# APPLYING COMPUTATIONAL THINKING TO HUMANITIES AT SCHOOL

## TOOLKIT for primary school formal and informal educators

This educational toolkit for teachers and informal educators, which targets students between 6 to 12 years old, has been created with the aim of answering the following questions:

Can computational thinking be applied to cultural heritage and humanities subjects?

In which way this approach can be beneficial for pupils and teachers?

# INTRODUCTION

## What

Cult-tips toolkit is an online free resource and guide for primary school teachers and educators who want to combine computational thinking with cultural heritage either in school teaching or in informal educational contexts (such as museums). Lesson plans contents and activities are addressed to kids from 6 to 12 years old.

## Why

Cult-Tips project focuses on computational thinking as a vital skill for pupils' futures promoting the application of this approach not only to science and maths, but also to humanities. The Toolkit has been created to give educators a practical guide to introduce this approach into their teaching activities (in art, geography, history, language, literature).

Computational thinking can help children develop a problem solving attitude:

- articulating and decomposing a problem
- thinking logically
- recognizing patterns and similarities
- recognizing and retaining only pertinent information
- learning by trial and error
- finding solutions
- designing algorithms

And all this can develop practical and essential skills along the way, putting to use hard and soft abilities, such as:

- Teamwork
- Navigating social situations
- Persistence
- Deep thinking
- Physical, emotional, and logical perception
- Information analysis
- Information retention
- Resource recognition and management

## How

By combining subjects which are traditionally taught separately, we hope to engage more pupils with both computational thinking and art, culture and cultural heritage. This leads to new collaborations between teachers and to new combination of disciplines: arts teachers can collaborate closely with STEM teachers, new lessons take form and new chances of outdoor education occasions are created.

# INTRODUCTION

## Using the Toolkit

Our classroom toolkit provides teachers and pupils with ready-to-use lessons and activities. Every partner in the project has developed two country specific lesson plans, using one plugged and one unplugged methodology. Lesson plans can be easily adapted to different local contexts. Each lesson plan has been tested in class with teachers and pupils, leading to a final toolkit resource that can suit the needs of individual classes in different countries.

The toolkit offers a variety of computational thinking examples to be used either in class or in informal educational contexts, using both plugged and unplugged methodologies, and addressing ~~to a range of~~ an age target from 6 to 12 years old kids.
All lesson plans incorporate step-by-step procedures, learning activities, external links, tour ideas and a glossary to deepen the different subjects. Teachers are encouraged to use the contents of the toolkit to suit their curriculum and the interests of their students.

## Glossary

Here the definitions of some terms you will find throughout the toolkit:

**Computational thinking**: a set of problem-solving methods that involve expressing problems and their solutions in ways that a computer could also execute. Thinking like a computer: in a logical, step-by-step way.

**Coding**: is the process of creating instructions for computers using programming languages.

**Plugged approach**: using specific computer softwares and technologies to code.

**Unplugged approach**: using methods that allow learners to access computing concepts without the use of a computer.

**Hands-on activity**: doing a particular thing, rather than just talking about it or getting someone else to do it.

**Digital skills**: the skills needed to use digital devices and technology.

# SUMMARY


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PLUGGED
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PLUGGED
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# WHERE CAN I DISCOVER SYMMETRY?

KEYWORD
artworks

TYPE
plugged

AGE
9-11

PRINT IT!

## Description

The activity helps students reflect on the concept of "symmetry". We realize that we notice symmetry every day because we live in a symmetrical world. The concept of symmetry is crucial for architects, designers, weaving interiors, tailors sewing clothes and other specialists in the field. Symmetry is order and coherence.

## Scope

Students will discover symmetry with respect to a line or point in nature and various historic/cultural objects in the world, while developing many important soft skills - effective communication skills, teamwork, dependability, flexibility, leadership, problem-solving, research, creativity, work ethic, and, of course, Computational Thinking.

## Target

9-11 years old

## Tools

- https://www.mathsisfun.com/geometry/symmetry-rotational.html
- https://www.mathsisfun.com/geometry/symmetry-artist.html
- https://www.livescience.com/4002-symmetry-nature-fundamental-fact-human-bias.html

## Materials

- Computer, LCD projector, internet;
- paper, paint, markers;
- https://www.mathsisfun.com/geometry/symmetry-artist.html (Watch and train how symmetry works in relation to the line).

## Procedure Step-by-step

### 1. Warm-up questions

Start a discussion with students on the question: "Can we discover symmetry in nature and in various objects in the world?"

Give them a chance to interpret and defend their point of view. Make a short debriefing and conclusion: Symmetry is not only the concept used in mathematics. Without symmetry, architects wouldn't be able to design objects, tailors to model clothes, etc.

### 2. Hands-on activity

Divide students into groups. Each group will need to find out how symmetry works with respect to the line using the reference: https://www.mathsisfun.com/geometry/symmetry-artist.html and symmetry with respect to the point: https://www.mathsisfun.com/geometry/symmetry-rotational.html.

Once each group finds out how symmetry works in terms of line and point, each group has to choose one of the suggested countries in the world to look for different historic/cultural objects that are symmetric.

In each country, three symmetrical objects must be discovered. At least one of the three objects must be symmetric with respect to the point, the other two with respect to the line. Then, they have to prepare a slide presentation so as to present their work to the rest of the class.

### 3. Final Discussion/Reflection

- Encourage students to compare and contrast the buildings presented by each group. (You may use Double Bubble Mind Maps to visualize the outcomes. https://www.dvusd.org/cms/lib/AZ01901092/Centricity/Domain/1535/map-double-bubble.pdf)
- Ask them to name one thing that was the easiest, one that was the most challenging, and one that surprised them most.

### 4. Wrap-up

It might be useful to point out that there is always a possibility to apply the theory gained in the classroom to the daily life.

## Duration

**30 minutes** for introduction to the topic, building (making a structure) the approach and forming research teams of students.

**40-60 minutes** for the projects to be developed.

**20–30 minutes** for presentations, discussion and wrap-up.

## Digital skills required

No digital skills required.

## Competencies acquired by kids:

Communication skills, teamwork, dependability, flexibility, leadership, problem-solving, research, creativity, work ethic, Computational Thinking.

## Curriculum Links

Mathematics, Art

## On tour

After presentation of the topic, and working out the theoretical part, it is possible to set out and look

for the symmetrical objects practically anywhere: in the museum, art gallery, some historic site or

plan the tour using the https://en.actionbound.com/ visiting some monuments.

## Glossary

- **Line symmetry:** This just means the figure is all symmetric about the line; just like the mirror image.
- **Point symmetry:** This means when from point we check the two diametrically opposite sides (opposite points) they are same.

# FROM NUMBERS TO LETTERS TO EXPLORING THE MUSEUM!

KEYWORD
artworks

TYPE
unplugged

AGE
9-11

PRINT IT!

## Description

Students, divided in small groups (5 pupils each), have to solve riddles to discover the works of art of the museum. The teacher will formulate the riddles with coded language using binary numbers. Pupils, using computational thinking skills, will identify the words, solve the riddle and find the relevant work of art (i.e., the **Capitoline She-wolf** located in Musei Capitolini).

## Scope

The aim of the lesson is to provide pupils with basic computational thinking methods. The "Binary" tool will help them understanding basic programming language and how computers work by converting the binary language, which is a code language, into letters and, hence, into words. Moreover, the lesson is also aimed at fostering pupils' knowledge about the works of art of the museums. However, the lesson could be easily adapted to any other kind of cultural attractions.

## Target

9-11 years old

## Country

Italy

## Tools

Unplugged – Binary Alphabet

## Materials

- Downloadable and printable Binary Alphabet kit (see Annexes 1 and 2 below)
- Paper
- Pens/pencils

## Procedure Step-by-step

### 1. Warm-up questions

- Have you ever visited the Musei Capitolini?
- Do you know which works of art you will find there?
- Do you know what a code language is and what it looks like?
- Have you ever communicated with your peers through code language?
- Have you ever heard about the binary language?

### 2. Hands-on activity

1. Divide the class in groups (max 5 students each)
2. Provide the students with the template (Annex 1) which explains how the binary language works
3. Explain to the pupils
4. that they will be given a riddle, formulated with the binary code (Example provided with Annex 3)
5. that they will have to solve the riddle to find out the specific work of art in the museum it is referred to
6. Provide the students with pens/pencils and paper, useful for decoding the riddles
7. Students, hence, will reach the attraction and listen to the teacher's explanation from an artistic and historical point of view.

### 3. Final Discussion/Reflection

- Were you able to decode the language?
- Did you encounter any difficulties in understanding the binary code? If so, which one?
- Do you think that this kind of language could be universally understood?
- Do you think this represents a logical way to communicate?
- Did you enjoy the riddle solution activity?
- Would you create a riddle about a cultural attraction you like for your peers (with or without the binary language)?
- Would you like to repeat the activity for a different attraction? If so, which kind?
- Would you like to explain what the binary language is and how it works to your peers?

