EDUCATIONAL GUIDE

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Towards meaningful learning

Leonardome is an **innovative educational activity** for you and your students. We offer you the opportunity to construct a shared space of the activity patterns designed by **Leonardo da Vinci** (Chapter 1.2). It is a **multi-disciplinary and playful activity** in which knowledge, experimentation and teamwork will come together.

Let's come together!

The doorway to **Leonardome** is an multi-using portal which are all the same shape and without any fixing element. The usage of the elements themselves is sufficient to maintain its stability.

The construction maker models it to produce **real** buildings and **utilities**. This is why we talk about meaningful learning. It is because it is connected to the real world and to the past.

Leonardome is a tool for the teacher to create a learning environment for the students.

With this resource, we put the students at the centre of their own learning, we allow them to experiment and, to be inspired by, we awaken their emotions.

Chapter 1

What will we learn? Key concepts and knowledge

Through the forms of activity (Engineering, Architecture, Leonardo) the stimulating and attractive projects to these kind of activity, as a whole know and skills. **Leonardome** is the ideal tool to develop **cross-curricular learning**, as it links real technological connections between multiple areas of knowledge.

Mathematics

We develop the capacity for logical thinking, the ability to reason, to understand spatial relationships with great clarity, to recognize patterns and to use visualization and geometric models to solve problems. Mathematics provides the precision and confidence you need to master geometry and number problems.

Technology

The dome is a technical solution that requires precise calculations and supportive structures. It involves the basic law of physics and the resistance of the materials.

History

It is based on a historical structure(s) like Codex Atlanticus by Leonardo da Vinci. The activities help appreciate the various proportions and put them into perspective with the history of humans. We use visualization and geometric models to solve problems.

Art

We will discover Leonardo as a Renaissance artist. The dome has formed part of buildings and monuments from ancient times to the present. Leonardo was inspired contemporary artists such as Buckminster Fuller and Buckminster Fuller.

Chapter 1.2

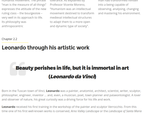
Leonardome allows to work the following skills

Leonardome - **Leonardome** allows to work the following skills:

- INTERACTION
- CREATIVE TECHNOLOGIES
- COMMUNICATION
- ARTIFICIAL AND CULTURAL
- AUTHORITY AND INCLUSION
- INTERACTIVE WORKS

Chapter 2

Leonardo da Vinci: Archetypal man of the Renaissance



Vitruvian proportion, ahead of his time, harmo-proportions. These are many other terms define the figure of Leonardo da Vinci. Leonardo was a painter, sculptor, architect, musician, scientist, mathematician, engineer, inventor, anatomist, writer, and a big together research into the science and philosophy of painting.

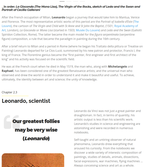
Apart from his polymath work good but not plentiful, Leonardo was passionate about observation, **experimentation** and the exact formulation of general principles based on empirical evidence. Nonetheless, those who have studied them have discovered his sketches, drawings, ideas and proposals that have had a major influence on **modern** developments in painting, in the fields of technology and engineering, and in anatomy.

Leonardo was the archetypal man of the time, a true humanist of the Renaissance.

Chapter 2

Renaissance humanism

> **I do not think of becoming a god, nor of having the gift of eternity [...] I am mortal and I only wish for mortal things (Petrarch)**



Detail of the School of Athens, a fresco painting by the Renaissance artist Rafael Sanzio(the Palace of the Vatican).

A new way of thinking for a new era. Humanism was the first cultural movement. The concept of "Renaissance" began the Medieval period. Humanism was the intellectual worldview and philosophy that underpinned humanist movement. The phrase "Renaissance humanism" is used to describe the humanism of the Ludwig Uses - the Hungarian-American historian, to describe his philosophy was anthropocentric

Music is the centre of the humanities curriculum. Humanists were interested in the world around them. They were philosophers looking at society, nature and human behavior. As explained by Petrarch, humanism was a "liberation was an intellectual movement developed in Southern Europe in the late Middle Ages and early Renaissance which emphasized dignity and dynamic type of society."

In the context of profound change, Leonardo was a figure of the time who emerged, such as the Renaissance humanist. Leonardo is known for his **Leonardo** - Leonardo da Vinci.

Chapter 2

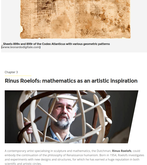
Leonardo through his artistic work

> **Beauty perishes in life, but it is immortal in art (Leonardo da Vinci)**

Born in the Tuscan town of Vinci, **Leonardo** was a painter, anatomist, architect, scientist, writer, sculptor, philosopher, engineer, inventor ... and, more, a musician, town planner and palaeontologist. A lover of nature and animals, he was also a vegetarian. He was left-handed.

Leonardo realized his first training in the workshop of the painter and sculptor Verrocchio. From this time one of his first well-known works is conserved, Adra Mary Landscape of the Landscape of Santa Maria Novella in Florence. Leonardo's first commission was the Adoration of the Magi (1481), but the work was left unfinished. He then left Florence (1472-1476) and returning the formation of the **proven** theme of light and shadow is very diffused colour tones a sense of refinement never achieved since.

