DO IT YOURSELF - STEAM IN FIVE EASY STEPS!

104

Steam-h - Improving STEM learning experience in primary schools through a steam-based multidisciplinary approach

STEAM - H Teacher Training Modules
If you have any questions regarding this document or the project from which it is originated, please contact:

Giulio Gabbianelli
Co.meta srl, via Einaudi, 88
61032 Fano (PU)
Email: g.gabbianelli@consultingmeta.it

The revision of this document ended in June 2022.
Project website: **www.steamh.eu**

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

“Steam-h, Improving STEM learning experience in primary schools through a steam-based multidisciplinary approach” is an Erasmus+ Strategic Partnership - KA201 Development of innovation project.
Project Number: 2019-1-IT02-KA201-062224

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

This document has been created by the collaboration of the whole Steam-h partnership:
Co.Meta srl (IT) project Coordinator, ByLinedu (ES), Talent s.r.l. (IT), Fablab München (DE), La Nostra Escola Comarcal (ES), Steam Education Ltd (IR), Lehrer-Wirth-Straße (DE), I.C. “Simone De Magistris”(IT).

Steam-h

Improving STEM learning experience in primary schools through a steam-based multidisciplinary approach

Intellectual Output n.4
HANDBOOK - DO IT YOURSELF - STEAM IN FIVE EASY STEPS!

This document is licensed under a creative commons attribution-non-commercial-share alike 4.0 international

Table of Contents

DO IT YOURSELF
STEAM IN FIVE EASY STEPS!

DIY STEAM is a Simple 5 Step handbook for teachers who have never done STEAM activities before!

It is laid out in 5 easy steps with images, easy to follow examples, and helpful guides.

1: UNDERSTAND

2: PLAN

3: GATHER

4: ENGAGE

5: EVALUATE & CELEBRATE

Introduction to STEAM-H

This handbook is an output of STEAM-H - an Erasmus + KA2 innovation development project co-funded by the European Commission. Eight partners from four different countries, Italy, Germany, Spain and Ireland, have combined their expertise to develop this handbook as an introductory guide for teachers with little or no experience in STEAM approaches to try it out for themselves.

The purpose is to encourage you as teachers to understand STEAM approaches to education, to try a variety of STEAM activities and see how easy it can be, and to share and encourage other primary teachers and educators to engage!

We also ask you to participate in our evaluation and feedback process, so we can share the benefits of your experience! [See STEP 5/page 35 for details]

STEP 1: UNDERSTAND

WHAT IS STEAM ANYWAY?

STEAM_H

Science - Tech - Engineering - Arts - Maths - Humanities

WHAT IS STEAM?

Most of us have heard of the acronym STEM that is related to the initials in English of these four key areas: Science, Technology, Engineering and Mathematics.

The coining of the term STEM is generally attributed to the National Science Foundation in the USA in the 1990s. Since then, educational projects, as well as industry and government initiatives that use and promote STEM, have arisen all over the world to try and address challenges in education, industry and in daily life, with a multidisciplinary approach.

Some years later, the concept of STEAM began to be conceptualized, (again believed to be from the USA), by linking traditional STEM subjects with art, the arts, and creative thinking. As such the A in STEAM is from the English Art or Arts, and can include any area of the arts, humanities and design.

STEAM has evolved around the world as a method to improve science, technology and mathematics education, and as an approach to designing more holistic learning models to teach creative and critical thinking, support project based learning, and develop a more participatory and collaborative education system.

In this STEAM-H project our main focus is on increasing inclusion in education, with a multidisciplinary approach to provide more meaningful learning experiences for and with the students, and facilitate the integration of students who might feel excluded from or extremely challenged by STEM subjects for a variety of reasons.

This handbook is our collective effort to provide a simple, DIY guide to explain how and why to integrate STEAM into your classroom, in 5 easy steps. We hope you try it and enjoy it!

THE BENEFITS OF A STEAM APPROACH

There are as many benefits to STEAM approaches, as there are approaches to STEAM around the world!