### 4. Wrap-up

- Did you enjoy this kind of team working?
- Was it feasible for the group to decode the language or do you think it would have been better to proceed alone?
- Did you face any challenge? Were you able to easily overcome them?
- Was this activity helpful to enjoying the museum and its works of art?

## Duration

The duration of this lesson is about **3 hours**.

## Digital skills required

No digital skills required.

## Competencies acquired by kids

Students will be able to:

- Work in groups
- Problem-solving
- Have basic knowledge of what a code language is
- Have basic knowledge of what the binary language is
- Use logical thinking to decode the language
- Use logical thinking to solve the riddles
- Create at least a riddle for a cultural attraction
- Learn information about the works of art, found out through the riddles' solution.

## Curriculum Links

Art and History (for working on cultural attractions); Informatics (for the binary language); grammar and comprehension competences in the national language (for the riddles solution and creation).

## On tour

The lesson plan proposes to enjoy Musei Capitolini in Rome (Italy) with pupils.

The official link for kids' activities in Musei Capitolini is: http://www.museicapitolini.org/en/keywords/bambini

## Glossary

- **Work or art:** a painting, sculpture, poem, piece of music, or other product of the creative arts, especially one with strong imaginative or aesthetic appeal.
- **Binary code:** text, computer processor instructions, or any other data using a two-symbol system. The two-symbol system used is often "0" and "1" from the binary number system.
- **Riddle:** a puzzling, tricky, and often funny question asked as a game or as a test of one's thinking skills.

## Annex 1 – Binary Alphabet fulfilled template

| Base 10 | Binary | Letter |
|---|---|---|
| 0 | 00000 | |
| 1 | 00001 | a |
| 2 | 00010 | b |
| 3 | 00011 | c |
| 4 | 00100 | d |
| 5 | 00101 | e |
| 6 | 00110 | f |
| 7 | 00111 | g |
| 8 | 01000 | h |
| 9 | 01001 | i |
| 10 | 01010 | j |
| 11 | 01011 | k |
| 12 | 01100 | l |
| 13 | 01101 | m |
| 14 | 01110 | n |
| 15 | 01111 | o |
| 16 | 10000 | p |
| 17 | 10001 | q |
| 18 | 10010 | r |
| 19 | 10011 | s |
| 20 | 10100 | t |
| 21 | 10101 | u |
| 22 | 10110 | v |
| 23 | 10111 | w |
| 24 | 11000 | x |
| 25 | 11001 | y |
| 26 | 11010 | z |

## Annex 2 – Binary Alphabet empty template

| Base 10 | Binary | Letter |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |

## Annex 3 – Example of riddle formulated with binary language

The work of art relevant for this riddle is the Capitoline She-wolf, inside Musei Capitolini in Rome (Italy).

### Higher level of difficulty:

Decoded riddle:
***"She raised the most famous twins in Rome and became the symbol of its foundation."***

Coded riddle:

10011-01000-00101 10010-00001-01001-10011-00101-00100 10100-01000-00101 01101-01111-10011-10100 00110-00001-01101-01111-10101-10011 10100-10111-01001-01110-10011 01001-01110 10010-01111-01101-00101 00001-01110-00100 00010-00101-00011-00001-01101-00101 10100-01000-00101 10011-11001-01101-00010-01111-01100 01111-00110 01001-10100-10011 00110-01111-10101-01110-00100-00001-10100-01001-01111-01110

### Lower level of difficulty:

Decoded riddle:
***"She-wolf; Romolo; Remo."***

Coded riddle:

10011-01000-00101-10111-01111-01100-00110; 10010-01111-01101-01111-01100-01111; 10010-00101-01101-01111

# LEGO SECRET LANGUAGE

KEYWORD
artworks

TYPE
unplugged

AGE
9-11

PRINT IT!

## Description

Convey contents and data via a secret language: with Lego, children can write coded language and share messages. The process is simple: behind each letter, children put a different Lego brick (variation in shape and/or color). So each brick corresponds to a letter. Having agreed on the Lego brick alphabet, children can code a word first, then proceed to a small sentence. You can apply this to quizzes and homeworks, challenging more abilities at the same time.

## Scope

Students learn the basics of a programming language and how to logically convert text into code. After this lesson, they will be able to convert text into a coded language, to think in steps and to make mutual agreements to work together.

## Target

6-8 years old; 9-11 years old

## Country

Netherlands

## Tools

Unplugged, so no softwares needed

## Materials

When preparing the activity, bear in mind the class needs to be divided into small groups: so multiply everything by the number of groups you will have (maximum 3 students each).

- Lego bricks (or other small things);
- Bottom plates of Lego;
- small notes or post-its;
- pencils.

## Preparation

- Copy the worksheet and the lesson notes for this lesson for each group;
- Provide some space on the floor if necessary

## Procedure Step-by-step

### 1. Warm-up questions

Try and start a discussion with the class, by asking some questions:

Who has ever written secret language?

- Who did you do that with?
- What did the secret language look like?
- Could others read it too?
- If you would make your own secret language, what would it look like?

### 2. Hands-on activity

Here we describe step by step how to write your own code language with Lego. In this way you can create your own programming language that only you understand. The "computer" can "translate" your Lego blocks into words and vice versa, of course.

Each group gets a box of Lego bricks (or other material) and a Lego building board, then starts writing a letter per each post-it, lining them on the floor. First connect each vowel – they are the most common letters – to its Lego block; then proceed with the other letters.

You can also make another letter by turning a cube into a different position.

To understand the process, start making an easy word, such as ball, for example.

A kid from each group leaves the class – this kid is the computer, ready to decode the secret word. The group chooses a word and writes it down on a worksheet, then turns it into Legocode.

Fold the paper and the "computer" can come back and he/she translates the code into the word. Note that you do need to fold or cover the word. Continue like this until everyone has been the computer.

### 3. Final Discussion/Reflection

- how did you and your group get started on the assignment?
- what problems did you encounter?
- how did you solve the problem?
- Were you able to read the secret language of lego? How did you manage that?
- How was the cooperation?
- What did you like best?

### 4. Wrap-up

What is difficult?

- Students should put down easy-to-find cubes near the vowels.
- They should not immediately make a very long sentence.
- Challenge them by pointing out that you can also put a Lego cube down differently

## Duration

The duration of this lesson is about 1,5 hours.

# LEGO SECRET LANGUAGE

KEYWORD
artworks

TYPE
unplugged

AGE
9-11

## Digital skills required

No digital skills required.

## Competencies acquired by kids

The students understand that you have to collaborate to work on a code language, otherwise the other cannot 'translate' it into understandable text.

## Curriculum Links

This activity can easily be applied to all subjects: the teacher can choose the words to guess, picking them from a specific topic. The Lego alphabet can be shared by the whole classroom and used to solve quizzes and riddles.

## On tour

You can use this lesson very well with cultural heritage.

Have children code with the words they have learned from a cultural heritage lesson.

For example, the topic is monuments.

Children can code the names of places they have visited. And then they can also recreate the monuments with Lego building or invent and build their own monument from Lego. In this way, you can use this lesson in many ways in your cultural heritage lessons.

## Glossary

- **unplugged:** that means you don't need a computer for it

## Lesson Notes Lego Code Language

Here we describe step by step how to write your own code language with Lego. This way you create your own programming language that only you understand. The "computer" can "translate" your Lego blocks into words and vice versa of course.

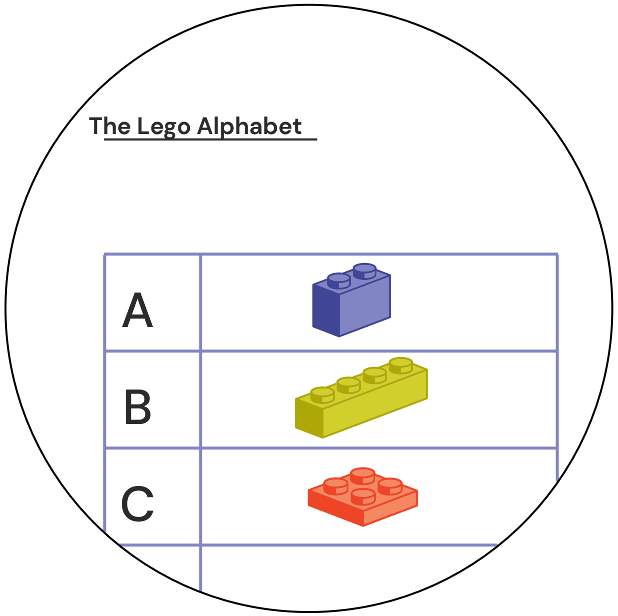
1. You all get a box of Lego bricks (or other material) and a Lego building board.