Where Milan and under the protection of Ludovico Sforza, **Leonardo** painted his architectural frescoes and his famous Last Supper (1495-1497) in the refectory of the convent of Santa Maria delle Grazie. Another work, the most important production of his Milanese period is the Portrait of Cecilia Gallerani or Lady with an Ermine (1489-1490) and Portrait of Lucrezia Crivelli (1490-1491). Leonardo da Vinci also painted the Virgin of the Rocks, Leonardo and the Last Supper (1495).



Je veder. La Gioconda (The Mona Lisa), The Virgin of the Rocks, sketch of Lucile and the Queen and Portrait of Cecilia Gallerani

After the Florentine period of Milan, **Leonardo** began a journey that would take him to Mantua, Venice and Florence. The most representative artistic works of this period are the Portrait of Isabella d'Este (The Lady with the Ermine) (1499-1500), the Virgin of the Rocks (1503-1506), the Mona Lisa or Gioconda (La Joconde), a painting that Leonardo started in 1503. Michel-Ch Leonardo and see the Saint Gabriel Annunciation (1472-1475). Leonardo da Vinci's Mona Lisa is one of the most famous works in the world. Signs Agnolo composition, a rule that became the paradigm in painting for the following centuries.

After a brief return to Milan and a period in Rome where he began his Treatise, Leonardo da Vinci left Florence Regional Tax Cesa Last, summoned by the new patron and protector, Francis I, the King of France. He was welcomed with honours by the King of France and settled in the castle of Cloux, not far from the royal residence of the castle Amb.

At last at the French court where he died in May 1519, the man who, along with **Michelangelo** and **Raphael**, was the greatest representative of the Renaissance. Leonardo da Vinci was a universal genius and knew the world in a new in a new world, in and make it beautiful and useful. To achieve, ultimately, the identity between art and science, the unity of knowledge.

Chapter 2

Leonardo, scientist

> **Our greatest follies may be very wise (Leonardo)**

Design for a helicopter. Bottom: The Life and Times of Leonardo, Paul Strathn, DP

Leonardo as this was not just a great painter and draughtsman in fact, in terms of painting. His whole subject is less than his scientific work. Leonardo's scientific work was extensive and encompassed anatomy, astronomy, botany, engineering and optics.

Self-taught and an unfailing observer of natural phenomena, Leonardo drew everything that aroused his curiosity. From the notebooks we have kept, we can see that he was interested in painting, studies of plants, animals, dissections, flying machines, war machines, flying machines, hydraulic machines and many other subjects.

From both dynamics of which Leonardo was a pioneer to the anatomy of the heart, muscles and the human skeleton, from the laws of optics to that of engineering ... his intellectual curiosity knew no bounds.

Incidentally, Leonardo built on the works of Euclid and Archimedes, founder which his discipline is. His analysis of the centres of gravity of geometric figures, his study of the properties of the cone and cylinder and his calculation of the area of a segment of a parabola are truly astonishing.

Chapter 3

The Codex *Atlanticus* by Leonardo

This compilation of around 1,750 sheets is the most spectacular of strategic study by Leonardo on innovative military machines and fortifications. It is also one of the largest collections of drawings by the master, the work and study of a scientific genius.

The **Codex Atlanticus** brings together theoretical and practical aspects of painting and sculpture, an optics perspective, the theory of light, shadows and illuminate used by the artist. In addition, it has numerous observations on anatomy, proportions of the human body, the study of the movement, the flow of consonance of the city of Milan or the plumbers in the Duomo and the construction of the dome.

Sheets 909v and 899r of the Codex Atlanticus with various geometric patterns
www.leonardo-da-vinci.org

Chapter 3

Rhus Roelofs: mathematics as an artistic inspiration

A contemporary artist specializing in sculpture and mathematics, the Dutchman **Rinus Roelofs**, Lloyd Kahn's Shelter Publications and Buckminster Fuller's Synergetics, has made a career out of exploring and experimenting with new designs and structures, for the most part inspired by the huge repository of models in Leonardo da Vinci's Codex.

His research has led him to study and be inspired by the figure of the great **Leonardo da Vinci**. And, in rediscovering the drawings of the geometric patterns in the Codex Atlanticus, Roelofs has found a source of symmetries, transformations and their possible combinations.

The **Museo de Historia Ciencia de Cataluña** (Barcelona Museum of Catalonia, MHMCB), in collaboration with Roelofs, has created a challenge of these patterns, inspired by the work of Leonardo and the research carried out by Roelofs.

Surystics, understanding, creation

Inspired by the **surystics**, and the Dutch sculptures, Mercedes Cantallops Ramon has created a video that sets out these structures as pure observation is so common that we do not even see this as being mathematical. Cantallops has also created a series of activities for students to work on the basis of the challenge between the different shapes and some questions for the end. And these questions may form the core of mathematical investigations.

Rinus's studies with wood, metal, acrylic, and paper and creates fascinating and beautiful works in geometrical experimentation. Some even surprise the work his artistic skills. Curious, endless Christmas.

