and participate in the challenge which consists in designating a lunar base in 3D.

Evaluate

Several parts are subject to student analysis, reflection, and self-evaluation:

- engage phase: functioning of a group to make collective decisions
- explore phase: cross-assessment of the diagrams proposed by peers
- explain phase: cross-assessment of the videos proposed by peers

ANNEX 1: instructions for the engage phase

INSTRUCTIONS

(To be given to each participant)

You are part of the crew of a spacecraft originally programmed to reach a mother rocket from the illuminated side of the moon. Due to mechanical problems, you had to land about 320 km from the scheduled rendezvous. During the landing, most of the on-board equipment was damaged, except for the 15 objects below. It is vital for your crew to get back to the mother rocket and you must choose the essential equipment for this long trip.

The exercise consists in classifying the 15 items in order of necessity. Put the number 1 in front of the one you think is most important, 2 in front of the next one, and so on until you reach 15 in front of the one you think is least useful (Appendix 2 - decision sheet).

A matchbox

Concentrated food

50 meters of nylon rope

A silk parachute

A solar powered heater

2 x 45 caliber pistols

A case of powdered milk

2 tanks of 50 kg of oxygen each

A celestial map of the lunar constellations

A self-inflating lifeboat

A magnetic compass

25 liters of water

A medical kit and hypodermic syringes

Light signals

A solar powered transceiver (medium frequency)

ANNEX 2: decision sheet for the engage phase

DECISION SHEET

(To be given to each participant)

Objects	individual ranking	difference in points	collective ranking	difference in points	ranking of N.A.S.A.
A matchbox					
Concentrated food					
50 meters of nylon rope					
A silk parachute					
A solar powered heater					
2 x 45 caliber pistols					
A case of powdered milk					
2 tanks of 50 kg of oxygen each					

A celestial map of the lunar constellations					
A self-inflating lifeboat					
A magnetic compass					
25 liters of water					
A medical kit and hypodermic syringes					
Light signals					
A solar powered transceiver (medium frequency)					
	Total :		Total :		

ANNEX 3: results and explanations of N.A.S.A. for the engage phase

RESULTS AND EXPLANATIONS PROVIDED BY N.A.S.A

(To be given to each participant)

To establish their classification, the experts of the N.A.S.A. were based on the alternate use of 2 criteria:

- what ensures biological life
- what ensures the possibility of joining the mother rocket.

These 2 criteria mean, by their association, the survival.

Objects	Explanation	ranking of N.A.S.A.
A matchbox	The absence of oxygen does not allow them to ignite	15
Concentrated food	Efficient way to repair energy loss	4
50 meters of nylon rope	Useful for roping up, climbing rocks; possibly for hoisting the injured	6

A silk parachute	Can be used to protect from sunlight	8
A solar powered heater	Not useful: suits are heated	13
2 x 45 caliber pistols	Can be used to accelerate propulsion; in a pinch to end one's life	11
A case of powdered milk	Nutritional trap: more cumbersome than concentrated food	12
2 tanks of 50 kg of oxygen each	First essential element of survival	1
A celestial map of the lunar constellations	Essential for orientation	3
A self-inflating lifeboat	Can be used as a sled to pull objects; the gas (CO) used for this device can be used for propulsion	9
A magnetic compass	No use on the moon; the magnetic field is not valued there	14
25 liters of water	Indispensable to compensate a strong dehydration due to the very great heat on the illuminated side of the moon	2
A medical kit and hypodermic syringes	The injections of vitamins, serum etc...require a special opening (provided by the N.A.S.A.)	7
Light signals	Useful when the mother rocket is in sight	10
A solar powered transceiver (medium frequency)	Useful to try to communicate with the mother rocket but this device does not have much range	5
	Total :	

Art MINI MOOC - Lesson Scenario

"IMMO- Imago Mundi (The World Image)"

Liceo Scientifico S.Cannizzaro - Palermo, Italy

Are you sure you really know how the World is?

Which is the right map of the World, today?

The MiniMOOC aims to introduce the new **STEAM** methodology in the curricular activity throughout the interaction of different **subjects: History, Geography, Art, Math and Science** and it **is addressed to pupils 14-18 aged**.

It wants to make students aware of how their own idea of the world is reflected on the shape of the globe represented on a geographical map. Since ancient times, people have always needed to shape the world from their own point of view, that represents their culture in a large sense (knowledge, beliefs, etc). Geographical maps can be realized in different material support (stone, paper, wood) in relation to their antiquity. They can represent a piece of land as it is known or imagined during the time and they have different purposes, not only traveling as one might expect. Most of them astonishes us as they are masterpiece!

The activity also allows the students to develop several skills:

- **soft skills**: Integrated skills activity; to analyse and discuss; collaboration, presenting results, creativity, communication in English, time management, etc.
- **hard skills**: to recognize and explain people's different ideas through the History (knowledge and beliefs); how to draw a geographical map and the technique of scale representation.

The main goal is to organize - The World maps exhibition - in an imaginary Museum space; however, students are involved to reflect on the contemporary representation of our planet.

The MOOC is divided in 5 parts:

1. **Engage:** Who did them ?
2. **Explore:** Are you sure to really know how the World looks?
3. **Explore:** Why all the World maps are wrong ?
4. **Extend:** "The World Image": create your exhibition!
5. **Evaluate**

1. Engage: Who did them? (30m.)

In this section, the **objective** is twofold:

- To become familiar with the theme of geographical maps and to understand the particular point of view (knowledge and beliefs) by representing a space;
- To investigate and discuss in group.

Instructions for the task:

You can find 5 maps as resources. Discuss with your mate to investigate: who might built them; in which period: what was relevant to show in them; what purpose they were made for.

You will provide with a pdf sheet which suggest you some criteria to analyze the maps.

2. Explore: Are you sure you really know how the World looks? (30 m.)

In this section, pupils are provided with different contemporary representations of the World and they try to understand which one is the right one and why. They observe and discuss together (in pair) the reason of the different views. They are also stimulated to check and to compare the real size of the countries.

In this part of the activity, we suggest using:

- Five contemporary geographical maps freely downloadable from the web;
- The true size: a tool to compare different sizes of countries.

Instructions for the task :

You can find resources - different contemporary maps. Discuss with your groupmate what is different in them, which one could be the right one and why. Try to check and to compare the real size of some countries (www.thetruesize.com). Is the real size always respected in the World representations?

3. Explore: Why are all the World maps wrong? (1.30 h)

In this section, pupils are provided with a maths practical lesson to understand the use of a scale representation by the Cartesian axes, and they practise on that.

In this part of the activity we suggest to use the video "Why all the world maps are wrong" (https://www.youtube.com/watch?v=kIID5FDi2JQ); to increase students attention, the same video is provided using Nearpod with self-check questions (https://app.nearpod.com/presentation?pin=N34WS).

In the second part, students (in groups) are asked to discuss in an imaginary "World meeting" to choose and present the map that represents the World. They are invited to learn more on Gall-Peters and to face the problem on maps and racism (we suggest "Most world maps show north at the top. But it doesn't have to be that way" posted by the journalist Gary Nunn).

Instructions for the task:

How is it possible to transfer a spherical surface on a plane? Which kind of maps use different projection ways? To answer these questions and learn more on the use of a scale representation, you will attend the online maths lesson "Why all the world maps are wrong" (https://www.youtube.com/watch?v=kIID5FDi2JQ) .

In the second part of the activity, try to imagine to take part in a "World meeting" to discuss and choose the more useful map that represents the World. Work in a group and present your opinion in a public speech. The better solution will be the one more voted.

4. Extend : "The World Image": create your exhibition! *(2 h)

In this section, the aim is to create a Museum with 4 exposition areas (virtual or real) based on criteria (discussed by students in teams) to present the maps. This activity develops higher-order thinking skills.

Students (in groups) are provided with 12 different maps, and they are invited to understand who produced them (space and time) by using a table sheet. Then they are asked to organise the exhibition "The World Image" and to divide the maps into 4 spaces, identifying the criteria. They discuss and make their decisions.

The teacher takes the role of defining the context for inquiry and he/she stimulates the students to define their relevant questions, construct coherent explanations, communicate and share their results. Teachers are provided with the table sheet " Which map are you observing?" with the map's descriptions.

Instructions for the task:

Now it's time to create your exhibition: "The World Image exhibition"!

You are provided with 12 different maps. In groups, try to understand who produced them (where and when) by using a table sheet to organise your idea. Check your hypothesis with your teacher. Then start to organise your own exhibition "The World Image": divide the maps into 4 spaces, identifying the criteria, and label each map with the relevant information. Be creative and invite people to visit your space!

*This activity is based on Marco Cecalupo research, Laboratorio "*Le carte del mondo*", Historia Ludens association.

5. Evaluate (30 min.)

Students are provided with a self-evaluation questionnaire to test themselves and the activity as well. The aim is to make the students able to express their general impression. Particularly, questions are related to what they learned, to the different skills developed and to the satisfaction and improvement suggested by them.

At the end of the miniMooc Imago Mundi we asked in a questionnaire some questions to the students. Here is the questionnaire at the link:

https://docs.google.com/forms/d/1RAb1c51VgopbJ-kbkVFnHkJNF5VnbzNdjX6dUigIsHc/edit

Students are provided with a self-evaluation questionnaire to test themselves and the activity as well. The aim is to make the students able to express their general impression and reflect on the

ideas learnt. Particularly, questions from 1 to 6 are related to what they learned; questions from 7 to 16 are related to the different skills developed; questions from 17 to 19 are related to the satisfaction and improvement suggested by the students.

The same aspects are checked by an evaluation grid based on the teacher observation

Evaluation activity

(To be given to each student)

1) Can you tell us three things you learned today?
2) What was new for you?
3) What was difficult ?
4) What was surprising?
5) What more would you like to find out?
6) Did you find this activity useful
   - to understand different point of view through the space representation
   - to orient yourself through the main events of history
   - to recognize and explain people's different ideas
   - to make appropriate use of historical, geographical terms
   - to understand the technique of scale representation
   - More
7) On a scale from 1 to 5 (1 minimum and 5 maximum) how much analytical skills have improved?
8) On a scale from 1 to 5 (1 minimum and 5 maximum) how much the problem-solving ability has improved ?
9) On a scale from 1 to 5 (1 minimum and 5 maximum) how much critical skills have improved?
10) On a scale from 1 to 5 (1 minimum and 5 maximum) how much the ability to argue has improved?
11) On a scale from 1 to 5 (1 minimum and 5 maximum) how much creative skills improved?
12) On a scale from 1 to 5 (1 minimum and 5 maximum) how much has the teamwork ability improved?
13) On a scale from 1 to 5 (1 minimum and 5 maximum) how much the evaluation ability has improved?

14) On a scale from 1 to 5 (1 minimum and 5 maximum) how much the integrated subjects activity is useful?

15) On a scale from 1 to 5 (1 minimum and 5 maximum) how much have your language skills improved?

16) On a scale from 1 to 5 (1 minimum and 5 maximum) how much has your scientific knowledge improved?

17) On a scale from 1 to 5 (1 minimum and 5 maximum) how much did you enjoy the activity?

18) Could you tell us what would you improve in the activity?

19) Would you suggest carrying out this activity with other students? YES NOT

Annex: Evaluation grid for the teacher

Student:_____

	To what extent she/he ……..	1	2	3	4	5
1	understands different point of view through the space representation					
2	orients her/himself through the main events of history					
3	recognizes and explains people's different ideas					
4	makes appropriate use of historical, geographical terms					
5	understands the technique of scale representation					
	To what extent …					
6	analytical skills are improved					
7	the problem-solving ability is improved					
8	critical skills are improved					
9	the ability to argue is improved					

10	the creative skills are improved					
11	the teamwork ability is improved					
12	the evaluation ability is improved					
13	language skills are improved					
14	scientific knowledge is improved					

1 is minimum – 5 is maximum

Here some few answers to the questions

Can you tell us three things you learned today?

- about the maps
- Maps are cool; maps are weird; maps are expression of man kind
- The old maps of the different places in the world, that the countries in our world map are bigger than what they are in reality and also how the Roman maps looks like
- how maps works, how world was seen through the years, the different seen
- How maps works, how world was seen through the years, differences in mpas from different part of the world
- History of Maps, to distinguish between Maps and how to collaborare Better with foreigners
- Not every map is correct
- The story of the maps, the maps before the discover of America and how to repair the maps through the centuries
- How to correctly read a map, how to precisely describe it and how to recognize the period of a map just looking at it
- Old maps and real size of contries
- Représentation of sphère to planisphère, Italian foods
- The dates of different world maps, new food flavour, and new countryside
- The different ways, what causes, and how we prioritize distortion in maps.