The overall aspiration is to facilitate better understanding in, and empowerment of, the learner. But the specific purpose of STEAM approaches is very much dependent on the context. As such every organisation, educator and learner will apply the approach and experience the benefits in different ways.

STEAM Approaches aim to be:

- Creative
- Interdisciplinary / Transdisciplinary
- Flexible
- Relevant to the Learners
- Inclusive
- Hands-on
- Participatory
- Fun!

STEAM Approaches aim to engage:

- Creativity
- Critical Thinking Skills
- Curiosity
- Change of Attitude to Learning
- Collaboration Skills
- Confidence
- Communication

We believe that using a STEAM approach and teaching kids to think both critically and creatively is key to the development of a society which understands and is fully engaged with the world around it, the resources on which they depend, and in planning and creating a better future.

STEAM Education Ltd

The benefits of a STEAM approach are connected with the need to refresh the learning process to the new reality of society and students.

One evidence: *Society is characterised by the speed of changes*

One Need: *It is necessary for schools to participate in this change*

One Consequence: *Changes on the educational community to adapt to this permanent transformation*

One change: *The role of the teachers is to help students to 'learn to learn', to help them to build their own knowledge.*

One way: *New ways of learning, teaching and management need to be organized and implemented. STEAM approach is a way to manage this change.*

Enric Ortega, La Comarcal

In the real world STEM, Arts and Humanities are all connected!

Science and art have something very important in common: they both seek to reduce something infinitely complex to something simpler. History is replete with stories of where art and science converge and intersect, encircle each other and occupy the same space at the same time. They represent the reciprocal relationship of these two routes towards self- knowledge along which we navigate – of art underpinning science and science enriching art. They can be considered signposts to connections between these parallel roads. Roads which once were one, and which are converging once more

From 'Why Science Needs Art - From Historical to Modern Day Perspectives' By Richard Roche Sean Commins, Francesca Farina, ISBN 9781138959224. Richard is a Neuroscientist working in National University of Ireland, Maynooth and collaborating with STEAM Education

STEP 2: PLANNING STEAM PROJECTS

We have provided a number of sample activities for you to try out in STEP 4, but ultimately we want you to be confident to plan your own!

The following pages are simple guidelines to help you plan, execute and evaluate your own STEAM project! Choose and match STEAM activities that are desirable, feasible and viable for you in your situation.

Before You Begin a STEAM Project it is useful to ask yourself at least some of the questions provided in our **STEAM Planning checklist** on the following pages.
And we have provided a simple **STEAM Canvas Tool** to organise your thoughts & plans [see Page 13].

First we will run through some useful information about STEAM Spaces and Resources.

PLANNING STEAM PROJECTS

STEAM-H
Science - Tech - Engineering - Arts - Maths - Humanities

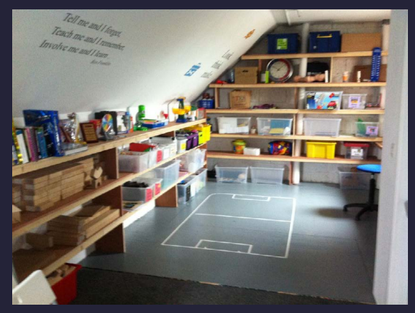
PHYSICAL SPACE

If you don't have a dedicated physical "STEAM" space in your school don't worry, you don't need one! There are activities and opportunities to suit all kinds of spaces, including regular classrooms.

Consider the questions about space included in our checklist in the following pages.

If it helps you can sketch out [digitally or on paper] a rough blueprint of your classroom / school / surroundings to highlight the space and resources available and develop a "vision board" for STEAM activity planning.

Or jump straight into your classroom with one of the activities provided in **STEP 4**



MENTAL SPACE

Creating and allowing the mental space for relaxed and open engagement is as, if not more important as the physical space!

Time is an important element - the requirements really depend on the specific activity - but aim to have enough time that you and the students don't rush through activities, and still have time for discussion, reflection, and clean up / display.

Open-mindedness is another really important element - both you and the students will have a better time if you are open to doing things in different ways than "normal"; sometimes it is necessary to make a bit of a mess, and/or go on a tangent to see where you end up.