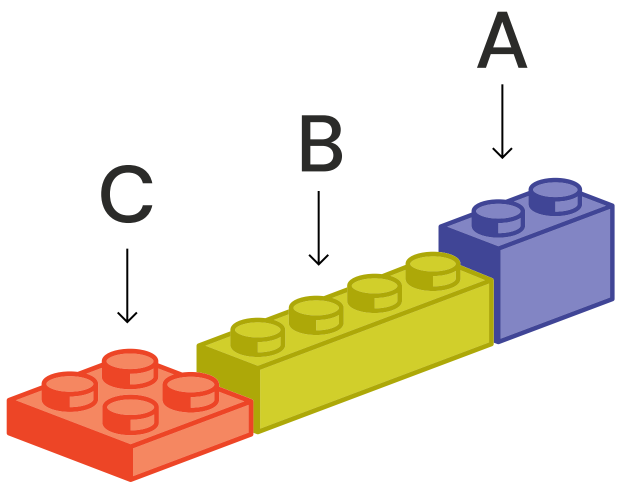
2. Start your Lego Alphabet and first put on the vowels cubes: they occur most frequently. After this, place Lego cubes on all the other letters as well.

3. Of course you can also make another letter by turning a cube.

4. First choose an easy word. For example, ball.

5. From your group, one goes to the hallway, he/she is the "computer". You take the worksheet and write a simple word on it. After this, you make the word in lego code with the lego blocks.
   Fold the paper and the "computer" can come back and he/she translates your Legocode into the word.
   Note that you do need to fold or cover the word.
   Continue like this until everyone has been.



## The Lego Alphabet

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| A | B | C | D | E | F | G | H | I | J | K | L | M |

## Worksheet – Lego code language

**1a.** Write a simple word below and code it into Lego code language and fold this paper so that the word is no longer visible.

FOLDING

**1b.** Write down what the word is in the Lego code language. Is it correct?

**2a.** Write another word below and code it into Lego code language and fold this paper so that the word is no longer visible.

FOLDING

**2b.** Write what the word is in the Lego code language.

FOLDING

**3a.** Now write some words below and code them into Lego secret language and fold this paper so that the sentence is no longer visible.

FOLDING

**3b.** Write the words here. Is it correct?

# HERITAGE IN TOWN

KEYWORD
city

TYPE
plugged

AGE
9-11

PRINT IT!

## Description

Discover the heritage that surrounds your school.

Take pictures, look up the stories, make them into snacksize info.

Then add your own art to it and have others discover your route!

## Scope

Students will get to know their local heritage in a fun and interactive way and share this with anyone they want.

## Target

9-11 years old

## Country

Can be done in any country

## Tools

App: Space Time Layers

https://apps.apple.com/us/app/spacetime-layers/id1382638760

https://play.google.com/store/apps/details?id=nl.newnexus.SpacetimeLayers&hl=it&gl=US

## Materials

- Phone/camera/tablet to take pictures.
- Tablets or computers for every 2 students to look up information.
- Art supplies, any thing goes, whatever you (or your students) would like to work with.
- A tablet or computer to put your info into the app.

## Procedure Step-by-step

### 1. Warm-up questions 10 minutes

You can open the conversation by asking to your pupils: "Do you know any art or landmarks near the school? Why are they there, who made them?"

### 2. Hands-on activity 1 hour 30' max

**Lesson 1** - Take a walk through the surroundings of the school with your class and take pictures of anything they or you find interesting. It is nice if you choose the route before taking your class outside, make sure it is not too long and there are at least enough landmarks/heritage sites for every 2 students.

**Lesson 2** - Print out the pictures you made. Have every 2 students pick at least one. They can also work alone if they like. Have them look up more information about this picture. They then translate this information into a piece of snack size information.

**Lesson 3** - In the next lesson they can pick an art form to make their own art about their landmark. They can replicate it or make something that they think fits this landmark. For instance, a dance, a poem, a piece of theatre, a painting, claywork, textile art, a lego build... anything is possible.

**Lesson 4** - In the last lesson they will finish their art work and put their information into the app, with the help of the teacher (if needed). A school can make a free log in on the website: spacetimelayers.app. This gives you the ability to make your own layer, which then can be seen in the app.

Make sure you have something to do for the children who are ready with their work and have entered it in the app.

### 3. Wrap-up

Once the route is finished, you can create a qr code and share this with parents or perhaps a local paper.

## Duration

**Four 1h lessons; if you work with younger children it can take about 1h30 per each lesson.**

## Digital skills required

- Make a log in on a website.
- enter information on a website.
- figure out the working of a website.
- share a qr code.

## Competencies acquired by kids

- Transform information into a snack size portion.
- Transform local heritage into new art
- Enter information on a website

## Curriculum Links

It is related to Art, Science, History

## On tour

Your local heritage! Which can be as close as the building of the school, the name of the school and the name of the street the school is on.

## Glossary

- **Heritage** might be a new word for some children.

# GEOMETRIC SHAPES IN THE ENVIRONMENT

KEYWORD
city

TYPE
plugged

AGE
6-8

PRINT IT!

## Description

Students will learn about geometrical shapes in the works of art as well as in the world around them. They will find out about different elements of urban architecture, interpret the history and the present of the city.

## Scope

Possibility to notice and recognise geometric shapes in the world around us will increase students' motivation in learning maths. What is more, it will also increase their curiosity and encourage them to apply the theory learnt at school to daily life.

## Target

6-8 years old

## Tools

Minecraft

## Materials

- Sheets of paper;
- pens;
- multimedia or interactive whiteboard;
- Lego blocks;
- one tablet per group.

## Procedure Step-by-step

### 1. Warm-up questions

Ask students to name places and things where you can find geometric shapes.

Write their suggestions on a board.

Ask them if they can name artworks where geometric shapes are essential.

Show them some pictures of famous works of art that use geometric shapes, for example *Woman in Hat and Fur Collar* or *Three Musicians* by Pablo Picasso, as well as of some famous historic buildings in your country.

Ask them what similarities they notice.

Briefly describe and conclude: geometric shapes and dimensional shapes are found not only in mathematics. Architects cannot do without geometric shapes when designing buildings, artists use them in their works, designers when creating and sewing clothes, and so on.

### 2. Hands-on activity:

Divide students into groups. Each group will have to find and name what geometric and spatial figures they notice in the given objects:

https://www.camping.lt/lt/lankytinos-vietos/pazaislio-vienuolynas;

https://exploretrakaivilnius.lt/lt/pilys-ir-piliavietes/traku-salos-pilis

Then, using Lego blocks, they have to reconstruct part of one of the buildings.

Finally, the students compare their findings and works with the other groups, and make some general observations.

Then each group has to choose another well-known historic building in the country. The teams will have to analyse the architectural object (tasks with geometric shapes). They should also count geometric spaces and plane shapes, calculate areas, perimeters.

Distribute roles (director, cameraman, art critic, journalist) and create an improvised TV show for the presentation of an architectural object.

### 3. Final Discussion/Reflection:

Ask students to name three things they have learnt and one thing they still are not sure about. Be ready to lead a brief discussion and to comment.

### 4. Wrap-up:

Encourage students, working in groups and using Minecraft, to create a building for the future citizens. Ask them to use the most common patterns they have spotted in the buildings and art works today.

Students may either present their works in the classroom or share them on the Padlet.

## Duration

**2 hours** for a school – work

Homework (time depends on the complexity of the work as well as on the students' skills in Minecraft)

**30-40 minutes** for homework presentations (optional)

## Digital skills required

Knowledge of Minecraft

## Competencies acquired by kids

Students will develop the main soft skills: effective communication skills, teamwork, flexibility, leadership, problem-solving, Computational Thinking, research, creativity, work ethic.

They will also improve their understanding of art, architecture and their skills in IT.

## Curriculum Links

Art, mathematics, IT

## On tour

Explore the city!

You can go to the Old town and choose some buildings there or go to the new areas and look for the most modern buildings that seem different and interesting.

You can use https://en.actionbound.com/, and decide what buildings your students should see and analyse.

## Hands-on:

If you wish to add an extra application to your school activities, we suggest you asked

your students to:

- make a collage image by using geometric shapes only. As a first step, each pupil can sketch an outline of a drawing; as a second step, the drawing gets simplified into geometric shapes only. Third step: each child cuts the shapes from scrap paper or coloured sheets, which then get glued on the A4 basis. This makes them focus on the presence of geometric shapes everywhere.
- you could also try and develop a 3D workshop, modeling geometric shapes out of plasticine or clay, and applying the aforementioned process.

# EXPLORE YOUR CITY

KEYWORD
city

TYPE
unplugged

AGE
6-8

PRINT IT!

