STEAM ing ahead
Fostering critical thinking, problem-solving and creativity

Co-funded by the European Union

IC Battipaglia Salvemini - Italy

THE STEAMing ahead

L.I.V.E

Lively – *Inclusive* – *Vertical* – *Exciting*

Abstract:

The STEAM disciplines, for their variety, make learning *Lively*, able to develop creative, cognitive and metacognitive skills and, at the same time, social, relational, emotional, in a dimension of collaboration, *Inclusion* and connection with the world and with people. They are an opportunity for collective growth and the development of transversal skills in the *Vertical* curriculum starting from Kindergarten school. The *Exciting* aspect of STEAM disciplines has been working with smart technologies. In particular, what fascinated our students was the study of **Golden ratio** and the awareness of its double nature, that is, the quantitative aspect and the aesthetic one. In fact, it has the ability to make beautiful and harmonious objects and in particular everything what affects our senses, making many elements of nature live.

INTRODUCTION

Much more than an acronym, the word STEM refers to an engaging and inclusive teaching approach for girls and boys, in order to bridge the gender gap in these disciplines.

It is an approach to teaching/learning, in which greater space is given to critical thinking (asking questions, not taking things for granted), creative thinking (imagining alternatives and looking from multiple points of view) and performative thinking (translating thoughts into actions with real and constructive impact), with the aim of creating the problem-solvers of tomorrow.

A question of mentality and method rather than content.

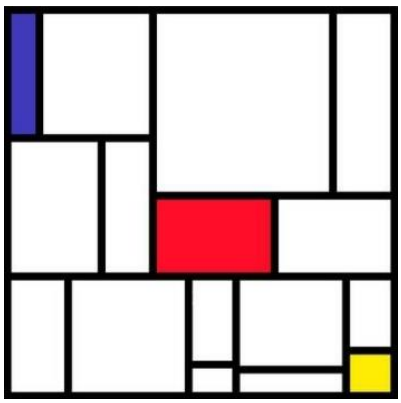
The scientific method is the heart of the STEM approach. In the strict sense: question, observation, hypothesis, experimentation, measurement, formalization, public and continuous comparison. In a broad sense: curious openness towards reality, criticism towards all imposed knowledge, tolerance towards every position as long as it is supported by rational arguments. Just as in science it is not enough to declare, but it is necessary to demonstrate and know how to do, even in teaching that is inspired by the STEM approach it is not enough to read and repeat, but it is necessary to get hands-on and show results: if the kids don't try first person, if they don't get involved, starting from a problem and on the basis of solution hypotheses, with visible results, how can we affirm that they are really capable of doing something? If they know things, but don't know how to put them into practice, how can we talk about authentic learning?

PERFORMED ACTIVITIES

By participating in this project, our students were involved in various activities that saw them operate in different contexts, they discovered the golden ratio and its application in multiple fields, from art to architecture to botany, etc.

MATART

We started from Mondrian's painting to understand what the golden section is and how it is applied in geometry to obtain particular shapes: golden rectangles.



TOUCH SCREEN PEN

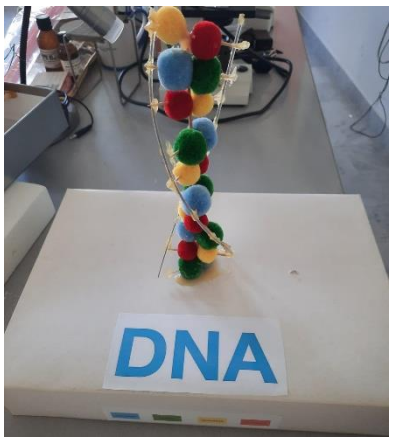
Discovery of current-conducting materials

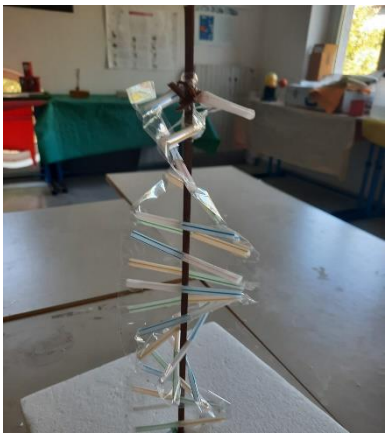
3D FOOD PYRAMID

It was created to explain in a simplified way which foods should be consumed more or less often to live healthy**.**

STRUCTURE OF DNA (3D MODEL)

DNA constitutes the fundamental substance of the gene and is responsible for the transmission of hereditary characteristics.