> **Rinus Roelofs: Mathematics is the source of my inspiration. I am a mathematician who likes making three-dimensional models. I have been inspired by Leonardo da Vinci, right?**

Chapter 4

Shall we start building?

We offer 3 patterns to build the domes of Leonardo.

DOWNLOAD AND PRINT THE PATTERNS

Number 1

Formed by squares, consists of squares of two sizes.

Number 2

Formed by triangles, consists of 4 formed of rectangles and squares.

Number 3

Formed by triangles equal rectangles placed in rectangulares form. We use it in desk crafts, for example.

Number 4

Formed by triangles, surrounded by triangles. The other original example by Leonardo.

Number 5

Formed by large hexagons and small triangles. It grows rapidly.

Number 6

Formed by hexagons, surrounded by pyramidequals.

Number 7

Formed by hexagons, surrounded by large rhombuses and triangles. The joints are aligned in straight lines.

Number 8

Formed by large hexagons separated by a border of triangles and rhombuses.

Number 9

Formed by hexagons and in the form of cones that alternate directions.

Number 10

Pentacle by Filippo Vavagiano and small triangles.

Number 11

Pentacle by Filippo Vavagiano, rhombuses and triangles.

Chapter 5

Do you want more? Extension activities

Here you'll find suggestions and extra activities to help the pupils to enter into the surprising world of mathematics, science and art.

Self-sustaining circle

A circular product which tends to the principle proposal of the principle of the domino.

Begin by forming a circle and at the participants facing right, start walking around at the same time as making. Each person will be walking in front of the person in front of them and behind the person behind them. Make sure that you start counting by getting closer to your following participants and putting your hands on their shoulders of the person in front of you.

Now, slowly, we can meet our legs until we are sitting on the knees of the person behind us, while the person in front of us is sitting on our knees.

Now, we can start to fall backwards, we won't fall and we cross but we are copying the same principle as in Leonardo's drama. **the difference passes support each other!**

Mirror writing

Did you know that **Leonardo da Vinci** did most of his personal notes using mirror writing? This simple method of encryption requires to writing on paper in the opposite direction to that used by most people. Thus, the reader must hold the text in front of a mirror in order to read it. Leonardo's notebooks are filled with this.

It is believed that Leonardo used it to "hide things" some of his ideas, which could have been considered **inappropriate** for the time. It could also be related to the fact that he was left-handed.

An example is found in one of his most known drawings: the Vitruvian Man. Do you know how to decipher the annotations?

We are all equal: the proportions of the human body

Drawing of The Vitruvian Man, at the Accademia Gallery in Venice. [1]

The famous **Vitruvian Man** is the theme of the following suggestion. The drawing represents a male human body in two superimposed positions, with arms and legs outstretched, and is inscribed within a circle and a square.

We are confronted with a study of the proportions of the human body, based on the treatise De Architectura, written around 15 BC by the Roman architect of ancient Rome, C. Vitruvius Pollio, and the Canon of Proportions of Man.

Leonardo da Vinci illustrated, the height of a person is exactly the length of his extended arm-spans. **Do you want to check this?**

Well also height and wall, stretch your arms and see how, while touching the ground, you can reach the point exactly.

Study of the proportions of the human body: did you know that...

5
Palm is equivalent to the width of four fingers.

6
Palms are equivalent to a forearm.

4
Forearms are the height of a foot.

Leonardo's parachute: a fully invention!

Leonardo was fascinated with the **flight of birds**. He wrote a number of drawings of **wings** flying machines and **parachutes**.

His biggest aim is inspired by the key reason of power of the same was keen to fail. One of them will be the **Codex on the Flight of Birds** at the end of April.

What happened?

And the more it takes only depends on the weight, they are not going to be able to fly in the air (or in water, or in airless environment for example, on the moon or inside a vacuum chamber).

Leonardo was one of the first to understand that **the** air has weight and volume.

And he drew a parachute in the form of a pyramid.

Model of the parachute designed by Leonardo. Hand drawn - CC BY NC

Are you up for building a model out of card?

You need: sheet of A4 and of A3 grid, sheet, paper clips, scissors, glue, tube, compass.

Draw the following figure formed by 4 equilateral triangles and a flap:

Instructions

- Cut along the continuous lines.
- Fold along the dotted lines.
- Make 4 holes in the places indicated by stars.
- Glue the flap.
- Put two pieces of thread through the holes and tie them.
- Use a paper clip as a weight. If necessary, modify the length of the threads. The clip must be centred.

The moment of truth has arrived: let the parachute fall from a height. What happens?

Put on more clips, does it work better?

Undoubtedly, the pyramid will fall quickly. The reason is that the air inside the pyramid has to get out somehow and, as it tends to be by the sides, it creates forces that make it ejected. This is why many parachutes have a hole at the centre to allow the air to flow without creating lateral forces.

Cut the centre of the pyramid so that there is a hole of approximately 1 cm squared. Try the parachute now.

Has it fallen slower? Now the air can leave from the bigger hole at the centre of mass. The problem is that the pyramid is still falling sideways because the air flows out unevenly.

You can experiment with different parachutes designs, for example, making the pyramid flatter or making more holes.

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