## Description

Using basic computational thinking skills, students - divided in 2 groups - have to draw a route on the map of Milan: from school to a cultural heritage site in the city (eg the Duomo Cathedral). Each group â¡®®ÌÖÌ•Ì yÌ Ì†yÈ‹ÌÌâ¡Ò ÌyÈÈºâÌÌyµ‹ÌÌ¡œµy®ÌÌÖºÌ…Ö¡®‹Ì instructions for the other group.

## Scope

The aim of the lesson is twofold: on the one hand to introduce basic concepts of computational thinking, and on the other to encourage students to discover their own city and its landmarks through the use of a map.

## Target

The activity is addressed to 6-8 years old kids. However, if plugged tools are introduced, it can be addressed to 9-11 years old students too.

## Country

Italy - Milan

## Tools

The activity is unplugged, but it can easily be transformed in a plugged one using Scratch, Code.org or other softwares.

## Materials

- A map of the city
- Paper
- Post-it
- Coloured pen/pencils
- Scissors

## Procedure Step-by-step

### 1. Warm-up questions ~10 minutes

You can start this activity asking students questions like these:

- Which is your favourite place in your city?
- Which are the most important monuments/ landmarks/cultural sites in your city?
- Have you ever visited them?
- What do you know about them?

### 2. Hands-on activity ~1h30

Split the class into two groups and give them a map of the city you like to work on.

The map may be divided in squares, in order to help students in the following activity.

Each group will have half an hour to discuss and decide which route and which monument/ landmark to choose, without being overheard by the other group.

Then, each group will prepare detailed instructions to go from point A (school) to point B (selected monument/landmark). They will have to draw/write instructions on post-its.

Groups will exchange instructions, trying and see if they are correct and lead to the the right place.

### Ì"¡µy®Ì ¡Ì†ÖÌÌ¡ºµ)Ò• •†Ò¡ºµ ~20 minutes

As far as the Computational Thinking methods is concerned you can ask:

- Could the two groups reach the right place?
- ¡ ¡† Ìâ•È•ÌÒ •Ì‹¡› †Ö®Ò¡•Ì#
- Were the instructions precise enough?

As far as the Cultural Heritage is concerned you can ask:

- Which extra info do we have on selected places?
- How would you describe the monument if you should write a note on the map?

### 4. Wrap-up dai 20 ai 50 minuti from 20 to 50 minutes

If your interest is to improve soft skills and computational thinking competences among your young students, keep the discussion on process:

- How did team work go?
- ¡‹ÌÒ •ÌÒâºÌœÈºÖÅÌÌ µ‹ÌÅÈº…®•´ÌÌ¡µÌÒ ‹•†¡Ì¡ºµÌ Ì‹• µ¡µœÌÈÖ®•Ì Ìâ È¡Ò¡µœÌÒ •
- How did they solve problems?

If your are more interested in working on discovering the city, you can add an extra activity asking the class to do some research on the cultural heritage sites and write down a little guide for other children who come to visit the city.

## Duration

About 3 hours

## Digital skills required

No digital skills are required, unless you decide to use Scratch or other softwares (in this case you need a basic knowledge of the software you choose in order to be able to help kids in coding simple instructions)

## Competencies acquired by kids

Students will be able to:

- read a city map
- work in group, discussing and taking decisions
- write down simple instructions
- describe at least one city landmark/monument

## Curriculum Links

Geography (if using maps of the city), art and art history (if working on monuments and landmark history); language (if directions are to be written in another language)

## On tour

You can take your class to visit the Duomo and to have a walk on the Duomo roof admiring the spires and the gargoyles.

This is the official link for kids activities at the Duomo of Milan:

https://www.duomomilano.it/it/infopage/bambini/37/

## Glossary

- **Cardinal directions:** North (N), South (S), West (W), Est (E)
- **Cathedral:** a church that is the official seat of a diocesan bishop
- **Gargoyles:** a waterspout, usually carved to resemble an odd or monstrous creature, that protrudes from a structure's wall or roofline
- **Spires:** a pointed cone shape on top of a building is called a spire

# EXPLORE YOUR CITY

KEYWORD
city

TYPE
plugged

AGE
6-8

PRINT IT!

## Description

This class should follow "Explore your city_ Unplugged" activity. Using www.code.org online free resource, students will write down simple coding instructions to convert the indications the designed on the map into a simple coding project.

## Scope

The aim of the lesson is twofold: on the one hand to introduce students to a basic programming activity, and on the other to encourage students to discover their own city and its landmarks.

## Target

The activity is addressed to 6-8 and 9-11 years old kids.

## Country

Italy - Milan

## Tools

The activity is plugged, and it uses the free online resource www.code.org

## Materials

- Internet access
- At least 2 computers

## Procedure Step-by-step

### 1. Warm-up questions ~ 15 minutes

- You can start this activity by creating two accounts on code.org website
- Then, you can start exploring the "Create" section of the website with your pupils. You can also show them one of the tutorials you can find on code.org

### 2. Hands-on activity

Split the class into 2 groups and ask each group to open his account on code.org. Guide them to open the "Artist" project and leave them experiment freely with blocks and different actions, so they can start discovering what happens if they add instructions in the workplace. ~ 40 minutes

Then, ask them to reproduce on code.org the indications they wrote on flashcards during the unplugged activity in order to go from school (point A) to a specific landmark in their city (point B). For this activity you can use "Artist" project. ~ 45/60 minutes

Following their achievements, encourage them to go one step further and add information and explanation regarding the landmark in their programming project, adding stickers and colors. ~ 45/60 minutes

### 3. Final Discussion/Reflection: ~ 20 minutes

When the task has been completed, the two groups can switch monitor and check if the route and instructions are correct. Each group can explain his work and pupils can discuss and share their points of view, checking whether they chose the same strategies or not.

### 4. Wrap-up ~ 30 minutes

If your interest is to improve soft skills and computational thinking competences among your young students, keep the discussion on process:

- How did team work go?
- Did the two groups find problems in taking decisions, defining rules, writing them down?
- How did they solve problems?

## Duration

Two lessons of about 2 hours each

## Digital skills required

Basic knowledge of code.org (for this project you can use Artist Projects) or any other free online coding resource (eg Scratch).

## Competencies acquired by kids

Students will be able to:
- develop a small project in code.org
- work in group, discussing and taking decisions
- write down simple instructions
- describe at least one city landmark/monument

## Curriculum Links

Informatics, Geography (if using maps of the city), Art and art history (if working on monuments and landmark history); Geometry (shapes and angles).

## On tour

You can take your students to visit the landmark they chose

## Glossary

Children will learn the glossary used in code.org projects:

- **Workspace**
- **Actions**
- **Logic**
- **Function**
- **Variables**
- **Project**

# EXPLORE A PAINTING WITH CODY-ROBY

KEYWORD
artworks

TYPE
unplugged

AGE
4-6

PRINT IT!

## Description

This is an activity that will allow children to learn about any picture while being introduced to computational thinking: visual language and coding can well work hand in hand!

## Scope

Children will learn about a painting, its components and their specific position. At the same time they will practice the sequences of instructions of computational thinking.

## Target

4-6 years old

## Country

Spain but it can be done everywhere

## Tools

The activity is unplugged and it uses Cody-Roby approach.

http://codemooc.org/codyroby/

## Materials

- A sheet of paper with a gridded work of art or a picture/photocopy and a grid printed on transparent paper to overlap.
- Instruction cards: move forward, turn right, and turn left.
- A pawn for each kid.

## Procedure Step-by-step

### 1. Warm-up questions

Open up the activity by letting children choose the art work they like the most among the pictures you prepared. You can ask them: “What do you like about the artwork you chose?”; “What does the artwork represent?”, “How many elements can you recognize?”.

Then, explain the game to the kids introducing *Roby* and *Cody* characters.

### 2. Hands-on activity

*Roby* is a robot who executes instructions and *Cody* is a programmer who provides instructions. Kids can either play alone, each one moving *Cody* along his/her artwork and grid, or they can play in couple, one giving instruction and the other moving *Cody*.

During the game, each player plays the role of *Cody* and uses the cards to give instructions to *Roby*, represented by a pawn to be moved on the grid, according to the instructions on the card.

The activity consists of identifying the different elements of a painting and managing to express their spatial positions.

Each participant will propose to take *Roby* to a specific element of the painting. To do this, he must give the name of the element and its position within the box.

The answer will be the sequence of instructions necessary to take *Roby* and place him on the requested item.

Once the question is answered, the participant who has programmed *Roby* will ask another question.

### 3. Final Discussion/Reflection:

- Were they able to give the instructions? Was it difficult?
- How many elements of the artwork could they identify?

## Duration

About **1 hour**

## Digital skills required

This is an unplugged activity and no digital skills are required.