What was new for you?

- the different techniques
- All the different types of maps
- Some new maps
- ancients maps

- The real representation of google maps
- I had never worked with Maps before
- Discovering some of the ancient Latin Americans maps, like the Aztec ones
- The Nearpod app we used during the presentation

What was surprising?

- All the weird ancient maps
- That our countries in the world map are bigger than what they actually are
- How modern maps are created
- The Google maps works
- The Christian map
- To see some of the most ancient maps and their extremely wrong idea of the world
- The real size of each country
- The very different ways to make maps

Technology MINI MOOC Lesson Scenario

"Photography"

Manisa Sosyal Bilimler Lisesi - Turkey

Introduction

Photography, the art of light, uses reflected light from a scene to record images and it is your camera which focused the reflected light and magnetified the image. The first film camera went on sale in 1888. The first digital camera went on sale in 1994. Today photography is changing from a chemical technology into a digital technology - with great advances in the field, photography deserves to be the topic of a Technology miniMOOC.

Technology is the main focus of the miniMOOC but the miniMOOC also practises some other disciplines. The target audience (high school students) must do Science, Art and Maths within that miniMOOC. It also allows the students to develop several skills:

- soft skills: Visual communication, Verbal communication, Creativity -Aesthetics, Attention to detail, Analysis, Critical Thinking, Logical reasoning, Observation, Brainstorming, Decision making, Active listening, Patience and Time management, Motivation, Collaboration, Coordination and Idea exchange;

- hard skills: Photography Skills, Photo Editing, Cell Phone / Digital Photography, Post Processing Apps Skills (Photoshop, Lightroom, Snapseed...etc), Social Media, Zoom - Photo composition, Foreign language skills, Computer skills and Presentation skills

The international miniMOOC outline involves 5 E's :

1. **Engage: Share two photos from your cell phone gallery and tell about them.**

2. **Explore: Put the photos into the correct sequence. Visit the museum and check the right sequence. Comment on the right sequence.**

3. **Explain: Answer a pre-test and study the knowledge of the photography**

4. **Extend: Explore the school museum within several activities and take the photos of the school museum objects.**

5. **Evaluate: Answer the post-test and Design a virtual museum.**

1. Engage: Share two photographs from your cell phone gallery and tell about them (15 m)

During this phase, the **objectives** are :

To become familiar with the theme of photography.

To promote the skills of Visual communication, Verbal communication, Attention to detail, Analysis - Critical Thinking, Logical reasoning, Decision making- , Active listening, Patience and Time management , Motivation and Idea exchange as well as Foreign language skills and and Presentation skills

Instructions for the task:

Choose 2 photographs from your own cell phone gallery and explain them to the other ones in your group.

Observation :

- The exercise is done in randomly made groups.

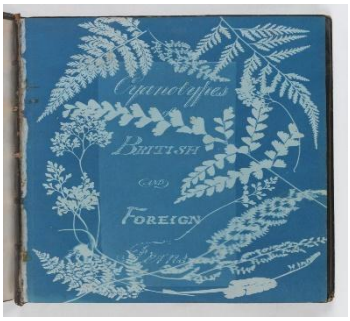
-The facilitator walks around and asks for more detailed explanation of the shared photographs.

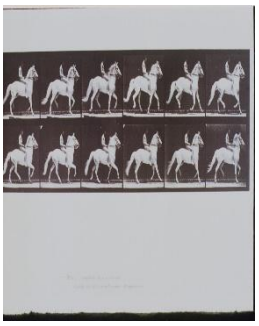
2. **Explore: Put the photos into the correct sequence. Visit the museum and check the right sequence. Comment on the right sequence (30 m)**

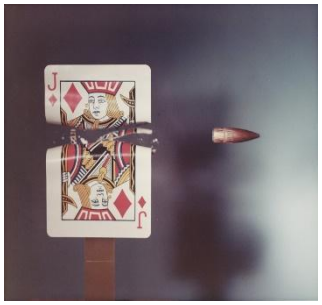
During this phase, the **objective** is to generate a timeline and put some given photos into the correct sequence by analysing (Critical Thinking, Logical reasoning – themes, techniques...etc of the photos - and Decision making) the photos mainly on Historical and thematic basis as well as the photo taking techniques.

Instructions for the task: Use a web 2 tool to create a timeline. You have several photos. Order the photographs in front of you chronologically based on logical reasonings. (What makes you believe this photo is the oldest, is it its theme, its technique ..etc? Can you make a guess about the period when it was taken?) and show them on the timeline.

Below are the photos chosen. Students are given the photos either as in hard copies or digitally on smart board.





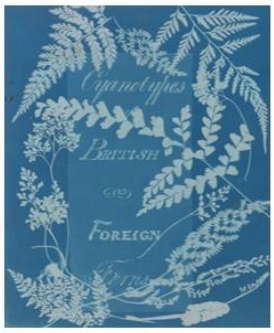


During the second step of this phase, the **objective** is to visit the museum and use the museum sources to check the results of the previous task and meanwhile making some more discussions about historical, geographical, political, and technological backgrounds of the photos.

Instructions for the task: Visit the museum of **https://www.scienceandmediamuseum.org.uk/objects-and-stories/history-photography** online and scan the text there to check if you have sequenced the photos correctly. We can make

some more discussions about historical, geographical, political, and technological backgrounds of the photos please.

See the correct answers:



Anna Atkins (1799 – 1871) was an English botanist and photographer. She is often considered the first person to publish a book illustrated with photographic images. Some sources say that she was the first woman to create a photograph.

Cyanotype, from Cyanotypes of British and Foreign Ferns, Anna Atkins, 1851

the "photogenic drawing" technique
an object is placed on light-sensitized paper(AgCl) and exposed to the sun to produce an image

The Horse in Motion, Eadweard Muybridge, 1878.

Eadweard Muybridge (1830 – 1904) was an English photographer important for his work in photographic studies of motion, and in motion-picture projection.

Dessau, Germany, Henri Cartier-Bresson, 1945

Henri Cartier-Bresson (1908–2004) is a French photographer and a well-known figure in the street style photography. He was also a co-founder of the Magnum Photos agency. Cartier-Bresson took this photograph in 1945 at a transit camp in Dessau, Germany.

Jack of Diamonds playing card hit by a .30 calibre bullet, Harold Edgerton, 1970

"The man who froze time"

Dr Harold Edgerton (1903–1990) is famous for his split-second photographs, which reveal actions that are too fast for the human eye to see.

From 'The Last Resort', Martin Parr, 1985

"The fundamental thing I'm exploring constantly is the difference between the mythology of the place and the reality of it ... Remember I make serious photographs disguised as entertainment. That's part of my mantra." **-Martin Parr**

Untitled, Hannah Starkey, 1997

Hannah Starkey (1971-) is a British photographer who specializes in staged settings of women in city environments.

From 'Afghanistan: Chronotopia', Simon Norfolk, 2001

Simon Norfolk is known for his large-scale colour photographs of the aftermath of wars. Ruined landscapes, buildings and local communities are his typical themes.

3. Explain: **Applying a pre-test and giving the knowledge of the photography (45 min)**

During this phase, the **objective** is to measure students' existing knowledge of photography and provide students with basic photography knowledge - from analogue to digital photography- .Students are given knowledge about photography (exposure, aperture, shutter, ISO... etc) and digital photography. They are also asked to use some apps (EXPOSURE TRIANGLE SIMULATOR, TAKING PHOTOS WITH LIGHT, PHOTOSHOP

Instructions for the task:

I. **Answer the questions in the photography test below .**

PHOTOGRAPHY TEST

1. In order to minimize file size and loss of quality of an image for printing, how should it be saved?

A .gif B .tiff C .png D .html

2.The amount of light or darkness on a photograph is known as the:

A. Exposure B. Shutter Speed

C. Contrast D. Sharpness

3.In a low lighted room the ISO should be set.....?

A. The highest setting there is on that particular camera

B. The lowest setting there is on that particular camera

C. Between 1/40 and 1/160, depending on the camera

D. About f/2.8

4.What is shutter speed measured in?

A. Stops B. F Numbers C. Seconds D. Exposures

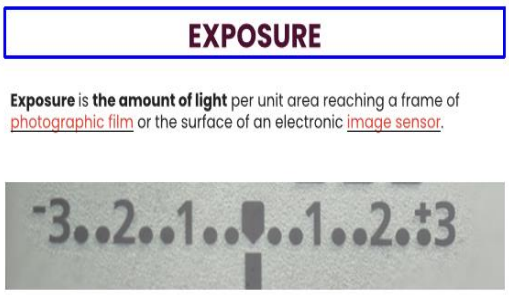
5.If a shutter speed is 1/100, what is twice as quick?

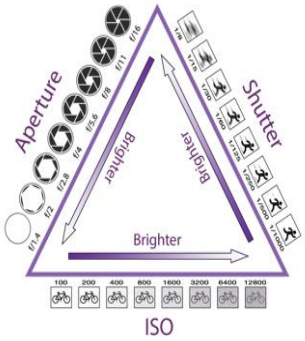
A. 1/50 B. 1/200 C. 1/500 D. None of the above

6.What is Aperture measured in?

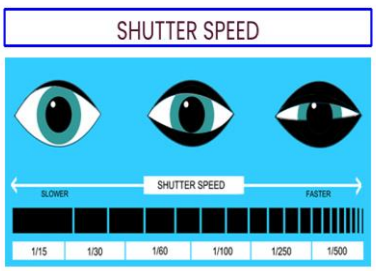
A. Spots B. Stops C. F Numbers D. Fractions

II. Let's study the basics of photography



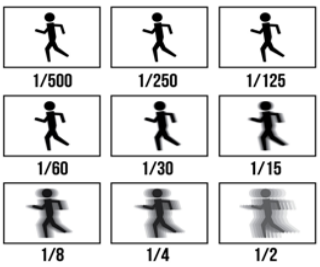


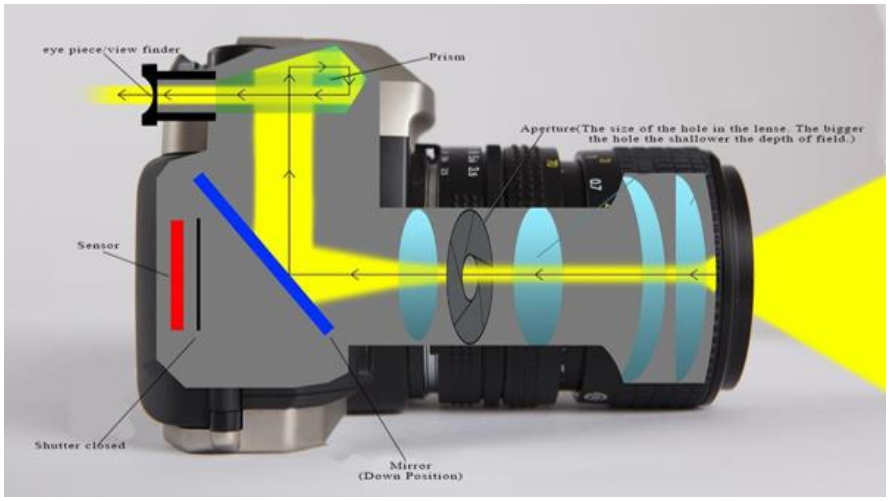
1.