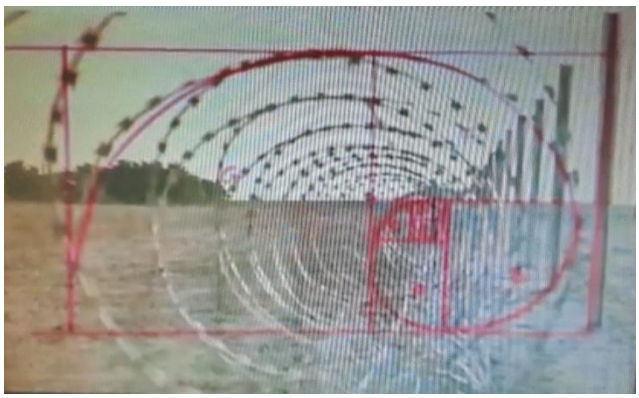


SUSPENDED GARDEN

The structuring of a vertical school garden aimed to promote among pupils: • ecological education to reconnect them to the importance of water • the principles of environmental education through sowing, care and composting activities. • physical and psychological well-being. • care for one's territory and respect for the planet's resources. • well-being and socialization, necessary factors in the formation of sustainable communities.

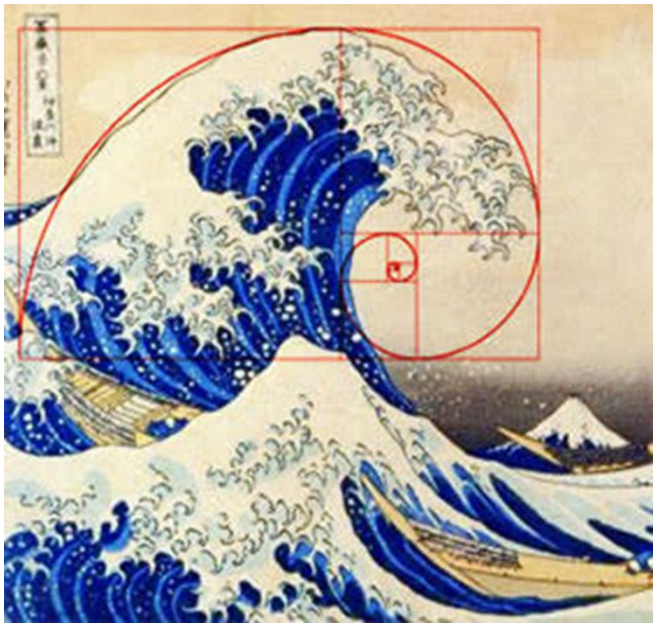
WAR

Addressing the theme of war we found the golden section even in the arrangement of the barbed wire!!!!



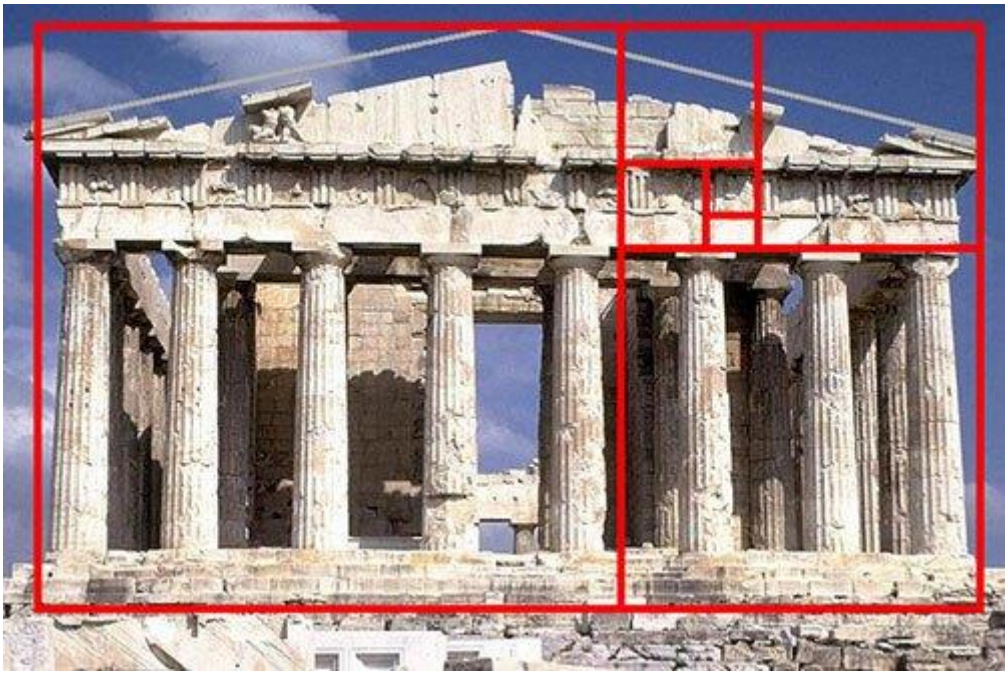
THE SEA AND THE GOLDEN SECTION

The pattern of the waves, originating from marine currents, reminds us of a golden section, as do other "inhabitants" of the sea depths.