STEAM Planning Checklist & Simple Reflection Sheet

	PLAN	ASPIRE	REFLECT: How did it go in the classroom?				
	ASK YOURSELF...	AIM FOR..	Super!	Very Well	Ok	Not sure	Not well
CHALLENGE	What are you aiming for? What kind of challenge do you want? What practices does it promote? What is the level of active learning it allows? What is its connection with the context?	Relevant, fun, authentic, achievable. Include multiple parameters/levels and possibilities for success. Discuss with students what they are aiming for/ what "success" might look like . The process is as/more important than a specific result / outcome!					
CONTEXT	What is the context? What role does it play in the project? What degree of authenticity does it allow? How does it frame the challenge? What is the motivation of the learner to engage?	Clarity, coherence, consistency. Better to focus clearly on a few things /a key question or topic in depth, rather than trying to cover too much. The more relevant to the lives/aspirations of the learners the more engaged they will be!					
EDUCATIONAL OBJECTIVES	Which learning objectives do we want to achieve? What others could be/are usefully included/applied?	Keep it simple. Aim to focus on a few key objectives that engage different skills and competencies. Link skills and competencies to real world applications and opportunities.					
CONTENTS	Which content will you include in this project? How will the contents be presented? Are there any content areas missing that would support better learning and engagement? What level of depth will you go towards?	Accessible Targeted to the level(s) of the learners. Allow room for meander, discussion, space to be creative, to think and process the information/activity.					
LOW TECH MATERIALS & RESOURCES	What kind of materials do you have easy access to? Can you use recycled/upcycled etc materials? Do you have a budget for materials and or external expertise and support?	Aim for upcycling, recycling, re-use, re-purposing of as much as possible. There is no need to spend a lot.					

	PLAN	ASPIRE	REFLECT: How did it go in the classroom?				
	ASK YOURSELF...	AIM FOR..	Super!	Very Well	Ok	Not sure	Not well
ICT - TOOLS & HIGH TECH	What tools and technologies do you have access to? Which will you use? Do you have sufficient devices and expertise for each child/group of children to participate? Why? What will they be used for? What do they promote? What do they activate? What else might do the same job?	The technology and tools should be the vehicle for learning, not the purpose of the STEAM project - irrespective of whether it is a high tech activity or low tech. Poems are written with pencils not by pencils!					
PHYSICAL SPACE	What space/spaces are easily available to you & for how long? Do you plan to display or exhibit the project outcomes in the same space and leave time for other classes to visit and explore? Does your idea/project require specific materials that will affect where you do it e.g. water sources	Aim for a space that suits the activity or challenge - Any of the following will work, depending on the situation: classroom / hall / art or STEAM room/ playground / virtual spaces / other.					
MENTAL SPACE	This is as if not more important than the physical space! -Plan time for discussion, reflection, and clean up as well as the activity, all the elements are important, as is time to process everything	- Open minded, relaxed and open engagement - Encourage doing and thinking about things in ways that you might not normally do, looking from different perspectives -Sometimes it is necessary to make a mess, or see where a tangent takes you!					
CLASSROOM ACTIVITIES	What is the sequence of the activities planned? Are they following a logical process? What ways of thinking, doing or speaking will be important in the classroom?	Give yourself enough time! Time requirements really depend on the specific activity - aim to have enough time that you and the students don't rush through activities, and still have time for discussion, reflection, and clean up. Use/create an appropriate space for you and your students - physical and mental!					
S-T-E-A-M-H	What level of interdisciplinarity is the project promoting? What discipline or disciplines guide the project? What others are used? To what degree are they integrated? Will we use S, T, E, A, M and/or H techniques and procedures? In what ways?	You don't have to force in all of the S, T, E, A, M areas - integrate the disciplines / topics that are relevant to solve/address the proposed challenge. Usually, there is a discipline that acts as a leader. No need to study all disciplines / subjects with the same depth The point is to support understanding not to create division oro competition between subject areas. Be surprising! If you get an "I never knew that was science / maths " type of response that's great!					