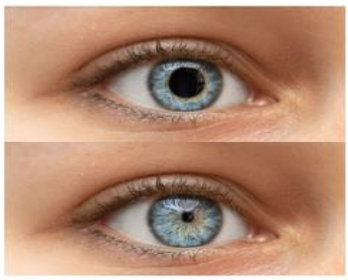
Shutter speed:

- affects the amount of light
- controls how long the camera shutter remains open
- 30", 1", 1/2, 1/30



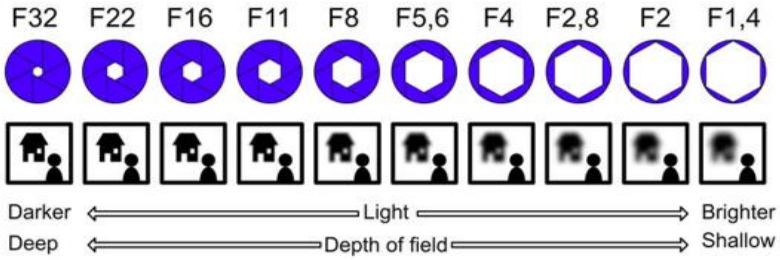

eye piece/view finder
Prism
Aperture(The size of the hole in the lense. The bigger the hole the shallower the depth of field.)
Sensor
Shutter closed
Mirror
(Down Position)

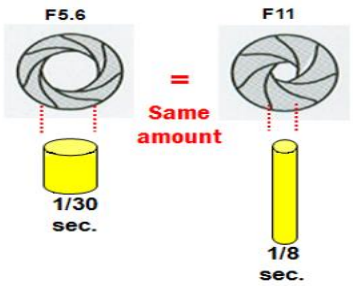
APERTURE

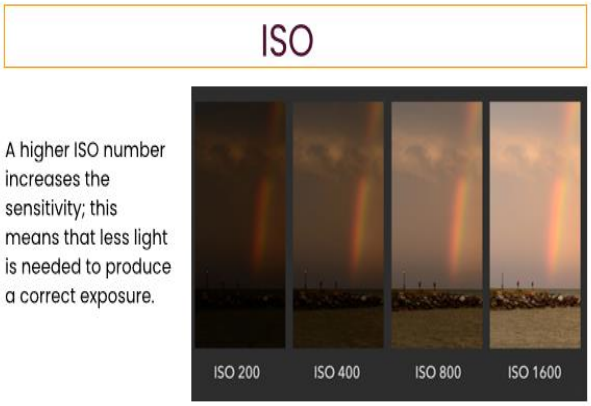


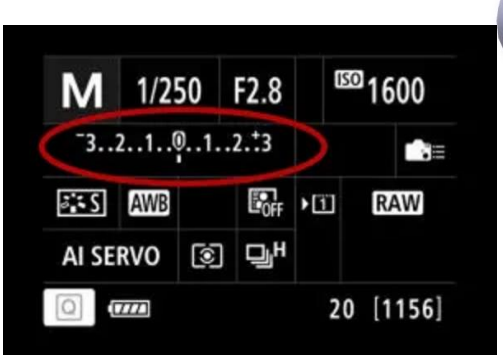

f/2.0


f/5.6


F32 F22 F16 F11 F8 F5,6 F4 F2,8 F2 F1,4
Darker
Light
Brighter
Deep
Depth of field
Shallow


F5.6
=
Same amount
F11
1/30 sec.
1/8 sec.





III. Let's try "EXPOSURE TRIANGLE SIMULATOR"

IV. You can literally draw with light! Let's take photos with light.

V. Visit www.digital-photography-school.com and get more information and some tips about digital photography- self-discovery-

4. Extend: Exploring the school museum within several activities and taking the photos of the school museum objects (90 m)

During this phase, the **objective** is to do some workshops at the activity stations to allow students practise some more disciplines (making soap and lip balm (Chemistry, Maths and Art), repeating some tongue twisters (Language), drawing some moustaches, beards of different periods(Art, History, Politics). Visiting the school museum students are asked to make some connections with the workshops and the school museum. Find more about those tasks at our project twinspace on e-twinning https://twinspace.etwinning.net/116309/pages/page/2203440

Another objective is to make students to practise the knowledge of photography by taking the photos of the museum objects (promoting their **Creativity –Aesthetics, Photography Skills, Photo Editing , Cell Phone / Digital Photography, Post Processing Apps Skills (Photoshop, Lightroom, Snapseed...etc), Social Media, Zoom - Photo composition skills**)

Instructions for the task :

I. There are four activity stations. Stop at each and participate in the workshop required.

Activity Station 1: Shaving the balloons (Ice breaker- Warmer)

Barbers used to choose their apprentices with the test of shaving balloons.

Activity Station 2: Making soap and lip balm (Chemistry, Maths, Art)

Resource Used: https://www.healthline.com/health/how-to-make-soap#finishing

SOAP RECIPE

Ingredients :

20 oz. coconut oil, 10 oz. olive oil, 9 oz. distilled water, 4.78 oz. 100 percent pure lye, 20 to 40 drops of essential oils, colourants (optional), dried herbs or flowers (optional)

Directions :

Measure your ingredients; Set the slow cooker to low ; Add the coconut oil to the slow cooker to melt; Prepare the lye solution- Slowly add the lye to the water ; Stir the solution as you add the lye with a spatula; Set aside the lye solution - cool it for 15 to 20 minutes- ; When the coconut oil has completely melted, add the olive oil and Stir; Continue blending and stirring for 10 to 15 minutes when the oils and lye solution have thickened and look like pudding; Cook on low for 50 minutes; Turn off the slow cooker; Add essential oils and colorants -Mix well ; Pour the mixture into the soap mold. Top with dried herbs, if using.

LIP BALM RECIPE: STUDENTS' OWN ADAPTED AND DEVELOPED RECIPES

Activity Station 3: Repeating some tongue twisters and translating them into your languages (Languages)

What did a barber say to another barber?

1st version : Bir berber bir berbere: "Bre berber gel beraber, Bir berber dükkanı açalım" demiş.

2nd version: Bir berber bir berbere: "Bre berber, gel birader, biz beraber Berberistan'da bir berber dükkanı açalım" demiş.

3rd version: Bir berber bir berbere: "Bre berber, beri gel" diye, Bar bar bağırmış.

4th version : Bir berber bir berbere: "Gel beraber bir berber dükkanı açalım" demiş.

Activity Station 4: Drawing some moustaches, beards of different periods (Art, History, Politics).

Study the worksheet of Famous People – Famous Moustaches and draw moustaches and/or beards of different periods

WORKSHEET: Famous People – Famous Moustaches

Resource used: https://www.britannica.com/story/famous-mustaches-in-history

- How are those moustaches called and why?

- Whose moustaches are they- Can you name the owners of the moustaches?

- Can you tell about the periods when those people lived and important events of those periods?

1.

2.

3.

4.

ANSWERS:

1. William Howard Taft : U.S. President William Howard Taft wore the classic "handlebar" moustache.

2. Salvador Dalí: It's very probable that Salvador Dalí was known as much for his unusual waxed moustache as for his Surrealist paintings. Dalí's corpse was exhumed in 2017, some 28 years after his death, so that forensics experts could collect DNA as part of a paternity suit. They discovered that his moustache was still intact.

3. Adolf Hitler: The fascist dictator was known for his instantly recognizable grooming style. So unmistakable was his "toothbrush" moustache, a type characterized by thick whiskers that span the width of the nose, that it is often called the "Hitler moustache."

4.Ambrose Burnside : American Civil War general Ambrose Burnside is known as the originator of side whiskers, which were later called "sideburns," a name inspired by his surname

II. Let's visit the School Museum of Barbering History and Culture. Can you make some connections between the workshops and the museum? Do you think that it is possible to use museums as alternative teaching environments and use its sources to practise different disciplines?

III. Take the best photos of the museum objects using the knowledge of photography provided and necessary apps.

Some students' photos from the School Museum of Barbering History and Culture:







5. Evaluate: Applying the post- test and designing a virtual museum (90 min)

During this phase, the **objective** is to measure students' comprehension of the knowledge of photography by use of the post-test and build up a virtual museum by use of the photos taken.

Instructions for the task:

I. Answer questions in the photography test.

PHOTOGRAPHY TEST

1. In order to minimize file size and loss of quality of an image for printing, how should it be saved?

A .gif B .tiff C .png D .html

2. The amount of light or darkness on a photograph is known as the:

A. Exposure B. Shutter Speed

C. Contrast D. Sharpness

3. In a low lighted room the ISO should be set……?

A. The highest setting there is on that particular camera

B. The lowest setting there is on that particular camera

C. Between 1/40 and 1/160, depending on the camera

D. About f/2.8

4. What is shutter speed measured in?

A. Stops B. F Numbers C. Seconds D. Exposures

5. If a shutter speed is 1/100, what is twice as quick?

A. 1/50 B. 1/200 C. 1/500 D. None of the above

6.What is Aperture measured in?

A. Spots B. Stops C. F Numbers D. Fractions

II. Use your photos of the school museum objects- Build up **the virtual School Museum of Barbering History and Culture**.

Chapter IV

Assessment tools, assignments, and projects

Assessment and impact evaluation:

Assessment is an integral part of teaching and learning. It helps instructors with determining whether the goals of instruction are met and improving the instruction. That's why it is not wrong to say that assessment affects decisions about instructional needs and improvements. Impact evaluation has an accountability purpose also to determine how well a program has been working. Because of the common aim of assessment and impact evaluation to determine the efficiency of the instructional process, the path of impact evaluation has been adapted and developed to assess and evaluate the impact of specifically miniMOOCs.

Accordingly, an evaluation team had been set up who defined the timeline and developed an evaluation plan. The evaluation plan required to develop some survey instruments. Those basic survey instruments have been adapted and developed by each country in accord with the unique needs and aims of their own miniMOOC. The partner countries used and tested them during the international workshops – Learning Teaching Training Activities with pupils in Turkey, France, and Italy – while piloting the international miniMOOC. The findings were analysed and disseminated to improve the miniMOOC.

Besides ***i.*** those surveys to assure the quality of the miniMOOC, ***ii.*** some tests (applied as pre- and post-tests) and worksheet to give and measure knowledge and skills provided within the miniMOOC and ***iii.*** extra assignments and projects offered as well as another miniMOOC scenario are collected in that Module for your use.

I. Surveys to assure the quality of the miniMOOCs

National workshops allowed to create several national teaching - learning scenarios delivered in accordance with C2 (Lithuanian virtual Learning Teaching Training Activity) and as in miniMOOCs to practise the structure of the miniMOOCs and get ready for the intellectual output of INTERNATIONAL MINIMOOCS. Below is the Template and the Assessment Scale designed for the national MiniMOOC Teaching Learning Scenario.

I.I National miniMOOC Teaching Learning Scenario Template and Assessment Scale

Title : Author(s) :

Relevant Disciplines:

Age of target students:

Teaching time:

Online teaching material:

Resources used:

Integration into the curriculum:

Aim of the scenario:

Learning – Teaching Styles:

Skills Promoted:

Activities (Introduction; Main part; Conclusion):

Assessment Scale (to be filled by teachers and students)

Rate the scenario on a scale of 1-5. 5 means the most.

Level of difficulty: 1 2 3 4 5

Depth of knowledge provided: 1 2 3 4 5

Creativity of the title: 1 2 3 4 5

Availability of the online materials and resources used: 1 2 3 4 5

The relevancy of the scenario with the curriculum: 1 2 3 4 5

Efficiency of the learning teaching styles: 1 2 3 4 5

Practicality of the activities: 1 2 3 4 5

Answer the questions.

I did not like when _____

I liked it the best when _____

My suggestion(s) to improve the scenario is/ are _____

Tick the checklist.

The class atmosphere was positive.

The activities were well planned, and their instructions were easy to follow.

The participants (teacher and students) were actively involved in all phases of the scenario.

The participants used intensive technology and language.

The workshop was well-organized.

The scenario was used within different disciplines.

The aims of the lesson were fulfilled: it could promote various skills.

The materials, resources and activities provided students' understanding of the topic.

The museums' materials have been used.

During the C2 mobility (virtual teacher Training Activity) the structure of the international miniMOOCs was studied and a template was designed accordingly. Below is the Template designed for the International miniMooc Teaching Learning Scenario. (The suggested structure was originally created by ODL project, and adapted in Eras'Muse project)

I.II International miniMOOC Teaching Learning Scenario Template and Assessment Scale

1. Engage:
Objectives
Instructions for the task
2. Explore:
Objectives
Instructions for the task
3. Explain :
Objectives
Instructions for the task
4. Extend :
Objectives
Instructions for the task
5. Evaluate :
Objectives
Instructions for the task

Please note that a miniMOOC Session Feedback Form was also developed by the Evaluation Team to assess the quality of the International miniMOOCs. Each country adapted the Feedback Form in accord with the unique needs and aims of their own mini MOOC, however the general quality criteria were the same. The partner countries have used and evaluated mainly the miniMOOC Sessions/Workshops and also the miniMOOC Session Materials/Activities through the Feedback Forms during the international workshops – Learning Teaching Training Activities with pupils in Turkey, France and Italy – while piloting the international miniMOOCs. Below is the Feedback Form with some other variations (adaptations) by each partner.