ARCHEOLOGY AND GOLDEN SECTION

In a place very close to us we found a golden rectangle and therefore our dear golden ratio applied to the architecture of many years ago!!!!!



FEEDBACK ON STUDENTS

The three fundamental phases of the STEAM activities carried out with the students were:

1. Heart: the engagement phase, where teachers must capture the attention of the children and propose the activity to them, launching it as a both cognitive and practical challenge
2. Hands: the exploration and elaboration phase, in which the students carry out the task/project, usually divided into groups, trying to follow the essential steps of the scientific method and using technical-engineering applications, in order to arrive at products visible towards that kids are attracted to and ultimately proud of, because they created it
3. Head: the Lecture phase, i.e. the lesson which systematises what the students have done, raising them to a more general conceptual framework, reserving a time for the presentation and re-elaboration of the results to be tested and evaluated.

The students showed responsibility, effective and constructive collaboration, attracted by the new methodology which saw them as protagonists in the proposed activities.
The opportunity to achieve a unique and personal achievement, to create something they have designed and planned instills a sense of ownership, personal pride and responsibility, and the perseverance to succeed. The key for these desirable attributes to emerge lies in the pedagogical decision to forego prescribed step-by-step models and processes and leave students with the personal choice to creatively design the learning path. Approaching learning in a context where there are no boundaries between subjects and where the focus is only on asking and seeking answers encourages natural curiosity in students. Closing knowledge into categories that don't connect is harmful to our students, because in the real world, everything blends together. When a topic sparks curiosity, this is the first step in inquiry-based learning. Students guide their learning through the questions they ask, discovering the answers themselves. They also share and reflect on what they learn, taking ownership of their learning at every step. In inquiry-based learning, the teacher serves as an educational guide, not as a sage on the stage. Teachers are there to monitor student progress, provide structural support when needed, and ensure that the focus remains on student questions and observations.
Students were given greater autonomy and this helped develop their critical thinking and problem solving skills.

TEACHERS' EXPERIENCES

The forms of activity that a teacher must have clearly in mind when programming and which allow this intertwining of Know-what and Know-how are essentially of three types:
a) **Problems:** a Problem is something that is not well understood and that needs to be resolved
b) **Tasks**: a Task is something that must be done to achieve a certain result or fulfill a certain role
c) **Projects:** a Project is a path of conception and implementation that leads to a certain product.
To apply this type of teaching methodology, teachers need time, space and resources to plan in groups, they must be willing to get involved and experiment with new paths, distancing themselves, when necessary, from the comfortable frontal lesson, while maintaining the essential objectives of the teaching unchanged. their teaching activities, and finding the right balance with the more traditional aspects of teaching, which can still be difficult to give up. The approach of individual teachers to activities designed in a laboratory and active manner, interdisciplinary and linked to problem posing and problem solving strategies, is calibrated and diversified depending on the educational background of each teacher and his/her training.
The training of the teachers involved is of great importance, as is their motivation and willingness to follow self-training paths, which are often essential in the path of every teacher.
Transversal skills or soft skills are recognized around the world as essential in work and life. However, their importance has increased exponentially due to the accelerated rate of change in society that we are experiencing globally today, particularly the transformative and all-pervasive impact of digital technology and the internet, combined with the effects of globalization. The main transversal skills, which are most relevant regarding STEAM activities are:

1. REFLECTIVE THINKING AND PROBLEM SOLVING
2. COLLABORATION AND COMMUNICATION
3. LEARN TO LEARN
4. DIGITAL SKILLS AND MENTALITY
5. INITIATIVE AND INDEPENDENT THINKING
6. CREATIVITY
7. SELF-DIRECTED LEARNING
8. SOCIAL SKILLS

Therefore, in developing transversal skills through the application of different educational methodologies included in the STEAM approach, the student is an active subject in the learning process, tends to show greater motivation to learn and is more likely to realize his/her potential and his abilities. This change from traditional education emphasizes the interests, skills and learning styles of each student, placing the teacher as a co-agent of learning.

***Steaming AheaDisability*: Inclusion and STEAM, a winning partnershi to achieve the fundamental objective of all training courses: "being able…"**

During the Erasmus STEAMing Ahead project the IC Battipaglia Salvemini took part in the planning and implementation of STEAM activities. Various classes were involved in the activities in which there were students with more or less serious disabilities. Each activity involved the full and active participation of all students, without the need for dispensatory measures and with a reduced number of compensatory tools.
The students involved reasoned, formulated hypotheses reporting various points for reflection, discussed with their classmates, stimulating everyone's curiosity and interest. During the activities, each student developed positive attitudes and learned to interact with their classmates, respecting each individual's learning times.