TRY THIS SIMPLE STEAM PLANNING CANVAS

Context

Description of Activity:

ICT - Tools & High Tech

Low Tech Materials & Resources

Content

Educational Objectives

Mental Space

Physical Space

Classroom Activities

S	T	E	A	M	H

STEP 3:

GATHER STEAM SUPPORT & RESOURCES!

STEAM-H
Science - Tech - Engineering - Arts - Maths - Humanities

GATHER STEAM SUPPORT & RESOURCES!

STEAM SUPPORT

It's more fun and easier to make progress if you have a team / a few people to support your efforts. Consider working together with other teachers to develop and try your STEAM activities.

You might also consider working with an external partner, such as a visiting scientist / engineer / artist / tech person or organisation like a Fab Lab/Maker Space. Visiting specialists are a great way to engage the students and provide different perspectives on the activities and the possibilities for your students' future.

STEAM RESOURCES

STEAM Resources are Everywhere!

Lots of regular school supplies can be used in STEAM activities - everything in the arts and crafts department, recycling/up-cycling materials, science equipment, computers etc.

High Tech STEAM activities involving computers/laptops/tablets and/or technical equipment such as soldering tools, glue guns etc. might require the use of a computer lab or a specifically designed area such as a "maker space" type area.

Example 1: You are planning a once-off project/lesson/activity, you only have a couple of hours, you need something very easy to set up and remove - this will inform your space and materials choices [don't use e.g. slow dry paints, or clays; don't start with high tech; go for no-tech/low tech/simple materials -if it goes well you build on it for the next activity/plan].

Example 2: You are planning a longer running project that you want to come back to periodically, leaving the materials/resources in place, with the longer term idea of an exhibition of some kind -this will inform your space and materials choices in different ways [ideally a more open, art room type space, water supply, space/facilities to leave paint/glue/clay etc to dry].

Depending on the above you might require some adjustments to the space available.

STEAM RESOURCES
Low Tech/No Tech

“No-Tech"

Options include Arts’n’Crafts materials, materials from the recycling bin, re-usable/ upcycled materials and “regular” day-to-day school supplies.

“Low-Tech & Tinkering”

Tinkering is a form of informal learning, based on learning by doing, using low tech tools combined with recycled materials, paper, plastic and wood. Tinkering allows children to learn to experiment and play games, while developing skills such as problem solving and team work. You can easily and quickly build objects, design creative products that move, draw or float, explore different materials, work with mechanical elements or gears, create simple functioning and luminous electrical circuits, and much more.

Examples of low tech materials:

Batteries, magnets, 3V electric motors, electric/copper wire or sticky copper tape, alligator clips, LEDs, playdoh/ paper/ potatoes can all be used to make e.g. simple circuits, without any great expense or technical expertise. Add a glue gun / insulating tape / blue tack / straws / large plastic caps /wooden sticks/skewers / rubber bands / empty plastic bottles / scissors / pliers and more to make electrical circuits, small robots, mechanical toys, marble tracks, chain reaction mechanisms, sculptures. The possibilities are endless!

STEAM RESOURCES - Where to Start with High Tech

Don't be afraid! You can start trying out high tech activities in your classroom without much, if any, expense, depending on the equipment you already have - e.g. tablets, phones and laptops can all be used to run easy to use free or affordable software to help you try activities involving fun techie activities such as Coding, 3D modelling, Stop-motion animation/ storytelling with software, and simple soldering for electronic circuits.

- Try coding with your class with Scratch Jr., Lightbot.

- Tell stories with Puppet Pals, use Book Creator or any Stop Motion app.

- If you have access to 'Lego We Do' you can also let them code to different subject related contents. In combination with lego brick building, reading stories and collaborating with a partner is a lot of fun.

- If you have robots like Dash or Bluebot for example, then you can let your pupils learn to read and understand and collaborate while programming the robot.

- Start 3D modelling [easy with Laptops, WLAN & Tinkercad] [See activity in STEP 4]

- No tablets? No Laptops? No problem! You can do some coding with Bluebot / Beebot so you can work with 6 groups in the class. All of these activities encourage and engage pupils to collaborate, build, create, measure, code, exchange ideas and in the end do a presentation in front of the others showing the processes they went through, what difficulties they had programming it, what ideas they elaborated together and so on.