I.III MiniMOOC Session Feedback Form

MiniMOOC : _____ – Feedback form –	

Session n° xxx – Date	
Instructions: answer to the following questions with key-words and short phrases, in an anonymous way.	
Did the subgroup and facilitator have a plan? (e.g., vital, useful, useless, etc.). Did each participant have the opportunity to express him or herself?	☐ yes ☐ no ☐ yes ☐ no
Did each participant listen to the suggestions of others, or did they try to impose their own list?	
Was there leadership, conflict, or grouping within the subgroups?	
How long did the various decisions take?	
Did any of the subgroups adopt decision-making methods such as majority rule, give-and-take, or chance? Were they creative?	
Any suggestions?	

I.IV. MiniMOOC Session Evaluation Form

Mini-Mooc : _____ – Evaluation form –	
Part 1 – Production	**Part 2 – Oral presentation**
Level 1	

Instructions have been partially followed: the diagram/video is incomplete; museum's materials have been partially used ; the diagram/video is basic work	0-2 pts	The oral presentation can be improved: the vocabulary is basic; there are some spelling, syntax and grammar mistakes ; the pronunciation can be improved	0-2 pts
Level 2			
Instructions have been correctly followed : some details are missing, but the essential informations have been presented ; the museum's materials have been correctly used and presented ; the diagram/video has been well shaped	3-5 pts	The oral presentation is satisfying : there are some mistakes, but the vocabulary is relevant ; the presentation is easy to understand ; the pronunciation is fluent	3-5 pts
Global score on 10 pts: Comments:			

I.V MiniMOOC Workshop Feedback Form

Please fill this form to give us some feedback about the workshop. Select with a cross the most appropriate answer, giving grades from 1 to 5, 1 is low accuracy and 5 is highly accurate.

Statement	1 (no)	2 (rarely)	3 (balanced)	4 (mostly)	5 (yes)
1. **About the topic** Considering it was a Science/ Technology/ Engineering/ Art/ Maths workshop, was the topic boring (1) or rather interesting (5)					
2. **How was your working in groups**? Did every participant have the chance to express him/herself?					
3. **About the films/other materials/activities** Did you understand the films**/**other materials/activities (5) or was it hard to understand the language (1)?					
4. **About the instructions** Were the verbal and written instructions clear?					
5. Do you feel happy with your **contribution t**o the workshop ?					
6. Are you satisfied with the new **knowledge** that accumulated through this workshop?					

Suggestions for improvement….

I.VI MiniMOOC (Lesson) - Feedback Form -

(To be given to each student)

1) Can you tell us three things you learned today?
2) What was new for you?
3) What was difficult?
4) What was surprising?
5) What more would you like to find out?

6) Did you find this Mini Mooc -lesson - useful

- to understand different point of view through the space representation
- to orient yourself through the main events of history
- to recognize and explain people's different ideas
- to make appropriate use of historical, geographical terms
- to understand the technique of scale representation
- More

7) In the scale from 1 to 5 (1 minimum and 5 maximum) how much analytical skills are improved?
8) In the scale from 1 to 5 (1 minimum and 5 maximum) how much the problem-solving ability has improved ?
9) In the scale from 1 to 5 (1 minimum and 5 maximum) how much critical skills are improved?
10) In the scale from 1 to 5 (1 minimum and 5 maximum) how much the ability to argue has improved ?
11) On a scale from 1 to 5 (1 minimum and 5 maximum) how much do creative skills improve ?
12) In the scale from 1 to 5 (1 minimum and 5 maximum) how much the teamwork ability is improved ?
13) In the scale from 1 to 5 (1 minimum and 5 maximum) how much the evaluation ability has improved ?
14) In the scale from 1 to 5 (1 minimum and 5 maximum) how much the integrated subjects activity is useful ?

15) In the scale from 1 to 5 (1 minimum and 5 maximum) how much your language skills have improved ?

16) On a scale from 1 to 5 (1 minimum and 5 maximum) how much has your scientific knowledge improved ?

17) On a scale from 1 to 5 (1 minimum and 5 maximum) how much did you enjoy the Mini Mooc –lesson-?

18) Could you tell us what would you improve in the Mini Mooc- lesson- ?

19) Would you suggest carrying out this Mini Mooc- lesson with other students? YES NOT

II. Some tests (applied as pre-tests and post-tests), quizzes, worksheet and practice sheet to give and measure knowledge and skills provided within the miniMOOCs

Each Mini MOOC provides learners with tests, quizzes, worksheet, practice and activity sheet to give and measure some knowledge and skills. Below is a collection of some of them. Please note that you can find them and more in Chapter 3 (miniMOOCs). That part aims to offer this collection as in some deliverables of each miniMOOC for teachers' practical use.

SCIENCE MINI MOOC DELIVERABLES

1. Worksheet: -Global Warming and Climate Change-

Instructions ***(To be given to each group)***

Resources used: https://olafureliasson.net/archive/artwork/WEK109190/ice-watch.

https://www.youtube.com/watch?v=QpftaPHvrBc

Related videos, articles and reports about the topic.

Causes and effects of climate effects of climate change. Film and text.

https://www.nationalgeographic.com/environment/article/global-warming-solutions

Rising concentrations of carbon dioxide are warming the atmosphere.

https://earthobservatory.nasa.gov/features/CarbonCycle/page5.php

About the IPCC Climate change report.

https://www.nrdc.org/stories/ipcc-climate-change-report-why-it-matters-everyone-planet#sec-whatis

Greenhouse Effect

https://www.nrdc.org/stories/greenhouse-effect-101#consequences

Press release: The Nobel Prize in Physics 2021.

https://www.nobelprize.org/prizes/physics/2021/press-release/

https://bifrostonline.org/a-sustainable-future/

A. Study the resources and answer the questions below in groups.

-What is the purpose of the installation?

-What is causing the glaciers to melt?

-Is climate change the same as global warming?

-How does carbon dioxide increase Earth's temperature?

-How can we stop the carbon dioxide effects?

B. Study the vocabulary box in the Science Mini Mooc and comment on your answers

2. Quiz: -Global Warming and Climate Change-

Instructions (To be given to each group)

Answer the questions

1-) True or false?

The greenhouse effect is when some solar radiation passing the atmosphere from the sun is absorbed by the Earth, while some is reflected back to space.

2-) Which of the following does not contribute to the reduction of greenhouse gases in the atmosphere?

A) Increasing applications for heating with less energy

B) Promoting the use of solar energy and nuclear energy

C) The use of systems that emit less carbon in thermal power plants

D) Increasing use of energy sources such as biodiesel instead of fossil fuels

E) The dissemination of accumulating hydroelectric power plants instead of river power plants.

3-) Which of the following is a consequence of the greenhouse effect?

A) Expansion of the impact area of glaciers

B) Increase in volcanic activities

C) Seeing increases in severe ground shaking

D) Decreased formation of strong winds such as hurricanes, hurricanes, and storms

E) Submersion of some of the coastal countries close to the poles with low average altitude

4-) True or false?

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle.

5-) Which of the following is not among the events that can be experienced due to global warming?

A) Decrease in the area covered by glaciers

B) Decrease in water vapor in the atmosphere

C) Increase in erosion and landslide events

D) rising sea levels near the poles

E) A change in the ratio of gases in the air

6-) Which of the following is a greenhouse gas?

A) water vapour (H_2O)

B) methane (CH_4)

C) carbon dioxide (CO_2)

D) All of the above

TECHNOLOGY MINI MOOC DELIVERABLES

1.Worksheet: - Order the Photographs Chronologically-

Instructions (To be given to each group)

A. Use a web 2 tool to create a timeline. You have several photos. Order the photographs in front of you chronologically based on logical reasonings.(What makes you believe this photo is the oldest, is it its theme, its technique ..etc? Can you make a guess about the period when it was taken?) and show them on the timeline.

Let's talk about historical, geographical, political and technological backgrounds of the photos please.

B.Let's check the right sequence and get some extra information about the photos. Comment on the right sequence.

Resource used: https://www.scienceandmediamuseum.org.uk/objects-and-stories/history-photography

2. Test: -Photography- (To be Applied as a pre-test and post-test)

Instructions (To be given to each participant)

Answer the questions

1. In order to minimize file size and loss of quality of an image for printing, how should it be saved?

A .gif B .tiff C .png D .html

2. The amount of light or darkness on a photograph is known as the:

A. Exposure B. Shutter Speed

C. Contrast D. Sharpness

3. In a low lighted room the ISO should be set……?

A. The highest setting there is on that particular camera

B. The lowest setting there is on that particular camera

C. Between 1/40 and 1/160, depending on the camera

D. About f/2.8

4.What is shutter speed measured in?

A. Stops B. F Numbers C. Seconds D. Exposures

5.If a shutter speed is 1/100, what is twice as quick?

A. 1/50 B. 1/200 C. 1/500 D. None of the above

6.What is Aperture measured in?

A. Spots B. Stops C. F Numbers D. Fractions

3. Test: - Selfies Challenge Sheet

Instructions (To be given to each group)

A. Find the person, food, landmark and the place asked, take selfies with them? The group with all 14 selfies first is the winner.

1. Which Mosque was built in the 16th century for Ayşe Hafsa Sultan, Süleyman the Magnificent's mother ?
2. What is a spiced paste in the form of candy, and claimed to restore health, youth and potency ?
3. What is the name of the trademark of the white goods giant ?
4. Where does the city governor work?
5. What is the hotel where French team stays ?
6. What is the building whose name was given by the people because of its imposing long columns and white color ?

7. What is the building which was used as a hospital for about 500 years in Manisa and now has been serving as the History of Medicine Museum within the body of Manisa Celal Bayar University for 8 years? (Hint : Its name was Hafsa Sultan Şifahane)

8. Who is the hero of the Manisa Social Sciences High School Museum?

9. What is Manisa famous for? (Hint : It can be eaten fresh or used to make wine, jam, juice, jelly, vinegar. You can find its dried type in winter)

10. What is the newly opened fast food restaurant that is welcomed with joy among young people?

11. It is in the centre of Manisa province and was built by Hüsnüşah (Husniyeşaz) Hatun, one of the wives of II. Bayezid?

12. What is the tomb whose owner has not been determined?

(Hint : It is located in the cemetery near Kumludere in the city centre of Manisa. The inscription of the tomb is not sufficient to know whose it is. It is thought to have been built in the 16th or 17th century)

13. Where is the Street with umbrellas ?

14. Who is in Fatih Parkı now ?

Meeting Point : https://goo.gl/maps/YLg1uVFW3k5aykmX6

Group Photo: What is that place famous for ?

ENGINEERING MINI MOOC DELIVERABLES

1. Worksheet : - Flying to the Moon-

Instructions (To be given to each participant)

You are part of the crew of a spacecraft originally programmed to reach a mother rocket from the illuminated side of the moon. Due to mechanical problems, you had to land

about 320 km from the scheduled rendezvous. During the landing, most of the on-board equipment was damaged, except for the 15 objects below. It is vital for your crew to get back to the mother rocket and you must choose the essential equipment for this long trip. The exercise consists in classifying the 15 items in order of necessity.

A. Put the number 1 in front of the one you think is most important, 2 in front of the next one, and so on until you reach 15 in front of the one you think is least useful. Use the decision sheet.

A matchbox

Concentrated food

50 meters of nylon rope

A silk parachute

A solar powered heater

2 x 45 calibre pistols

A case of powdered milk

2 tanks of 50 kg of oxygen each

A celestial map of the lunar constellations

A self-inflating lifeboat

A magnetic compass

25 litres of water

A medical kit and hypodermic syringes

Light signals

A solar powered transceiver (medium frequency)

DECISION SHEET

Objects	individual ranking	difference in points	collective ranking	difference in points	ranking of N.A.S.A.
A matchbox					
Concentrated food					
50 meters of nylon rope					
A silk parachute					
A solar powered heater					
2 x 45 calibre pistols					
A case of powdered milk					
2 tanks of 50 kg of oxygen each					
A celestial map of the lunar constellations					
A self-inflating lifeboat					
A magnetic compass					
25 litres of water					
A medical kit and hypodermic syringes					
Light signals					
A solar powered transceiver (medium frequency)					
	Total :		Total :		

B. Check the results and explanations provided by N.A.S.A

Please note that to establish their classification, the experts of the N.A.SA. were based on the alternate use of 2 criteria:

- what ensures biological life
- what ensures the possibility of joining the mother rocket.