STEAM disciplines represented an effective teaching tool for the promotion of equality, the valorization of individual differences as an opportunity for collective growth and the development of transversal skills and favored the integrated construction of personal and professional identity. From this perspective, they were an opportunity for emergence and realization for all those students with disabilities characterized by an introverted personality but placed in the right conditions, with the right tools and a correct methodological approach, these students acquired awareness of their abilities and had the opportunity to fully realize one's individual characteristics. STEAM activities have played a key role in the inclusion of all those students who struggle to emerge in competitive contexts or those involving group dynamics. The collaborative approach has allowed us to nourish and complete our ideas through exchange with others and allows us to develop that part of emotional intelligence as a skill linked to relational effectiveness.

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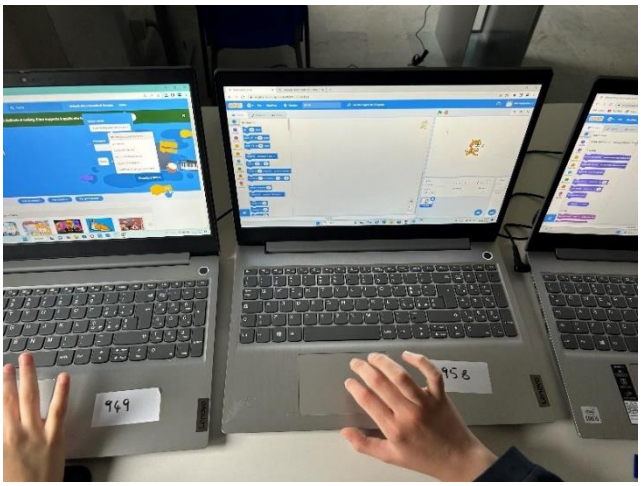

The results produced highlighted the attention of the new generations towards individual difficulties and towards possible concrete solutions. STEAM methodologies have managed to change a largely traditional practice, enriching daily teaching with more engaging and stimulating approaches both for students with disabilities and for those who, despite not having certified disorders, had often expressed boredom with school work.

CONCLUSIONS

In today's world, preparing students for future success means introducing them to these disciplines holistically to develop their critical thinking skills. Teaching STEAM subjects prepares students for life, as they are central both to their future employment and to the development of modern society. Integrating STEAM activities into school curricula has great potential in providing a richer educational experience. Students can acquire a different way of thinking based on the fact that the more you fail, the more you win. Education can be playful and natural, showing them the relationships between subjects and real life, thus increasing their sense of motivation, self-efficacy and their problem solving skills. These skills can be used throughout life to help them overcome difficult times and take advantage of opportunities whenever they arise. The project we have developed believes that teachers and schools can harness this "revolution" to make curricula more relevant, inclusive and useful. This process doesn't just need experienced teachers, but rather passionate people interested in giving students the best education possible.

The STEAM approach constitutes a valid teaching strategy to enhance the resilience, antifragility and learning abilities of the most vulnerable students. The activation of STEAM educational paths within the project made it possible to confirm the discovery made during the exploratory phase, which concerns the possible correlation between the creation of holistic training paths involving, therefore, humanistic and scientific disciplines and the level of resilience of the learners. To this trend that emerged during the exploratory phase, an even more specific observation was added, concerning the achievement of the most satisfactory results by the most vulnerable categories. Educating in STEAM, strengthening knowledge, awareness and the ability to solve problems are important prerequisites for improving skills, reducing vulnerabilities and educational poverty and building a culture of safety and resilience at all levels to be able to face the challenges of our time such as disasters, multiculturalism. The exploratory phase made it possible to consider the results of this research as an indication of a trend starting from a pilot project focused on an interdisciplinary STEAM-type training course. However, to hypothesize and study significant variables that can influence the fight against educational poverty and to identify the contributing causes that fuel scholastic and professional failure, this didactic experience has created the need to open up research which, starting from the experience carried out , orient and guide the construction and validation of a possible meta-model for the design of the training offer. The topics covered certainly represent the challenges that the school of the future will have to face to guarantee a functional educational space for innovative and inclusive teaching, capable of combating educational poverty. In fact, the varied topics, selected following a well-defined logic and teaching strategy, are intertwined in the network of the interdisciplinary STEAM approach. STEAM, therefore, in the light of this teaching experience and through a fruitful dialogue between the human, social, physical, mathematical and natural sciences, engineering and the use of new technologies, seems to offer original and innovative ideas and teaching strategies for reduce educational poverty and stimulate the resilience and antifragility of pupils in conditions of greater vulnerability.