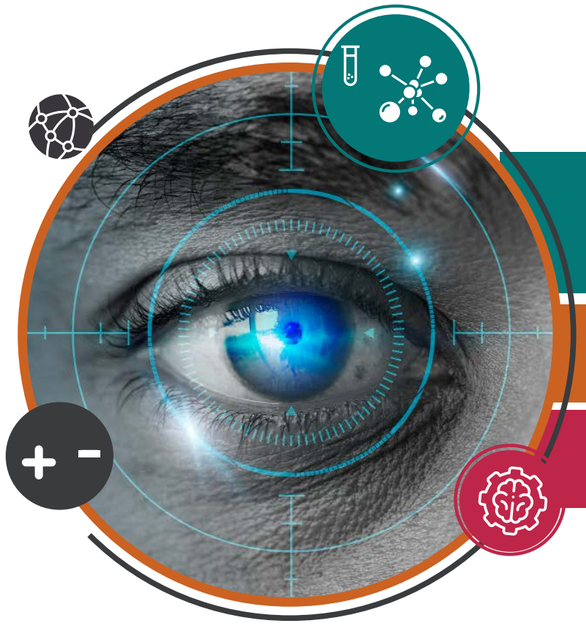
Examples of high-tech machinery and materials:
Tablets, Laptops, 3D printer, soldering stations, Bluebot, Dash, WeDo, Apps like lightbot, stop motion, puppet pals, wedo, dash wonder, BBC microbit, scratch Jr., bluebot, tinkercad, playmais, paper, scissors, pens

STEP 4:
ENGAGE - TRY OUR STEAM ACTIVITIES

The next few pages are a series of fun activities provided by each partner in the project for you to try!

*See our IO1 Report for more details linking STEAM approaches with the European Reference Framework for Key Competencies for Lifelong Learning

Competences are defined in the above EU document as “a dynamic combination of the knowledge, skills and attitudes a learner needs to develop throughout life, starting from early age onwards”.



Activity 1

STEAM Education Presents

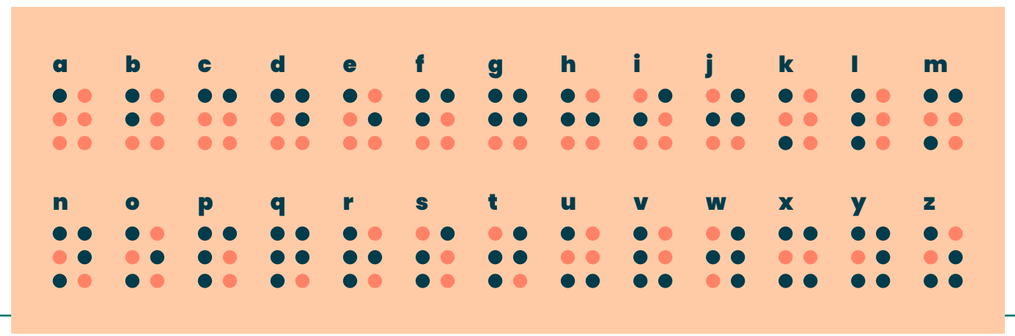
Exploring Eyes!

Description of Activity:

Students will explore eyesight through a series of STEAM activities and investigations, and then make their own braille tools to help understand how we can support people with eyesight challenges.

Key Learning Outcome(s): Students will understand

- the sense of sight, the structure of human eyes.
- the importance of sight and of observation in art and science
-the scientific process.
- creative approaches to understanding eyesight issues and helping people with sight challenges - DIY braille.



Resources Required:

Paper, colouring pencils, a few small mirrors are useful to have. There are several options for the braille board - e.g. a hole puncher and paper to punch out your braille alphabet. Alternatively you can use peg boards and pegs, or use buttons or play dough as spots on paper. If you are very creative you could make a large version using papier maché - It's up to you!