These 2 criteria mean, by their association, the survival.

Objects	Explanation	ranking of N.A.S.A.
A matchbox	The absence of oxygen does not allow them to ignite	15
Concentrated food	Efficient way to repair energy loss	4
50 meters of nylon rope	Useful for roping up, climbing rocks; possibly for hoisting the injured	6
A silk parachute	Can be used to protect from sunlight	8
A solar powered heater	Not useful: suits are heated	13
2 x 45 calibre pistols	Can be used to accelerate propulsion; in a pinch to end one's life	11
A case of powdered milk	Nutritional trap: more cumbersome than concentrated food	12
2 tanks of 50 kg of oxygen each	First essential element of survival	1
A celestial map of the lunar constellations	Essential for orientation	3

Objects	Explanation	ranking of N.A.S.A.
A self-inflating lifeboat	Can be used as a sled to pull objects; the gas (CO) used for this device can be used for propulsion	9
A magnetic compass	No use on the moon; the magnetic field is not valued there	14
25 liters of water	Indispensable to compensate a strong dehydration due to the very great heat on the illuminated side of the moon	2
A medical kit and hypodermic syringes	The injections of vitamins, serum etc...require a special opening (provided by the N.A.S.A.)	7
Light signals	Useful when the mother rocket is in sight	10
A solar powered transceiver (medium frequency)	Useful to try to communicate with the mother rocket but this device does not have much range	5
	Total :	

C. Please calculate your own score and compare it to the collective score and discuss about the results/comparison; analysis of the group dynamics.

2. Quiz: - The Scientific Notions -

Instructions

(To be given to each participant)

Answer the questions

1. **What are the gases exchanged during photosynthesis?**

□ Oxygen is absorbed and carbon dioxide is released

□ **Oxygen is released and carbon dioxide is absorbed**

□ Both oxygen and carbon dioxide are absorbed

□ Both oxygen and carbon dioxide are released

2. **Which kind of living beings can process photosynthesis ?**

□ All kind of living beings

□ Plants and animals

□ **Mainly plants**

□ Mainly animals

3. **What are the gases exchanged during cellular respiration ?**

□ **Oxygen is absorbed and carbon dioxide is released**

□ Oxygen is released and carbon dioxide is absorbed

□ Both oxygen and carbon dioxide are absorbed

□ Both oxygen and carbon dioxide are released

4. **What can solar radiation cause to living beings ?**

□ Boiling of the body water

□ **Genetic mutations**

□ Death by burns

□ Lack of oxygen

5. **What are the elements that protect living beings on earth from solar radiation ?**

□ Oxygen in the atmosphere and the biosphere of the planet

□ **Ozone in the atmosphere and the magnetosphere of the planet**

□ Carbon dioxide in the atmosphere and the hydrosphere of the planet

□ Water vapour in the atmosphere and the lithosphere of the planet

ART MINI MOOC DELIVERABLES

1. Worksheet : -How to Describe a Map-

Instructions (To be given to each participant)

Describe the maps according to the sheet below.

World's Maps

Map n° .....

The World is ...

In the Centre there is/are

……

The continents represented are

……

I can recognize

……

……

At the top there is/are

……

……

What is different from today?

……

……

……

It was made by ……

The period is ……

2.Worksheet: -The maps -

Instructions (To be given to each group)

B. Match the maps through their numbers to the right period and give a description of the relevant elements. The description will be useful to label the maps in your exhibition.

N°	*Age*	*Made by…*	*The world is…*
	2000 bC	**Sumer**	
	II cent. bC	**A greek from Alexandria (Egypt),** **Claudio Tolomeo**	
	III-IV cent.	**Romans**	
	VII cent.	**A Christian prayer,** **Isidoro from Seville**	
	XII cent.	**Europeans**	
	XII cent.	**A muslim arab, Al-Idrisi**	
	XV cent.	**Aztec**	

N°	*Age*	*Made by…*	*The world is…*
	XV cent.	**Europeans**	
	1587	**A Dutch,** **Gherard Mercator**	
	1977	**A German,** **Arno Peters**	
	2005	**Brazilians**	
	2005	**Chinese**	

C. Check yourselves and comment on the wrong hypothesis within a historical different point of view.

World's Maps –Answers

N°	*Age*	*Made by...*	*The world is...*
2	2000 bC	Sumer	The map has in the middle a point that represents Sumer, the capital city. Are visible, that are the rivers of Mesopotamia: Tigri and Eufrate. The map seems like a star, with the capital city in the centre and the kingdoms submitted at the corners.
10	II cent. bC	A greek from Alexandria (Egypt), Claudio Tolomeo	Are visible only the territories (lands and oceans) known by Greeks at the age of the Alexander's Empire. There are three main areas: Africa (limited to the northern regions), Asia, and Europe. In the middle, at the borders between the three areas, there is the capital city Alexandria (Egypt). Are visible lines.
4	III-IV cent.	Romans	Are visible the main routes and towns along the routes. Distances between towns are real, measured from the middle of the map, that is the capital city Rome. The north is not pointed up, so Italy is represented in the wrong direction, not vertically. This map is useful to travel.
5	VII cent.	A christian prayer, Isidoro from Seville	The world is represented like a perfect circle. Inside, two lines form a big "T", with the holy city Jerusalem in the middle. The North is not pointed up. Europe is on the left side, Africa is on the right side, Asia is pointed up.
8	XII cent.	Europeans	The world of this map is ruled by the christian God. It is a circle with a "T" inside, with Jesus with open arms and two angels in the upper corners. Are represented the main mountains, seas, and rivers, like Nile and Red Sea. The North is not pointed up. Europe is on the left side, Africa is on the right side, Asia is up (the sun is visible). The holy city Jerusalem is in the middle.
12	XII cent.	A muslim arab, Al-Idrisi	In this map the South is up, the North is down. In the middle there is the Arabian Region, with the holy cities of Mecca and Medina. Are visible the Indian Ocean and the Mediterranean Sea, and main rivers (Nile, Danubio, Tigri ed Eufrate), islands, mountains and lakes.
6	XV cent.	Aztec	The world known by Native Americans at that age is represented like a perfect square, probably referred to the capital city Tenochtitlan. The four sides of the square represent North, South, West and East. In the middle there is the King of the Aztec Empire. East, where the sun rises, is pointed up. This map can be useful also as an annual calendar.
7	XV cent.	Europeans	In this map, Europe is clearly represented, but the Americas are not still in the drawing. Are visible only african and asian regions that were related to Europe and Arabs. The North is pointed up.
11	1587	A dutch, Gherard Mercator	This is the first map that represents all world's lands, but the north of the world (Europe, Russian, North America) is larger than in reality. The territories are divided into Nations with coloured borders. This is the basic map that all scientists will use in the future.

N°	*Age*	*Made by...*	*The world is...*
3	1977	A German, Arno Peters	The map respects the equivalence of land's surfaces. Territories of Africa, South America, Indonesia appear so much larger.
9	2005	Brazilians	The world is like a sphere, with some lines starting from Brazil that go worldwide. This map has a specific goal: to show, by the lines, relations between Brazil and other countries.
1	2005	Chinese	The map is just like the European one that we usually can see, but with an evident difference: in the middle are the Pacific Ocean and East Asia. So, the position of Europe (left) and America (right) are inverted. In particular, Europe appears much reduced and in a marginal position

D. Now it's time to create your exhibition: "The World Image exhibition" !

Divide the maps into 4 spaces, identifying the criteria, and label each map with the relevant information. Be creative and invite people to visit your exhibition !

MATHS MINI MOOC DELIVERABLES

1.Worksheet : -Statistics-

Instructions (To be given to each participant)

A. Look at the table with the Crimean war victims and try to figure out what this is about. Use the Rose Diagram that explains the Table in a comprehensive manner (on your paper or projected on the able……. etc) and discuss about the importance of data presentation.

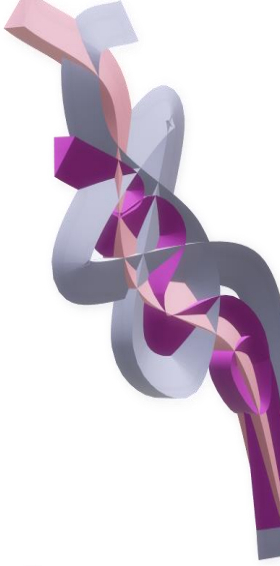
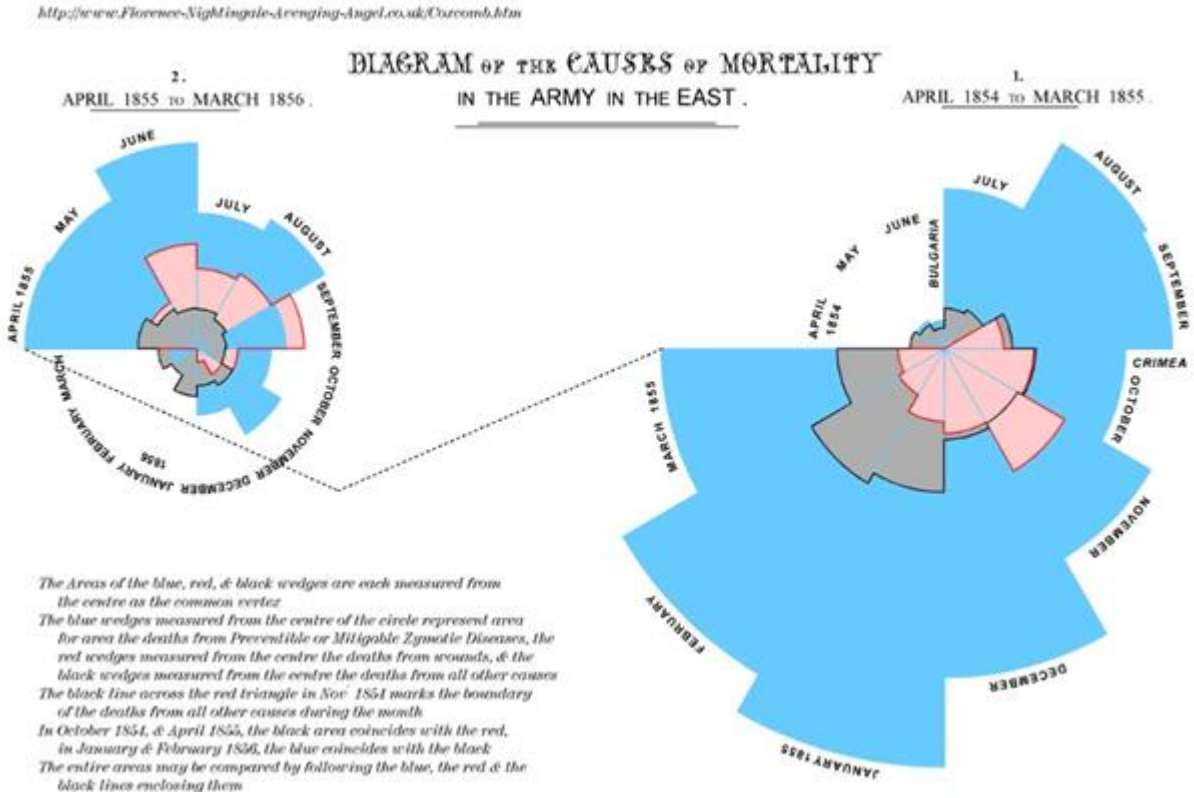


TABLE 2

Table Showing the Estimated Average Monthly Strength of the Army; and the Deaths and Annual Rate of Mortality per 1,000 in each month, from April 1854, to March 1856 (inclusive), in the Hospitals of the Army in the East

Date	Estimated Average Monthly Strength of the Army	Deaths			Annual rate of Mortality per 1,000		
		Zymotic Diseases	Wounds and Injuries	All other Causes	Zymotic Diseases	Wounds and Injuries	All other Causes
1854							
April	8,571	1	–	5	1.4	–	7.0
May	23,333	12	–	9	6.2	–	4.6
June	28,333	11	–	6	4.7	–	2.5
July	28,722	359	–	23	150.0	–	9.6
August	30,246	828	1	30	328.5	.4	11.9
September	30,290	788	81	70	312.2	32.1	27.7
October	30,643	503	132	128	197.0	51.7	50.1
November	29,736	844	287	106	340.6	115.8	42.8
December	32,779	1,725	114	131	631.5	41.7	48.0
1855							
January	32,393	2,761	83	324	1022.8	30.7	120.0
February	30,919	2,120	42	361	822.8	16.3	140.1
March	30,107	1,205	32	172	480.3	12.8	68.6
April	32,252	477	48	57	177.5	17.9	21.2
May	35,473	508	49	37	171.8	16.6	12.5
June	38,863	802	209	31	247.6	64.5	9.6
July	42,647	382	134	33	107.5	37.7	9.3
August	44,614	483	164	25	129.9	44.1	6.7
September	47,751	189	276	20	47.5	69.4	5.0
October	46,852	128	53	18	32.8	13.6	4.6
November	37,853	178	33	32	56.4	10.5	10.1
December	43,217	91	18	28	25.3	5.0	7.8
1856							
January	44,212	42	2	48	11.4	.5	13.0
February	43,485	24	–	19	6.6	–	5.2
March	46,140	15	–	35	3.9	–	9.1

The Deaths under the heads of "Wounds and Injuries" comprise the following Causes: Luxatio, Sub-Luxatio, Vulnus Sclopitorum, Vulnus Incisum, Contusio, Fractura, Ambustio and Concussio-Cerebri.