## Competencies acquired by kids

- Artistic knowledge
- Computational thinking
- Sense of orientation

## Curriculum Links

It is related to artistic / cultural heritage

## On tour

The activity can be carried out either before or after visiting a museum to learn about the works that will see or have seen.

## Glossary

You may want to discuss all the terms related to directions (right, left, next to, near, far, straight...)

Some elements shown by the artworks may be new for some kids. Discuss and explain new terms to the class.

# MONUMENTS CAN TELL

KEYWORD
monuments

TYPE
plugged

AGE
10-12

PRINT IT!

## Description

Investigate and create: this activity engages students in a research process first, followed by a second part dedicated to creativity – it is up to the students to make up a narration about the monument.

## Scope

- to learn how to search for information;
- to learn how to apply critical thinking in the selection of info;
- to get to know the work object of the study.
- to learn how to follow sequential instructions;
- to use conditional statements.

## Target

Target 10-12 years old

## Topic/type of cultural heritage

This process can be applied to any kind of artwork, building ecc.

## Tools

Scratch

## Materials

Computers to search for information and carry out the script.

It is preferable to have one computer per student, if this is not possible, students will work in pairs.

## Procedure Step-by-step

### 1. Warm-up

Try and understand what students perceive about monuments: what do they look for when they visit? Do they search for stories and characters? Do they concentrate on facts? Do they stick to observation?

This activity challenges their creative and interpretative capabilities.

Provide a short intro on the monument you wish them to work onto.

### 2. Research

Students take their time in looking for information about the work and selecting the ones they are going to use.

### 3. Story-board

Each student (or small group/couple) needs a script: they have to organize the info into a plot, dividing them into short scenes.

First step is the select (or invent) the characters who will tell the story.

Second step is attributing some content to one or the other character - each will speak using speech bubbles.

The storyboard will specify:

- setting (background images);
- characters and their movements;
- dialogues.

### 4. Coding and testing

Students perform the script and test it until it works fine.

### 5. Sharing

Students run classmates' scripts and answer questions.

## Duration

4 hours

## Digital skills required

A medium level in using Scratch is required.

## Competencies acquired by kids

- Artistic knowledge
- Computational thinking
- Critical thinking

## Curriculum Links

- history
- art history
- text writing

## On tour

You can use this activity as a preparation for a school trip or as a summary or intro for a history lesson.

# THE ROCKY OUTCROP DISCOVERIES



KEYWORD
monuments

TYPE
unplugged

AGE
9-11

PRINT IT!

## Description

A scavenger hunt concerning the landmark of classical antiquity: the Acropolis of Athens. Children will discover what is there (eg: the Parthenon,the Erechtheion, the Propylaea) and how to read it: the same procedure can be applied to smaller archaeological sites and areas - so do not be sad if your city has no Parthenon!

## Scope

The aim of the game is to get to know the Acropolis monuments (or any other archaeological area) and their history. You can also explore famous personalities related to your site, be it artists, architects or rulers.

## Target

Target 9-11 years old

## Country

Greece

## Tools

A computer or a phone, to use and connect to Actionbound and to make online searches.

Children will need a watch for time management.

## Materials

Paper and pens

## Procedure Step-by-step

**1. Warm-up questions** 10 minutes

Open up the discussion by checking what kids know and how they relate to the place:

- What do you know about the Acropolis of Athens (or other archaeological site of your choice)?
- Do you know what the word acropolis actually means?
- What is at the highest point of the Acropolis?
- Have you ever been there? If so, what would you like to tell us?

**2. Hands-on activity** 1 hour 30' max

You need the children to have an overview of the site before they embark in their research so your first move is to explore the Acropolis using Google Earth: observe the monuments and draft a list that everybody can see.

Divide the class in small groups, each provided with a computer.

Assign a monument to each group: they need to find info and pictures, in order to build their collective treasure hunt. Remind them to write down any unknown word they might encounter in their searches.

Check the pictures and info each group has gathered and invite them to draft a quiz on their building. It would be good to have from 15 to 25 questions in total.

Using your computer, upload the photos and the questions on Actionbound: when everything is uploaded, try and play the game - the whole class together.

**3. Final Discussion/Reflection**

- what was difficult in the process?
- have they managed to work together smoothly?
- what was challenging?
- were instructions clear enough?

**4. Wrap-up**

Underline and share the achievements the class has gained:

- they have learnt a lot about a specific archaeological site;
- they have managed a whole production process;
- they have built an educational tool together!

## Duration

1 hour 30'

## Digital skills required

The activity requires the use of a simple software, named Actionbound

https://en.actionbound.com/ so you will need to test it in order to be able to organize the activity with your pupils.

## Competencies acquired by kids

This activity will enhance the pupils cultural knowledge and their

- Computer knowledge and relevant hard skills (Use of a specific app)
- Critical thinking (distinguish what is important and what is not)
- Collaboration

## Curriculum Links

It is related to history / cultural heritage

## On tour

This indoor activity can be used as a preparation for any outdoor visit: you only need to adapt its contents to your needs. You can either do this before the visit, or afterwards: in this case, it will be a reinforcement of what they have seen and learnt outside.

## Glossary

Make the children share the unknown words they have met during the process, and write them down - with their explanation - for everybody to see.

KEYWORD
sculptures

TYPE
unplugged

AGE
6-8

PRINT IT!

## Description

The activity focuses on learning dates and names of a variety of classical sculptures and pieces related to the Acropolis (or any other archaeological site). We can also look for many different fragments of some buildings such as the Propylaea, the Temple of Athena Nikae and the Erechtheion.

## Scope:

The aim is to help children memorize important historical dates and names from sculptures and pieces belonging to the Acropolis. If you don't live in Athens you can apply the same lesson plan to any other archaeological area or even to any particular historical event.

## Target

6-8 years old

## Country

Greece

## Tools

The activity is unplugged

## Materials

30 to 50 flashcards with questions, infos, dates and details about the Acropolis. Ten/twenty of the flashcards can be fill in with questions about dates and names, the others with the relative answers.

## Procedure Step-by-step

### 1. Warm-up questions 20 minutes

Open up the activity by giving some ideas on how to create a roadmap with dates related to the Acropolis or to other sites/topics you chose to work on.

*For example*
The Acropolis is the main attraction of Athens. Its museum, which exhibits much of the treasures of the sacred mountain, has become the most important and popular museum in the city.

How many people visited the museum in 2019?
1,7 million

### 2. Hands-on activity 1 hour and 30'

Children are divided into 2 groups: each group has some flashcards, first they have to discuss inside their own group all the questions and answers they have, as some details of the piece of history (statue, object or else) will be missing they need to find the missing information discussing with the other group, getting some help from other student's cards and collaborating.

### 3. Final Discussion/Reflection

- What was the most ancient piece of monument or object you have encountered?
- What did you like? Disliked?
- What do you consider a useful/valuable object for ancient Athenians?
- Was it difficult to answer to all the questions on the flashcards?
- How did the group internal discussion go?
- How did the collaboration between the two groups go?
- Did you find a strategy to cooperate?

### 4. Wrap-up

You can organize a role play with students representing sculptures of famous personalities before going to visit the museum.

## Duration

about 2 hours

## Digital skills required

No digital skills are required for this activity.

## Competencies acquired by kids

This activity will enhance the pupils cultural knowledge and their

- Teamwork attitude
- Collaboration ability
- Problem solving capacity

## Curriculum Links

It is related to history / cultural heritage

## On tour

This indoor activity can be used as a preparation for any outdoor visit: you only need to adapt its contents to your needs. You can either do this before the visit, or afterwards: in this case, it will be a reinforcement of what they have seen and learnt outside.

## Glossary

Make the children share the unknown words they have met during the activity with flash cards, and write them down – with their explanation – for everybody to see.

# YOUR CITY IN SQUARES

KEYWORD
city

TYPE
unplugged

AGE
9-11

PRINT IT!

## Description

This lesson plan takes pixel art a step forward: introducing the notion of pixel as the minimum unit in the construction of digital images, children will learn basic coding techniques to construct or describe images, practicing until they are able to move forward to monuments and/or works of art from their artistic and cultural heritage.

## Scope

- Introduce concepts of computational methods associated with arts and sciences,
- produce plastic works of graphic design;
- recognize the existence of the pixel/dot as the minimum unit of the digital image;
- Understand the basic principles of encoding / decoding digital images;
- Know how to use the encoding / decoding in moments of creation and artistic production.