B. Watch the Film about Florence Nightingale [Florence Nightingale: Joy of Stats (3/6) - YouTube.] **Discuss the use of statistics and the power of statistics .**

C. Choose/decide a topic you want to collect a statistical material about and come up with a set of questions in order to find out what you want to know.

Please make a survey about the types of collecting data and their applicability and take notes to help you with collecting your own statistic material (survey) and create a data presentation.

Resource Used : [Better and better? A comment on Hans Rosling - YouTube]

(Roland Paulsen talks about the interpretation of data correlated to the other influencing factors that can mislead)

D. Present your data in a diagram of your choice and get feedback.

Resources Used : -Tutorials- [Excel Graph Tutorial | How To Make Graphs On Excel | Excel Tutorial For Beginners | Simplilearn - Bing video]

[How to Make a Bar Graph in Excel - Bing video]

[How To Make A Multiple Bar Graph In Excel - Bing video]

2.Practice Sheet – Presenting Statistics-

Instructions (To be given to each group)

A. Follow the instructions below and create an animated statistical presentation in Gapminder, offline using your own set of data or a set of data that is extracted from a national statistical database, or just create presentations using the Gapminder database.

Resources Used: -Tutorials- [Gapminder - step by step guide on Vimeo]

[How to use Gapminder Bubbles on Vimeo]

1. *The file has 5 Columns. The statistic should contain 3 sets of correlated data for each group you compare.*
2. *First column contains the names of the groups you compare. Each group name repeats on the amount of lines that your database should have. For example if you want to show a monthly statistic for a one-year period, then you'll have 12 lines. The group names can be shown in alphabetical order, so there will be 12 lines with group1, then 12 lines with group2, 12 lines with group3 and so on.*
3. *The second column contains the time in the time format of your statistic. If it's years, then 1975, if weeks then 2012w13 (means year 2012 week 13). You write in the first cell the first date, in the second line the next date and then select those 2 cells and scroll down to fill in automatically the rest of the time cells. Do that for each group.*
4. *The third column contains the appropriate data, one of the three sets of data of your choice, the fourth column contains the second set, and the fifth column contains the third set of data. Of course everything in the corresponding time lines, and the numbers you got from your statistic database.*

5. *The top line of the file should contain the names of the column, ex A: Country, B: Dates, C: Corona cases, D: Vaccinated people, E: Mortality cases. The purpose of these names it's that you should choose later in your animation what shall be on the horizontal line, what on the vertical line and what should be the size of a ball.*
6. *When the excel file it's finished save it on your computer under a name you remember. Open the Gapminder page, and work under the offline version. Insert your own data, choose an excel file and insert it.*
7. *Set the time format and the time frame, choose which data set would be shown on horizontal, vertical and ball size. Play a little with that and evaluate which presentation would look the best. See the tutorials for help.*

3.Test : - Statistics-

Instructions (To be given to each participant)

Group: …….

Answer the questions below:

-Write a characteristic about every type of data collecting that was mentioned in the film.

-Which one of the collecting data types was used for Covid-19 statistics?

-What type is appropriate for those statistics that political parties' uses prior to elections?

-What is a placebo question?

-Who would benefit most from misleading statistics?

-What tools can be used to mislead in statistics?

III. Extra assignments, projects offered

This part offers some extra assignments pertaining the miniMoocs, specifically the Technology themed Mini Mooc, a Steam project and an extra STEAM MiniMOOC for the

users to get deeper insights into the Steam Approach and for some further practice of STEAM scenarios.

Assignments

1. Create an Online Portfolio

2. Take a photo (Use your phone's camera app, Camera, Instagram, Hisptamatic , Camera Awesome or others)

Edit your photo (Use Camera+ (recently new and improved) , Snapseed, Photogene2 or others)

Share your photo (Online:Flickr, Picasa, Google+, Deviant Art, Pinterest / Apps: Facebook, Instagram, Hipstamatic and others)

3. Take one landscape photograph; one portrait photograph and one documentary photograph.

- Each image will be submitted with an over-exposed, under-exposed, and properly exposed versions.
- For each of the 3 images, write an abstract of why you chose these photos.
- Submit the image at 300 DPI in JPEG Format

GRADING CRITERIA

Creativity: Abstract: Format: Composition: Technical:

4. Below is the school NTF gallery with students' digital drawings created during the session of digital drawings. Build up an NFT gallery with students' photos now.

https://www.artsteps.com/view/618817193b4f970b62080c61

5.Create a digital album.

6. Look around, find and take its photos: Students are given a list of objects and /or emotions and asked to take their photos.

7. Photo Story: Students are asked to create a photo story. The title may be given.

8. Create a brochure of your school. Use photos.

9. Introduce a campaign against climate change and global warming. Create posters and leaflets. Use photos.

Projects:

1.1 STEAM Project: Plan of a French garden

In this sequence, the goal is to create a plan of a French garden for the high school.

The sequence contains 3 successive modules.

Module 1.1: Analyse the geometry of the garden of Versailles.

Tool: Google maps

Objective: determination of the general organisation (axis of symmetry, centre of symmetry, geometrical forms, harmony, perspective)

Expected production: analysis in the format of one's choice.

Module 1.2: Reproduce a grove to scale

Tool: Google maps (distance measuring tool)

Objective: choose a grove and reproduce it to scale. To highlight the geometric elements (axes and centres of symmetry, geometric shapes)

Expected production: a plan to scale

Module 1.3: Drawing a map of the school

Tool: distance measurements

Objectives:

- measure and reproduce to scale the space of the future garden (real or fictional);
- make a proposal for a formal garden in this space.

Expected production: a plan to scale associated with an artistic proposal

1.2 STEAM Project: Virtual visit of our high school

In this sequence, the goal is to create a virtual visit of the learning lab of our highschool.

The sequence contains only one module.

Source : https://blog.juliendelmas.fr/?creer-facilement-une-visite-virtuelle-d-un-etablissement-scolaire-d-une-entreprise-d-une-maison

Tools :

- smartphone (or a tablet) with a good quality camera to take spherical pictures;
- Google Street View application on the smartphone;
- a computer with Chrome or Firefox browser;
- a space on the web in parallel to your website to put the virtual tour online and make it visible to the visitors (for example accessible via FTP).

First step: Scripting of the virtual tour

- what rooms do you want to show? In which order?
- Where in the room do you want to take the picture?
- What will be the starting position of the virtual tour?
- what will be the image displayed when entering each room?
- on the spherical photos: where to place the navigation arrows to change rooms?
- where to place the information bubbles (to describe a room, a machine or other)?

Second step: Taking spherical photos and creating the virtual tour

A spherical photo is composed of about 50 photographs. These photos will go from the floor to the ceiling on 360 degrees to allow the user to have a complete view of the room, in all directions.

Third step : Organising the movements in the virtual tour

1. Choose a starting image : You must define the starting image for the virtual tour in each room. Just position the virtual tour at the desired location and click on "Set initial view". You can deactivate the "Auto Rotate" option to avoid movements.
2. Define the navigation arrows : By clicking on "Link Hotspot", you can position arrows in your virtual tour to change rooms or views (if you have several photospheres for the same room).
3. Define information points : By clicking on "Info hotspot", you can add an element on the photo that will bring information to the visitor, to describe a room, a machine... or bring any other precision to the visitor.

Fourth step: Putting your virtual tour online and hosting it

1.3 STEAM Project: Rainwater harvesting

In this sequence, the goal is to create a rainwater harvesting for our high school, connected to a vegetable garden.

The sequence contains 3 successive modules.

Module 1: Designing the overall project

Tools: google maps, smartphone, measuring tools, graphic production tools

Objective: choose a suitable location in the high school and make a scale plan of the rainwater harvesting project

Expected production: photo of the current location, enhanced with the planned project

Module 2: determine the capacity of the rainwater harvesting system

Tool: internet, computer spreadsheet

Objective: search the internet for information on the local weather to determine the capacity of the rain trap. The aim is to calculate the amount of rain that falls on the planned area during a given period from data found on the net.

Expected production: a data sheet describing the characteristics of the rain collector.

Module 3: Make an accurate budget

Tool: internet, spreadsheet

Objective: determine the material needs and for each need determine the price**.**

Expected production: a detailed budget.

STEAM MINI MOOC: THE TREE OF PARADISE

STEAM subjects : ART – HISTORY - SCIENCE

The project, in the perspective of a STEAM methodology, aims to innovate the curricular activity throughout the interaction of different subjects: **History, Art and Science (Biology- Botanic)**. It aims at the recovery of fundamental values for our culture and for our territory and to relate pre scientific wisdom, expressed through the strong symbolic value of art, and today's scientific approach, in order to overcome the rigid division between humanistic and scientific knowledge.

Depictions of nature can be about intellectual thought and spirituality. Art involving nature can be done simply to display the beauty of the natural world around us, to make scientific observations in an environment, or to open our minds to philosophical ideas about our own connection to nature and beyond .

A Museum is a building in which objects of historical, scientific, artistic, or cultural interest are stored and exhibited, therefore the Monreale Cathedral in Palermo - Sicily, can be visited as a museum too. The starting point of this project is the study of the medieval Cathedral of Monreale, one of the greatest existing examples of Norman architecture, a

synthesis of extraordinary knowledge and culture. The unit deals with the historical context, the artistic styles expressed in the precious Byzantine mosaics full of symbolism and also of representations linked to aspects of daily life (clothing and presence of agricultural landscapes).

From here begins the observation of the botanical species represented in the mosaics, with a strong symbolic value but also typical of a Mediterranean environment: the fig, the palm, the vine. In particular, students will be invited to recognize them and then to reconnect them to the survival of this environment today and to the analysis of its characteristics.

The symbology expresses an ancient wisdom of the world, pre-scientific, but still based on the observation of the characteristics and value that the natural environment keeps for mankind.

Can the ancient wisdom of nature, also expressed through symbolism, still say something to us contemporaries?

This topic can also be re-proposed in other contexts, starting from differences in iconographic representations.

The activity also allows the students to develop several skills:

- **soft skills**: Integrated skills activity; to analyse and discuss; collaboration, presenting results, creativity, communication in English, time management, etc.
- **hard skills**: to recognize and explain people's different ideas through artistic representation (knowledge and beliefs); to introduce the class to the artistic technique of mosaic and to understand the symbolic language; to analyse plants and to highlight the important aspects of them for the society; to compare the value of nature in the past, through art, and in the present.

The main goal is to compare and discuss two different approaches to nature expressed in art and science: a pre scientific vision, expressed through the strong symbolism in art, and today's scientific approach, in order to overcome the rigid division between humanistic and scientific knowledge.

Can the ancient wisdom of nature, also expressed through symbolism, still say something to us contemporaries? Pupils will express their ideas in a multimedia product.

Thinking skills involved (from lower to higher):

- **Observation** of different representations and real materials: with the help of a research-form, students **analyse and collect** them and **highlight** the important aspects.
- To **Discuss the** role of art in human life, beside the scientific approach; to **organize** the collected material (**creativity – critical thinking**).
- Integrated skills activity; teamwork; problem-solving; **assess** and **evaluate.**

Why "THE TREE OF PARADISE" could be a "good" microSTEAM topic?

1. It provides effective engagement to students;
2. It generates curiosity and leads to questions;
3. It generates a critical thinking;
4. It invites students to scientifically investigate;
5. It creates scientific and historical and artistic knowledge;
6. It requires students to use inquiry skills to explain the phenomena;

1. **Engage (30 m.) Who did it?**

It will be the spectacular context of the cathedral that will arouse curiosity in the students. We will refer to previous knowledge on the Norman period in Sicily, inviting the pupils to trace aspects of the Norman, Arab and Byzantine cultures in the cathedral. Pupils, while moving around, will have 10 minutes to observe and recognize the aspects. The observations will be shared, checked, and discussed. They will be reported in an observation sheet of the monument.

The task: In pairs, move around the Cathedral and trace 3 elements from Norman culture, 3 from Arabic and 3 from Byzantine. You have 10 minutes to observe and take photos of what you consider relevant. After that, we will all meet together again to share and discuss. Using the smartphone, create a short video – photo gallery with 3 sections (Latin, Arabic and Byzantin elements) with the pictures taken in the Cathedral. Share with the class.

2. **Explore: Nature in Paradise (60m.)**

In the second phase of exploration, the group will discover the plants represented in the mosaics (vine plant, fig, palm, tree of life) and the landscapes in which they are inserted.

After that, they will be invited to search on the web or they will be supported by the teacher to understand the symbolic value attributed to these plants in ancient times. They will work in a group and they will share their results that will be reported in a text. A question could be: Which leaves Adam and Eve used to cover themselves?

Finally, the pupils will be invited to make a personal sketch of a detail of the botanical representations or to recompose the parts of a puzzle representing a scene from the mosaics, working in a group. The final activity will strengthen the spirit of observation and the emotional aspect aroused by the artistic fruition.

Instructions for the task :

- In pairs, move around the Cathedral and trace the plants represented in the mosaics (vine plant, fig, palm, tree of life) and the landscapes in which they are inserted. Move from one side to the other and observe the scenes in the mosaics one by one. You have 10 minutes to observe and take notes and photos of what you consider relevant.
- Then, check in the net the symbolic meaning of them. At the end share your results with the class.

  Links where it is possible to find data about the use of symbols.
  https://www.christiansymbols.net/plants.html
  n.wikipedia.org/wiki/Plants_in_Christian_iconography

- Make a personal sketch of a detail of the botanical representations or to recompose the parts of a puzzle representing a scene from the mosaics, working in a group.

3. **Explain: How do they work? (60 m)**

In this section at school, pupils are provided with a Botanic laboratorial lesson .

In the biology laboratory, with the teacher's guidance, the leaves of the plants will be analysed and the teacher will illustrate their main characteristics, also in relation to the natural environment in which they grow. Through research on the net, the fundamental properties and geographical spread will be investigated. A specific analysis sheet will be provided. The online research will be carried out in pairs. (Appendix 1 and Appendix 2)

Instructions for the task:

Observe the leaves provided following the guided lesson; try the experiments and then research in the net about their habitat and their use in life.

4. **Extend: Art and Science : Can they talk to us? (30min)**

Symbology expresses an ancient wisdom of the world, pre-scientific, but still based on the observation of the characteristics and value that the natural environment has for mankind. Can the ancient wisdom of nature, also expressed through symbolism, still say something to us contemporaries? They discuss together.

Extend the research to some other artistic works (research online or provided by the teacher) that uses the same symbolism, capturing similarities and differences.

Pupils will illustrate the work in a multimedia product entitled "The tree of Paradise".

To learn more:

https://www.metmuseum.org/toah/hd/bota/hd_bota.htm

https://library.nga.gov/discovery/fulldisplay/alma99397903504896/01NGA_INST:NGA

Instructions for the task:

Can the ancient wisdom of nature, also expressed through symbolism, still say something to us contemporaries? Discuss this topic with your mate and extend the research to some other artistic works (research on the net or provided by the teacher) that uses the same symbolism, capturing similarities and differences. Then illustrate your views in a multimedia product entitled "The tree of Paradise".

5. **Evaluate**

Students are provided with a self-evaluation questionnaire (Appendix 3) to test themselves and the activity. The aim is to make the students able to express their general impression. Particularly, questions from 1 to 6 are related to what they learned; questions from 7 to 16 are related to the different skills developed; questions from 17 to 19 are related to the satisfaction and improvement suggested by the students.

The same aspects are checked by an evaluation grid based on the teacher observations (Annex 4).

ANNEX 1 : How to describe a leaf

(To be given to each participant)

SHEET Leaf observation.

1. **Materials needed: object slides and object coverslips, fine-tipped tweezers, squirts, filter paper, paper towel, stiff-backed razor blades or scalpel, dyes: floroglusin-HCl, Sudan III;**

Leaf observation.

Leaves can be looked at directly, without any special preparation, under the stereo microscope to observe stomata and trichomes from the outside.

To observe the organization of internal tissues, a transverse section of a dorso-ventral leaf is cut and mounted in water. Under the light microscope, the epidermis lined by the cuticle, the apical parenchyma, the spongy parenchyma, and, in many cases, the stomata located at the bottom of the stomatal crypts are observed; at the level of the midrib, the conducting bundles in which xylem and phloem mirror the arrangement they have in the stem can be observed.

Stomatal crypts are also visible by making the removal of a small portion of the ventral surface of the leaf, so as to reduce its thickness, and mounting the preparation thus obtained in water, with the dorsal surface facing the observer.

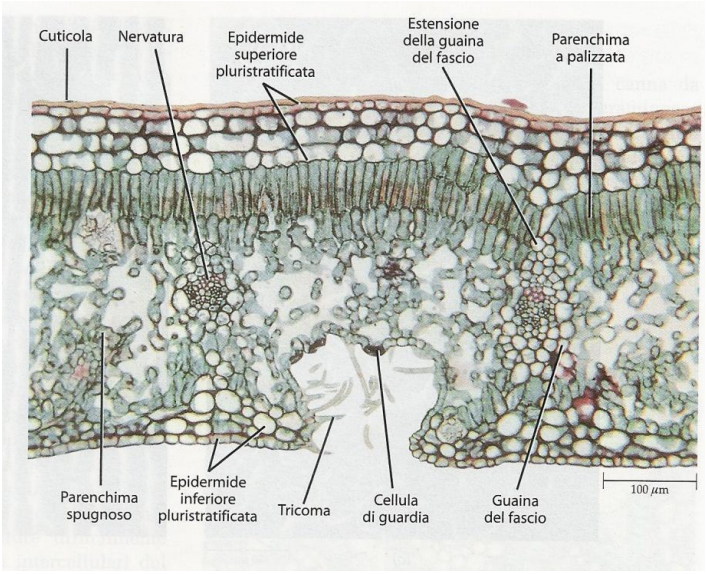


Figure 1 Cross section of Neriumoleander leaf.

Annex 2 : What the leaves are for?

(To be given to each group)

WHAT THE LEAVES ARE FOR?

Leaves make the plant's food by converting air and water into glucose (sugar).

Usually the leaf is formed by a flattened part called the lamina and a tough, elastic stalk called the petiole.

Like the stem, the petiole also has within it very thin vessels that carry raw and processed sap.

The petiole has an enlargement at the base, called a sheath.

Sometimes the petiole is missing and the leaf consists only of the lamina and sheath.

Mark the leaves without a petiole with an x.

The parts of the leaf

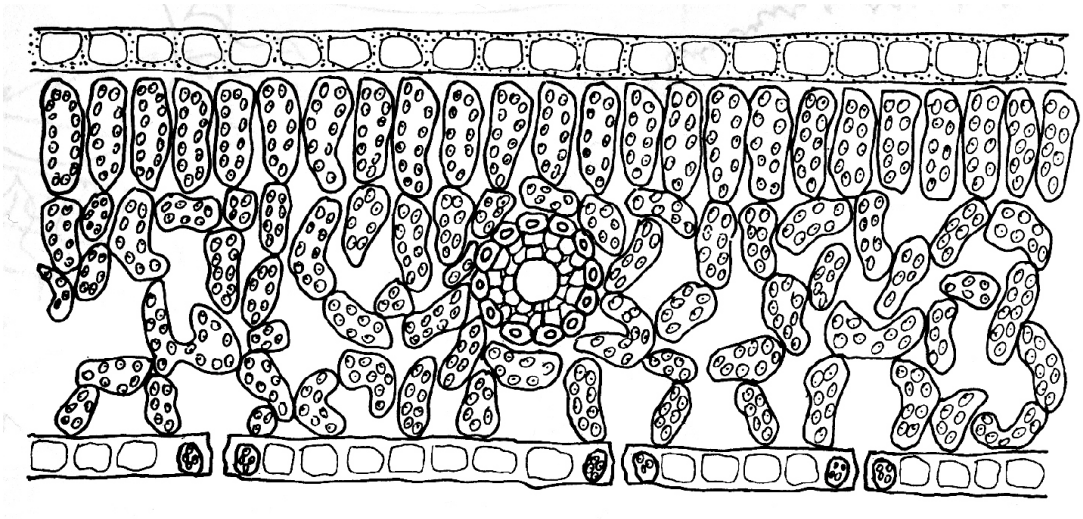
- The leaf lamina has:
- An upper, upward-facing, darker green page
- A lower page, facing downward and lighter green
- The veins, which contain the vessels in which the lymph flows
- Stomata, found mainly on the lower page; they are tiny openings that let air in and out.

Let's look at some leaves under the microscope: It is very interesting to look at the leaves under the microscope, because you can see the veins and especially the stomata better.

The leaves must be quite thin to allow the light of the microscope to illuminate them.

You do not get good results with thick leaves like those of magnolia

THE



CHLOROFILLA

SUGAR MOLECULES

The leaf is rich in a green substance called chlorophyll.

Chlorophyll is formed by the presence of certain mineral salts and sunlight in the leaf.

EXPERIMENT NO. .1....

Title: the chlorophyll

Question : Why are leaves green?

Hypothesis: Leaves are green because they contain chlorophyll, which is green.

Describe the experiment: We lay a leaf on a strip of filter paper and, repeatedly running the edge of a coin over it, draw a green line about 2 cm. from the edge.
We pour a few ml of alcohol into a glass and insert the strip so that it touches the alcohol.

Analyze the results: Alcohol runs up the paper strip displacing the colored pigment and separating it into different colors which are, starting from the bottom: brown/green: chlorophyll B; bright green: chlorophyll A; yellow: xanthophyll; orange: carotene.

Conclusion: The leaves are green because they contain chlorophyll; in autumn we see yellow, brown and orange leaves because the chlorophyll that masks the other colors is degraded.

EXPERIMENT ...2...

Title: **The stomata**

Question: What are stomata used for?

Hypothesis: The stomata allow oxygen to escape from the leaf

Describe the experiment:

- We put two green leaves in two cups filled with water.
- Then We place one leaf in sunlight and the other in a dark area.
- Wait for a couple of hours.

Analyse the results: Numerous bubbles formed around and under the sunlit leaf .

Conclusion: The gas contained in the bubbles is oxygen, a waste product of chlorophyll photosynthesis. It is released into the air by the stomata.

Annex 3: Evaluation questionnaire for students

Evaluation activity

(To be given to each student)

1. Can you tell us three things you learned in this activity?
2. What was new for you?
3. What was difficult?
4. What was surprising?
5. What more would you like to find out?
6. Did you find this activity useful

- to orient yourself through the main events of history
- to recognize and explain people's different ideas
- to make appropriate use of historical, artistic, and scientific terms
- to understand better some aspects of the natural system
- More

- In the scale from 1 to 5 (1 minimum and 5 maximum) how much analytical skills are improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much the problem-solving ability is improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much critical skills are improved?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much the ability to argue is improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much the creative skills are improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much the teamwork ability is improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much the evaluation ability is improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much the integrated subjects activity is useful ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much your language skills are improved ?