## Target

9-11 years old

## Tools

unplugged

- 1 Computer & Video Projector + Projection Screen
- MS Office (MS Word and MS Powerpoint)

## Materials

- Graphite pencils + Eraser & Sharpener (1 set per student)
- Black felt-tip markers (one per student)
- 6 sheets of A5 squared paper (6mm2 per square)
- 6 compasses (or 6 objects with a circular base, all the same size)
- 6 A5 sheets of squared paper (2mm2 per square)
- 6 sheets A5 of graph paper
- 24 photocopies of the MS Word file "Pixel Drawing p.Code
- 24 photocopies of MS Word file "Code" p.Pixel Drawing".
- 1 booklet of A4 squared paper (100g)
- 24 photocopies of the JPEG file "Christ the King X
- Post-it
- Coloured crayons
- Scissors

## Procedure Step-by-step

### 1. Warm-up questions:

- What is a pixel (plural: pixels)?
- How is it possible that, in most situations, pixels are not visible?
- What determines a higher or lower definition of the digital image built with pixels?
- Can a pixel be so small that it becomes just a point?
- How are digital images constructed by using pixels?
- Do you think you can write the code for a digital image built with pixels?
- Can you build an image with pixels, just by reading its code?
- How do you count the pixels of an image?
- Does the number of pixels of an image determine its best (or worst) resolution?
- How to apply pixelation to the study of the cultural heritage of Almada?

### 2. Hands-on activity:

**PART I – CONCEPT OF PIXEL** ~ 2 hours (if you follow every step)

**A. In a large group, in the classroom:** ~ 30 minutes

***a. What is a pixel?***

- Question students, testing their prior knowledge on the subject;
- This lesson plan focuses on the city of Almada, but you can use the the powerpoint "See Almada in Squares" (see appendix) as a model for your own city (slides 1-3);

- Collective elaboration of the definition of “pixel”.

**B. In heterogeneous level groups of 4 to 5 in the classroom:** ~ 60/90 minutes

***a. How is it possible that, in most situations, the pixels are not visible?***

- Show the powerpoint “See Almada in Squares” to discuss, through the graphic evolution of the hero “Super Mario”, the existence of pixels despite their invisibility (slides 4-6);
- Carry out practical exercises to prove the theories presented:

***b. What determines a greater or lesser definition of the digital image constructed with pixels?***

EXERCISE 1 > Draw a circle on graph paper:

- Distribute to each group an A5 sheet of squared paper (6mm2 per square);
- With a compass, or any circular object, draw a circle on the squared paper;
- With a black felt-tip marker, fill in all the squares where the line of the circle passes;
- Check the “irregularities” of the circle against the “pixelation”;
- Ask any student in the group to move away to the farthest corner of the room and, from that far corner, show the classmates the image of the drawn circle;
- Check that the pixelation in the circle is no longer visible when the distance from the object increases;
- Count the number of pixels in the image of the circle:
  — two dimensions: height x width (the square as a unit of measurement);
  — recording the number of pixels on that same sheet;
- See slide 7 of powerpoint “See Almada in Squares”.

EXERCISE 2 > Draw the same circle on another piece of graph paper:

- Give each group an A5 sheet of squared paper, the dimensions of the grid are smaller than the paper used previously (e.g. 2mm2 per grid) - (see MS Word attachment “2mm grid”);
- Repeat all the processes of the previous exercise, ensuring that the new circle has the same dimensions as the previous one;
- After execution, check that the pixelation in the circle becomes more defined as the grid size decreases...
- ... as well as with the consequent increase of the number of pixels;
- Counting the number of pixels existing in the image of the circle:
  — two dimensions: height x width (the grid as unit of measurement);
  — recording the number of pixels on that same sheet of paper;
- See slide 8 of the powerpoint “See Almada in Squares”.

***c. Can a pixel be so small that it becomes just a dot?***

POSSIBLE EXERCISE 3 > Draw the same circle on millimetric paper:

- Repeat all the processes of the previous exercises, but using an A5 sheet of paper with 1mm squares (see JPEG attachment “Millimetric Paper”);
- Instead of painting the square, just place a dot;
- Check, using the same strategies as before, the definition of the newly constructed circle line;
- Conclude why, nowadays, “point” is also called “pixel”;
- See slide 9 of the powerpoint “See Almada in Squares”.

***d. Observation of the schematization of all the exercises, through the powerpoint “See Almada in Squares” (slides 7-9)***

## PART II – (DE)CODING WITH PIXEL ~ 90 minutes

**A. In a large group, in the classroom:**

***a. How are digital images constructed, through the use of pixels?*** ~ 30 minutes

Start by questioning students and testing their prior knowledge on the subject;

You can refer to the powerpoint “See Almada in Squares” (slides 10-12), for preparing examples of coding for building an image with pixels / or you can use Almada anyway, even if it is not in your city.

Present the images on slide 11 (only with one colour plus white);

Refer that all images were built through a code or that it is possible to describe them using the same code

Use Slide 12 to present and explain the meaning/ significance of the code used.

**B. Individually / In large group, in the classroom:**

***a. Do you think you can write the code for a digital image built with pixels?*** ~ 15 minutes

Watch slides 13-14 of the powerpoint “See Almada in

Squares";

Distribute to each student a previously printed image on squared paper, on the left of the sheet, and ask the children to fill in, on the lines on the right, the code for that image (see MS Word appendix "Pixel Drawing for Code");

Ask kids to present their results and check how they did.

***b. Do you think you can build an image with pixels, just by reading its code?*** ~ 45 minutes

- Distribute a grid page to each student and ask the children to colour in, with graphite pencils, all the requested squares, according to the reading done to the lines of code (see annex MS Word "Code For Pixel Drawing");
- Presentation of the pictures to the class and collective correction (slides 15-17 of the powerpoint "See Almada in Squares").

***c. Do you have graph paper?***

For the fastest students, distribute to each a sheet of squared paper and freely let them choose an extra activity:

- invent their own drawings and code accordingly;
- offer their invented codes to their classmates, so that they can also decode, draw and discover what has been created;
- codify drawings previously created by other colleagues;
- try to recreate some of the simplest monuments of your city by means of pixelation.

**C. In large group / In small working groups, in the classroom:**

***a. How to count the pixels of an image? The number of pixels of an image determines its best (or worst) resolution?*** ~ 45 minutes

Lightly touch upon the terms DPI / PPP to explain what counting the pixels of an image consists of and what it is used for. Mention to the students that they will simplify their own counting method.

Taking advantage of all the existing work done so far (by the groups, provided by the teacher, done by students on their own, ...), the groups proceed to count and record the number of pixels in each of the images, as follows:

- count the existing squares on the vertical axis (height=H);
- count the squares on the horizontal axis (width=W);
- proceed to the most usual graphic representation: H x W = total no. of pixels
- Calculate
- record the value next to the corresponding image.

## PART III – CRISTO REI IN PIXEL (AND OTHER CITY MONUMENTS)

**A. In a large group, debating in the classroom:**

***1a. How to apply pixelation to the study of the cultural heritage of Almada?*** ~ 60/120 minutes

Start with a brainstorming and list the students' ideas, then select the best ones.

Sample and test the suggested tasks proposed by the children, applying them to some landmark in your city (refer to slides 18-19 if you wish). The steps can be:

- providing each pupil with a picture of the monument;
- drawing from memory or by sight; copying on light table or window glass transparency, tracing with carbon paper or charcoal pencil, ..., onto graph paper;
- filling in and colouring in black the squares covered by the line of the drawing;
- make any necessary corrections;
- count the number of pixels, calculate and record;
- Write the corresponding code;
- Select and check the feasibility of repeating the tasks with other monuments;
- Start general research on the selected monument(s).

## 3. Final Discussion/Reflection: suggest some questions for the participants, to start a discussion about the process and about the results

a. How many students in the class would like to repeat these activities but applied to other monuments / elements of cultural-historical heritage?

b. What to do next? How to do it (if we wish to repeat the processes, individually, with another Almadense monument)?

c. Which activities were not completed or where you found it very difficult to complete them?

d. Which of the tasks do you think need to be changed to make them work better? In which aspects?

e. Should any of the activities be discarded? Why or why not?

**4. Wrap-up: help the teachers underline what is relevant** ~ 30 minutes

In order to continuing the activities under this theme, the next steps could be as follows:

## PART IV – LEGO, SELFPIXEL & COLOUR CODING

**A. Activity(ies) dependent on the evolution of students skills (to be assessed by the class teacher)**

***a. See the following supporting materials for further activities:***

- Powerpoint of Módulo 11 – "Pensamento Computacional na Arte & Ciência"
- https://share.hek.ch/de/lego-selfie/?_sft_category=selber-machen

## PART V - ALGORITHMES

**A. Creating an algorithm for tasks already performed**

**B. Repetition of processes with other works and/or monuments in the city:**

***a. Verification of the reliability of the algorithm created***

## PART VI – STUDY TOURS

**A. In situ, observation of the monuments and works worked on in these sessions**

**B. In situ, observation of other monuments from Almada**

## PART VII – PIXELATION AND CODING IN ARTS

**A. Creation of codes and their application in dance activities and dramatic expression**

**B. Repetition of processes with other works and/or monuments in the city:**

***a. from pixelation to pointillism.***

## Duration

**4 sessions: 3x 90' + 1x 30' = 300' / 5 h of work (minimum)**

(see chapter "Procedure Step-by-step: 2. Hands-on activity" for the division of the activities into sessions and their respective time/duration)

## Digital skills required

No digital skills required.

## Competencies acquired by kids:

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- Work in groups, discuss and make decisions
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- Understand the notions of encoding and decoding
- Simulate the construction of digital images through the decoding of a given code
- Write the lines of a given code that represents the construction of a digital image
- Y º l Ö µ ‹ • È Ì Ò y µ ‹ l Ò  • l µ º Ò ¡ º µ l º › l ‹ •  µ ¡ Ò ¡ º µ l º › l y l ‹ ¡ œ ¡ Ò y ® l image (in number of pixels per area)
- Perform unstructured calculations to determine Ò  • l ‹ •  µ ¡ Ò ¡ º µ l º › l y µ l ¡ ´ y œ •
- Apply the knowledge just built to new learning situations related to arts, heritage and cultural-historical heritage

## Curriculum Links

Portuguese, mathematics, computer science and technology, education to Visual Arts.

## On tour, suggestion for linking the class activity to a site visit

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- PIXEL: de pic[ture] + el[ement]; plural, pixels; as an alternative to pixel, the word “point”, which has been used to mean pixel, i.e. “the smallest unit of a digital image”, can also be used.
- DPI: The resolution of an image is the number of pixels per inch it contains (1 inch = 2.54 centimetres).
The more pixels (or dots) per inch, the more information there is in the image (the more accurate it is); for example, a resolution of 300 dpi means that the image is 300 pixels wide and 300 pixels high; it is therefore composed of 90 000 pixels (300x300 dpi); thanks to this formula, it is easy to know the maximum size of a copy.
It is generally accepted that a resolution of l ‹ Å ¡ l › º È l y µ l ¡ ´ y œ • l ¡ Ì l ® y È œ • ® è l Ì Ö › printing; this resolution can be reduced in the case of prints viewed from a distance more or less distant from the observer (therefore related to the separating power of the human eye).

# MY CITY MONUMENTS

KEYWORD
monuments / city

TYPE
unplugged

AGE
9-11

PRINT IT!

## Description

Starting from the observation of a panel of tiles, children have to recognize historical-cultural references of a city in Portugal (Almada), define and identify which of them are monuments and, through decomposition and abstraction, produce abstract plastic works. A similar activity can be applied to other cities in other countries, starting from the observation of paintings, murales, statues or any other kind of artworks representing that city.

## Scope

The aim of the activity is to introduce basic concepts of computational methods; find a definition of monuments; recognize historical and cultural references of the city and know how to mark them on maps; understand the benefits of decomposition and abstraction in problem solving; learn to recognize patterns; produce abstract art works.

## Target

9-11 years old (if vocabulary is simplified it applies also to 6-8 years old kids).

## Country

Portugal, City of Almada

## Tools

- The activity will require:1 Computer with internet connection & Video Projector
- 1 Computer for each workgroup with internet connection
- Google Keep, Google Maps, Google Earth
- Padlet
- MS Office (MS Word and any basic drawing tool)

## Materials

- Graphite pencils + Eraser & Sharpener + Scissors + Stick glue (1 set per student);Red and black felt-tip markers (one pair per group);
- A4 Sheets of paper (one sheet for each work group);
- Wall pins1 Whiteboard (removable) + Blue, black, green and red markers
- JPEG file of a photo excerpt of the tile panel "Cidade de Almada", by Albino Moura (part 1) – "Metro [tram]";
- Scan of the model of the tile panel "Cidade de Almada" by Albino Moura (in, Contemporary Art Center – Casa da Cerca)
- Paper print of the List/Schematic of the "Types of Patterns to Recognize" (1 per student)
- RAW file of panoramic photography of the tile panel "Cidade de Almada" by Albino Moura (parts 1 and 2)
- A6 print, on paper, of the image "Metro [tram]" (25 per class)
- A3 print, on paper, of the image "Metro [tram]" (30 per class)
- 1 Almada Tourist Map, on paper, for each working group;

If you work on a city other than Almada, you will need a JPEG file of a photo of the artwork representing the city you want to work on and the city of your choice map.

## Procedure Step-by-step

### 1. Warm-up questions

Start a discussion with students on the questions:

- What can be considered a monument?
- Which monuments do you know?
- Can a tile panel or any other kind of artwork be considered a monument?

### 2. Hands-on activity

#### PART I – DEFINITION OF A MONUMENT (in large groups)

**A. What can be considered as a monument? 30'**

- Define a monument;
- Collectively write the definition of monument (projecting the outline in MS Word);

**B. What monuments do you know? / What monuments do you know in Almada/another city? 60'**

- Make a list of the monuments in Almada – or the city you have decided to work on – known by the students (using Google Keep or Padlet);
- Mark on maps the monuments on the list (paper maps; Google Maps; Google Earth);
- Look at the map again to discover other monuments in Almada;
- Complete the list of monuments in Almada.

**C. Can a tile panel be considered a monument?** 60′

- Observe the projection of the tile panel "Cidade de Almada" by Albino Moura or the piece of art you have chosen;
- Based on the newly constructed definition of monument, collectively answer the initial question with credited rationale;
- Analyze the concrete components of the panel to identify elements known by the students;
- Finalize the list of monuments (from the discoveries on the panel).

## PART II – PROBLEM DECOMPOSITION & ABSTRACTION (The whole class)

Observation and decomposition.

**A. Is it possible to identify all the monuments of the panel "Cidade de Almada? Or is it possible to identify all the elements fo the artwork of your choice?** 15′

- Define decomposition;
- Decompose the panel/artwork into small parts, isolating the monuments/elements, by themes, colors, shapes, interests or other classification of the students' choice (using digital drawing tool to work on image/photography);

**B. What is the first part of the panel/artwork to study / decompose (serving as an example for the next tasks)?** 15′

- Choose only one element of the panel/artwork to study/work on it in more detail;
- For example, project the isolated image of the "Metro" and begin its analysis.

## PART III – TRANSFORMING AN EXISTING WORK INTO AN ABSTRACT WORK: PATTERN RECOGNITION

**A. The whole class in large group, in the library, with the excerpt "Metro" (decomposed from the panel):**

***a. How to work with a piece after its decomposition?*** 30′

- Momentarily analyze only the projected image of the tram or the image you have chosen from the piece of art of your interest;
- Encourage students to give diverse opinions/considerations about it;
- Record these possible opinions/considerations in Padlet, using two columns: one for those of diverse nature; the other for those related to pattern recognition;

***b. What are patterns in a work of art and how do you recognize them?*** 30′

- Define with the children what a pattern consists of;
- List the possible types of patterns that children may have recognized:
  — Patterns relating to colors, lines, geometric shapes, "organic" shapes, textures.
- If necessary, at the end and with the introduction of notions by the teacher, complete the list of types of patterns to recognize;
- Print out on paper the list of the types of patterns to be recognized, for reference.

**B. Individually / The whole class in large group / In random groups of 3 to 4 students, in the classroom, with an image of the "tram" or the image you have chosen from the piece of art of your interest:**

***a. The first working example:*** 30′

- Distribute to each student an A6 printout of the example excerpt "tram";
- Individually, first with graphite pencil and then with felt-tip pen, recognize, identify and mark the possible patterns existing in the "Tram";
- Present to the class one of the patterns you have identified;
- Repeat the process with all the students until all the possible patterns are identified;

***b. In randomly formed groups of 3 to 4 students each:*** 30′

- Group the students according to the patterns they have identified;
- Isolate the excerpt in A6 format that is most enlightening from the point of view of identification and most useful in pointing out a pattern – serves as a model for further work;
- Distribute an A3 printout of the "Metro" to the group;
- Identify on the large copy (with soft graphite pencil or just by pointing) the pattern recognized and chosen by the group;
- The students, each in turn, cut out of the A3 paper all the parts of the "Tram" corresponding to their pattern, for example
  — Group 1 – Color : cut out all the shapes of black color;
  — Group 2 – Color : cuts out all the shapes of color salmon;
  — Group 3 – Shape : cut out all the squares;
  — Group 4 – Shape : cuts out all non-polygons;
  — Group 5 – Line : cuts out all the blue non-polygonal lines;

- Group 6 – Lines: cuts straight or curved lines in a color of your choice;
- Group 7 – Color&Shape&Line&Texture: cuts only shapes with closed lines (polygonal or non-polygonal) colored in any shade of blue

- Save and identify the elements cut out by the work groups.