- In the scale from 1 to 5 (1 minimum and 5 maximum) how much your scientific knowledge is improved ?
- In the scale from 1 to 5 (1 minimum and 5 maximum) how much did you enjoy the activity?
- Could you tell us what would you improve in the activity?
- Would you suggest carrying out this activity with other students? YES NOT

Annex 4 : Evaluation grid for the teacher

Student ……

	To what extent she/he ……..	1	2	3	4	5
1	understands different point of view through the representations					
2	orients her/himself through the main events of history					
3	recognizes and explains people's different ideas					
4	makes appropriate use of historical, artistic and scientific terms					
5	understands the aspects of the natural system					
	To what extent …..					
6	analytical skills are improved					
7	the problem-solving ability is improved					
8	critical skills are improved					
9	the ability to argue is improved					
10	the creative skills are improved					
11	the teamwork ability is improved					
12	the evaluation ability is improved					
13	language skills are improved					
14	scientific knowledge is improved					

1 is minimum – 5 is maximum

Chapter V

Methodology to empower museums in school education

by Elpis Association -Sweden and

Museu de L'Hospitalet-Spain

Traiect STEAM

By Museum de L'Hospital

Node-STEAM Network

Without a doubt, we are bound for a highly technological future. At the same time, we are in the midst of a paradigm shift that is having an impact on the entire framework of education, which must last a lifetime. Today, educational institutions are being rethought to respond to the priorities and needs of children and young people in a constantly-evolving society. We have begun educational transformation processes in which learning goes beyond the walls of the classroom, to work with an all-encompassing approach that attempts to find connections among different fields of knowledge. In such a context, it is crucial to equip individuals with tools that will empower them to develop their skills to the highest possible degree. Therefore, STEAM has become a fundamental instrument.

Therefore, including STEAM in visits to the museums feeds a virtuous cycle that involves society, the educational community, and the museum itself, providing us with the pretext and narrative to promote a museum concept that is open, free from walls or barriers, with an entire slate of experiences that begin before the visitor enters, and do not end until they have left, and in which technologies and digital environments become invaluable allies.

As the line between virtual and real blurs and renders the two concepts complementary, integrating STEAM into educational proposals around museums and heritage brings added value because they involve visitors and the educational community, adding to the virtuous cycle in which everyone stands to benefit.

The STEAM universe opens the doors to new learning methods that intend to make students the main guiding force behind an activity. The use of these methods empowers students to perform new tasks and acquire knowledge with work focused on values, autonomy, daily life, self-management, creativity and reflective and critical thinking.

Methodologies

This model is already applied in many recent proposals and for the educational projects of diverse cultural sites in Catalonia. At this time, when educational systems are being renewed to meet the occupational needs of the future, museums must take an active role in this effort, in order to offer experiences that inspire and stimulate curiosity, the critical spirit, learning and enjoyment. This way, and with the cooperation of schools, it is possible to guarantee students' capacity to learn, resulting in minds that are more aware of and committed to facing social, cultural and environmental challenges.

Why?

Museums are places of ability-based knowledge, as they provide opportunities to develop knowledge and skills that form part of the school curriculum in a practical, hands-on way. This is a key factor in the consolidation of memory, and therefore, learning. As stated in the Museums 2030. Catalan Museums Plan, Catalan museums must be integrated into the educational life of this country, and offer non-formal learning experiences both to students and those interested in lifelong learning. In this way, as museums have an interdisciplinary nature, they promote transversal work on diverse subjects under a single educational proposal. Thus, museums play a highly relevant role as centres of knowledge and, added to this, social drivers and transformers.

How?

For this to be possible, innovative learning methods that facilitate integration within educational and territorial networks must be applied. This exhibition is meant to be a resource to expand knowledge, and expedite the addition of new active learning methods to the museums and educational services of this country.

METHODOLOGIES APPLICABLE TO MUSEUMS

"Tinkering"

"Tinkering" is a method that empowers the student. It was born out of the "do it yourself" philosophy, and the growing popularity of "maker" spaces, the main idea of which is to learn while you do; in other words, they advocate using one's hands to build learning, define the meaning of it and achieve

understanding. Their ultimate goal is to stimulate thinking while you create with your hands.

Project-based learning

This method includes development of a project aimed at responding to real challenges, by which the student learns through contact with and exploration of the object of the problem. When done this way, students become the actors responsible for their own learning, and managing the team work flow. They also have the opportunity to choose the work subject matter that stimulates them most. On another note, this method encourages them to build bonds with the project they are carrying out and the organisation accompanying them.

Design Thinking

Design thinking is a work method increasingly applied in the educational and teaching ***Design Thinking***

Thinking Based Learning

With Robert Swartz and Arthur Costa as two of its leading figures, TBL is based on teaching-learning activities articulated to stimulate more effective thinking in everyday situations. Museums can apply this method by creating projects (open to all) that can resolve real problems that are relevant to society and the country, and also defining the dissemination strategy for the project's results.

Service-based learning

SBL enables users to focus proposals to be developed on specific needs. The pathways of action can be two-way. a) FROM THE MUSEUM OUTWARD (a number of lines of work are developed to provide solutions to problems of the community, with cooperation from the cultural centre, as a driver, and the community) or b) FROM OUTSIDE TO THE MUSEUM AND WITH THE MUSEUM (regular communication circuits are created with different types of centers.

Gamification

Generally speaking, gamification is using game-based dynamics, mechanics and aesthetics in non-recreational settings to acquire, develop and/or improve certain attitudes or problems. (Kapp, 2012). Gamification is based on the idea of using the main components of games—challenges, fun and enjoyment, the rules of play, interaction between teams, rewards and excitement—at times and in contexts in which they are not common.

Flipped Classroom

Flipped classrooms turn students into active players of the learning process. This method focuses on switching the traditional teaching model around: it concentrates on having students do the practical and knowledge consolidation parts of the process in the classroom, while theory and content are learned at home. The classroom abandons its traditional format, in which all eyes converge on the teacher and the chalkboard. This model brings in more flexibility, is more inclusive than the established model and opens possibilities to work a wider range of skills.

Citizen science

This methodological approach entails organising more intense, long-term projects based on matters that are relevant to a given group. Citizen science is based on a process in which a commitment is made by different actors participating in the resolution of real problems, which reinforces the joint construction of scientific knowledge at the individual and group levels.

With the direct participation of students, the scientific model is introduced for individuals and groups to learn to solve situations or

STEAM methodology promoted by non-formal education

by Elpis

STEAM is a relatively new but the hottest concept in the modern education. The idea of STEAM gathers under the same umbrella other educational concepts-methodologies like project-based learning, problem-based learning, inquiry learning, learning by doing, outdoors learning, experience-based learning, cross /trans/multi/interdisciplinary learning, discovery-learning. All these concepts demonstrated during the years that have the power to encourage pupils, even undergraduate students, to become actively engaged in their learning process. Connor, Karmokar, & Whittington (2015) assert that this model of learning produces levels of understanding, retention and transfer of knowledge greater than those produced in traditional classes/labs.

STEAM methodology cannot be found in schools and this can be explained by "disciplinary egocentrism" described by the lack of students' readiness to engage in multidisciplinary in-depth study and on the other side, the lack of academic staff unable or unwilling to engage in alternative approaches for their subjects. (Connor, Karmokar, & Whittington, 2015)

The disciplinary egocentrism encompasses two negative factors. Negative relatedness , the failure to see and create connections of a taught theme in a given discipline with other disciplines. This limited the understanding, the ability to extend and to create new ideas and applications. Another factor is a negative perspective, a rejection of other viewpoints and a failure in recognition of other perspectives and contributions. (Connor, Karmokar, & Whittington, 2015) Further , Connor, Karmokar, & Whittington (2015) affirm that disciplinary egocentrism is more often between the educational staff as the student body and this can explain the slow acceptance of new methodologies in pedagogy. The school education strives to assist the students to know things, to improve their learning performances as a means to prepare the graduation and the graduates for real-life challenges. But the real-life challenge is about understanding things and applying and performing the best function in a given situation. Pupils need to develop skills to see things, to see connections, understand them and link information cross disciplinary. Of course, to see these links and understand them requires very good preparation in each discipline . And this is the school's opportunity- to give a valid and equal education. The strength is a high performance education at all levels and intradisciplinary deeping studies. We have chances to learn every

minute if we have an open mindset. The environment, the nonformal/informal environment, outside the schools(agencies) walls and rules, offers challenges and opportunities to learn and problems to solve. In this project we accept museums as informal educational contexts.

Museum as informal educational context

Museums and schools set different approaches on the long-life learning process. Outside the schools' walls, museums offer a rich educational environment to develop attitude, skills, and deepening knowledge. The museums inexhaustible resources of values and collections testify to the evolution of humanity from all perspectives and offer considerable learning potential and moreover create an nonformal and informal educational environment. Learning in a museum is an experiential learning and supplies the traditional learning with more hands-on activities, interactions with real artefacts and promotes all-round development of pupils. Museums offer opportunities for STEAM activities, cultivate manipulative abilities and more than anywhere emphasise cross-disciplinary perspectives and expose learners to information in an inter/intra -disciplinary manner. Unfortunately, the lack of familiarity with the museum environment and the teachers' lack of confidence or competence to attend in the museum's context weaken school-museum relationships.

STEAM approach in non-formal manner/education

Non formal education arose as a complement to formal education, to cover the lack of pedagogical resources in different fields of activities, with focus on STEAM approach. Alternative centres of education promote and develop STEAM activities (like coding, robotics, science activities, museums activities etc) after school time or sometimes in collaboration with the schools or at request of them.

The non-formal education is driven by the passion and desire to learn, is based on inquiring and curiosity. In this way the knowledge and new skills are growing naturally and are gained intuitively. In non-formal activities pupils feel free to express themselves in innovative and out of box manners. In this way it encourages a kind of innovative mindset and fosters self-esteem. Non-formal educators and staff are professional in different fields of activities with very good pedagogical skills. They offer a relaxed and motivational environment where it

is encouraged the growing of ideas and feelings and foster the appreciation and motivation for learning and positive attitudes for community

Some STEAM methodologies

In this part it will be presented some methodologies from another perspective .While traditional instruction is more deductive, starts with theories and progresses with application of these theories, the art based pedagogical approaches are more inductive. They start with the **presentation of a case study**, **a problem**, **a topic** then the theories behind them are taught or students are encouraged to discover them after the need to know them has been recognized. There are various kinds of teaching methods that are commonly used in the field of STEAM such as project-based learning, inquiry learning, and discovery learning, other that combine the previous but in different manners as **flipped classroom**, **gamification** etc**.** In terms of the most popular model of STEAM approach, **project-based learning** is regarded as the most promising. This type of teaching focuses on the creation of an artefact or a product. Although project-based learning is not officially recognized as a type of teaching, it can still embrace the principles of learning. De Graaf & Kolmos(2003) identify three kinds of project-based learning:

Task project – defined by instructor, usually prescribes methods. This kind of project is a traditional instruction to create the educational ground for development. An example from our project can be using the instruction to create a table in excel and to write formulas.

Interdisciplinary project- the theme of the project and general rules of approach are defined by the instructor; the students identify the specific approaches and design the project. This method has a theme, a concept model that integrate theoretical concepts and methods from different taught subjects. This method requires certain aspects and experiences of the involved subjects in different phases of the project. Ex Minimooc: The Game etc.

Multidisciplinary project- has a theme that is studied from different disciplinary perspectives and methods, which are brought together to address a common problem. There are examples in our training like The Greenhouse, The Birds, The Primates, The Dance.

Inquiring based learning the students choose their problem/project and approach. The question is related with real-life situation. This learning environment is often connected with hand-on activities and engage the students and stimulate curiosity.
The weakness in this approach is the understanding or confusion of inquiry or the problem that should be the ground, in many cases the project is not inquiry- based. Another weakness in which degree is the project "student-centred". These two weaknesses may lead to an insufficient acquisition of necessary knowledge and skills and make the approach useless.

The method most connected with museum's artefacts is **Object-Based-Learning** (**OBL**). OBL is a student-centred method using objects, in museums perspective artefacts from museums, for a deeper understanding. This method is strongly connected with active and experiential learning experiences. OBL emphasis the learning and long-term retention through directly sensorial connection with the object of study as a source of inspiration and personal meanings making. OBL uses a variety of methods of investigation such surveys, semi-structured interviews, focus groups and observations. In our project this method was used by Italy - Imago Mundi , Sweden (Elpis)- The Game and Turkey - Photography. The students could have sensorial experiences to see, touch artefacts from museums, to travel in time and see, play, experience how our ancestors lived.

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The end