**C. The whole class in large group / In groups of 3 to 4 elements (those defined previously), in the classroom or in the library:**

***a. What to do with the parts / patterns that we removed from "Tram"/image of your choice? Why?*** 15′

- Distribute all the clippings from the previous activity among the groups that have already been formed;
- Distribute a sheet of A4 paper to each group;
- Ask them, after having broken down the "tram" into parts, to make a new and different composition by placing (still without gluing) the cut-outs on the A4 paper;
- All the members of the group give their opinions and guide the cuttings in order to reach a composition which is satisfactory for everyone;

***b. What is the abstract? / What is abstraction?*** 45′

- Observing the composition and follow the teacher's guidelines:
- What can't you compose? Another tram/the same image!
- Should you worry about composing "perceptible" shapes? No!
- What is the aim of the composition? Abstraction!
- Define abstraction;
- Each group should reformulate, if necessary, their compositions;
- Review with the teacher;
- Glue the new abstract composition.

**D. In groups of 3 to 4 elements (as defined above) / The whole class in large group, in the exhibition space, explaining and presenting the new abstract compositions:**

***a. What do you highlight in your abstract composition (what would you like to highlight)?*** 60′

- Each group chooses a spokesperson for the presentation of their work;
- Each group, in turn, posts its work on the exhibition panel;
- The spokesperson presents the work, mentioning which pattern(s) is/are recognised and isolated by the group;
- The teacher questions the whole group to reflect on the work achieved.

## 3. Final Discussion/Reflection

a. Did children elaborate a purely abstract composition or did they elaborate an abstraction in which they defined something perceptible/concrete?

b. Can an abstract composition have a title? Why (what is the reason)? What for (What is the purpose)?

c. If an abstract composition can have a title, would you like to choose one for your composition? Why that title?

d. What to do next? How to do it (if we wish to repeat the processes, individually, with another monument)?

e. What is an algorithm? Definition.

f. Do you think we can construct an algorithm for these tasks?

## 4. Wrap-up

If you wish to deepen some of the themes and activities planned above, it is possible:

### [before the] PART I

Definition of cultural-historical heritage and computational thinking:

- What do we already recognise as cultural-historical heritage?
- What do we already do using computational thinking?
-

### [when starting the] PART III

Transforming an existing work into an abstract work:

- Introduction to Abstract Expressionism
- The origins of Abstract Expressionism
- Key features of Abstract Expressionism
- Key artists of Abstract Expressionism
- Definition of Abstractionism

In view of the continuation of the activities within this theme, the next steps may be as follows:

## PART IV

Creation of algorithm related to the tasks already done

## PART V

Repeating processes with other art works and/or monuments in the city:

- Verification of the reliability of the created algorithm

## PART VI

Study visits:

- In situ, observation of the "Cidade de Almada" panel
- In situ, observation of other Almada's monuments

## Duration

**5 sessions of 90' each = 450' / 7.5 h of work**

## Digital skills required

Basic knowledge of:

- Google Workspace: google Keep, google Maps & google Earth
- Padlet online software
- Office: MS Word
- Drawing and photo software: Paint, for example, or another photo viewer that allows drawing/ annotating on images)

## Competencies acquired by kids

Drawing up definitions collectively

- Making specific lists
- Constructing simple tables (two columns)
- Read and write down a tourist map of their town
- Mark on digital maps the monuments of their town
- Define decomposition
- Decompose a work of art
- Work in groups, discuss and make decisions
- Define pattern
- Recognising, identifying, pointing out and isolating patterns in works of art
- Define concrete/perceptible vs. abstract
- Recreating an abstract work of art from concrete/ perceptible elements

## Curriculum Links

Geography, Art, History of Art, Mathematics, Computer science and technology, languages

## On tour

10 OF THE WORLD'S BEST VIRTUAL MUSEUM AND ART GALLERY TOURS

https://www.theguardian.com/travel/2020/mar/23/10-of-the-worlds-best-virtual-museum-and-art-gallery-tours

GUGGENHEIM BILBAO

https://artsandculture.google.com/partner/guggenheim-bilbao

MOMA LEARNING

https://www.moma.org/learn/moma_learning/

IT LOOKS LIKE KANDINSKY

(the world of sounds, shapes and colours by the abstract artist Vassily Kandinsky)

https://artsandculture.google.com/project/kandinsky

## Glossary

- **Cardinal Points**: North (N), South (S), West (W), East (E)
- **Monument** [notes for definition to be worked out collectively with students]:
  A monument is a type of commemorative structure in honour of a person or an event, which, over the years, has become relevant to a certain social group because it is a materialisation of the collective memory of historical events or testimony to the artistic and cultural heritage, due to its aesthetic, historical, political, technical characteristics, or its architectural relevance. (...)

  Examples of monuments include statues, (war) memorials, historic buildings, archaeological sites and cultural assets. (...) Mausoleum. (...) Literary, scientific, legislative or artistic documents. (...) Material remains or fragments through which we can learn about the history of past times.
- **Panel**: Painted picture. (...) Artistic work executed on a wall or on part of it (e.g.: tile panel).
- **Tile**: Thin ceramic plate, usually square, glazed on one side, with varied designs and colours, which is used to cover surfaces.
- **Decomposition** [notes for definition to be worked out collectively with students]:
  This is the breaking down a complex problem or system into smaller, more easily solved parts. These smaller problems are solved one after another until the bigger complex problem is solved. (...)

  If a problem is not decomposed, it is much harder to solve it. Dealing with many different stages all at once is much more difficult than breaking a problem down into a number of smaller problems and solving each one, one at a time. (...)

  Decomposition consists in breaking down a task, a work, a procedure, ..., into details.
- **Underground / Subway / Tram:**
  Railway, usually underground, intended for the rapid transportation of passengers in urban environments. Train running on such tracks = METRO.
- **Pattern** [notes for definition to be worked out collectively with students]:
  Once you've decomposed the complex problem into smaller problems the next step is to look at similarities they share. (...)

  Patterns are shared characteristics that occur in each individual problem. (...)

  What similarities do you observe? Finding these similarities in small decomposed problems can help us solve complex problems more efficiently. (...)

  In visual art there are always themes that are displayed through various patterns, such as the repetition of a particular colour, shape, texture or other geometric element.
- **Polygon**: From the Greek polygons; that which has many sides or angles; which is polygonal. Figure limited by three or more angles or by three or more sides.
- **Polygonal line**: Broken line (...) a set of two or more straight lines joined together, forming an 'open geometric figure'.
- **Abstraction** [notes for definition to be worked out collectively with students]:

  And what exactly does abstraction mean? There is no single answer. It can be a way of simplifying shapes. It can also be a way of purposefully distorting what you see. In fact, there are many kinds of abstraction. And many names to define them. For example, when using geometric shapes it is called geometric abstractionism [let's remember Mondrian].

  Abstract forms, that is, without correspondence to something concrete, with coloured fields/areas. (...) One of the most important goals [of abstractionism] was not to imitate nature, in a real way.
  The most crucial capacity of abstraction is to be able to identify [it is to endow ourselves with the ability to identify] what information, data or details can be ignored. (...) Abstraction aims to reduce complexity. (...) Exclusive consideration of one of the parts of a whole. (...)

  Abstraction focuses on the most significant information, repeating a process and applying it to different situations, tasks, problems, (...) [or] Applying abstraction processes in a loop, i.e. in repetitive cycles of using the same scheme of tasks/procedures with a view to solving the same problem. (...)

  Abstraction is... selection, repetition [loop], representation and reflection.
- **Abstract Expressionism**: Abstract Expressionism, also called the 'New York School', corresponds to an avant-garde artistic movement. (...) it emerged in the United States, in New York, in the 1940s. (...)

  This movement brought together aspects of the German expressionist avant-garde and the abstractionist current, thus creating a new trend of a symbolic and expressive nature. (...) many artists of this innovative current broke with the traditional easel art. They focused their artistic creation on human emotions and expressions, such as Jackson Pollock, one of the greatest representatives of American abstract expressionism.
- **Algorithm:** (...) An algorithm is a plan, a set of step-by-step instructions used to solve a problem. (...) Algorithms don't always involve complicated feats of programming; at heart, they are sequences of steps to move toward a goal. (...)

  Writing an algorithm requires extensive planning for it to work correctly. The solution your computer offers is as good as the algorithm you write. If the algorithm is not good, then your solution will not be good either. (...)

# CREDITS

This project has been funded with the support of the ERASMUS+ of the European Commission. The contents reflect the views only of the authors, and the European Commission cannot be held responsible for any use which may be made of the information contained therein

Co-funded by the Erasmus+ Programme of the European Union

**Project Partners:**

Learning Hub Friesland

KunstKade Cultuureeducatie in Leeuwarden

Escola Emidio Navarro Almada

Kauno Simon Daukanto Progimnazija

St. Michael's School Malta

IES Hermanos Machado Secondary School

IDEC

Effebi

Bartolomeo

**Design:**

Cecilia Negri per Associazione Bartolomeo