Links to Supporting Content: Lesson powerpoint **here**

Activity 1

Space Suggestions:

Any learning space is suitable. You can organize it in a way suitable for team work, with space for drawing.

Key Competencies Activated: Literacy, Multilingual, Mathematical, Science, Technology and Engineering, Personal, social and learning to learn, Cultural awareness and expression.

Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application.

Skills: Literacy skills, Problem solving skills, Thinking and working scientifically, Design and making skills, Creativity skills, Communications Skills.

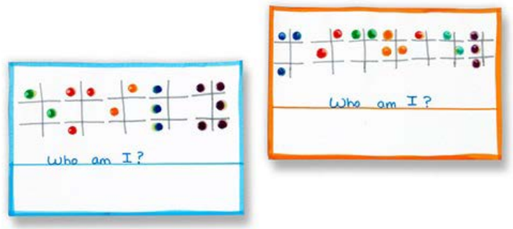
Attitudes: Understanding, Reasoning, Collaborative, Team-working, Empathy, Agency.

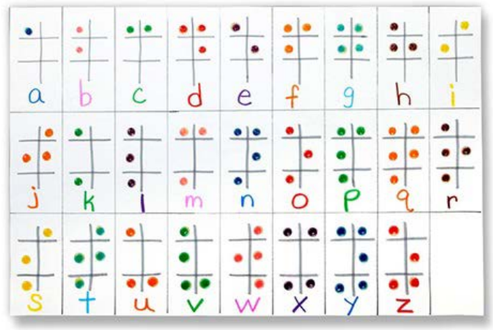
Suggested Duration of Activity:

Approximately 2 hours, or 2 sessions of ~1hour each

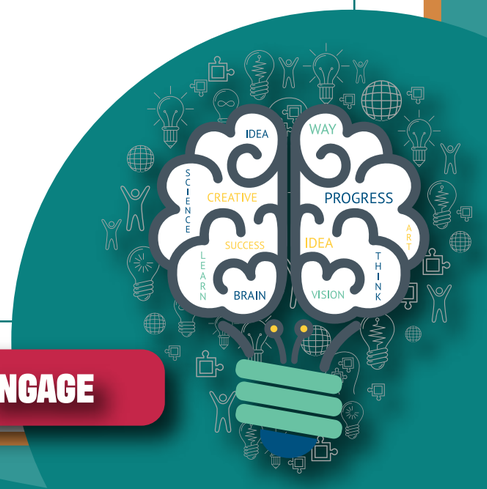
Steps involved:

1. Download the powerpoint presentation to show the students
2. The first section is an introduction to sight, the parts of the eye, and a fun observation game
3. Then the students either individually with a mirror draw their own eye, or team up in pairs and draw their partners eye -taking time to observe carefully and draw what they see
4. Then a short quiz on the functions of the eye
5. Finally we explore what happens when you can't see well - how do you read? Students will make their own braille board with the braille alphabet out of simple materials!
6. Discussion on eyes, sight, observation skills, and how we can help and support people with eyesight challenges.





https://www.crayola.com/lesson-plans/braille-alphabet-lesson-plan/



Activity 2

STEAM Education Presents

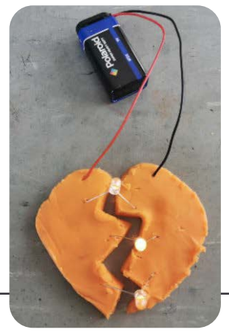
Simple Play dough Circuits

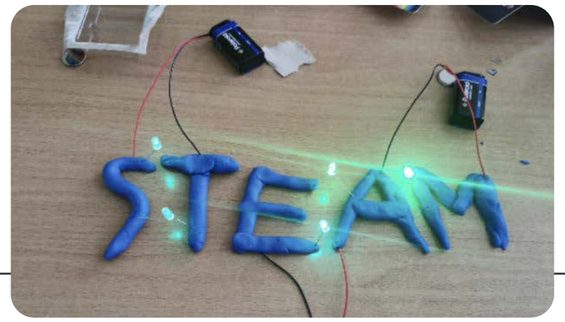
Description of Activity:

If you have never done any electronic circuits before, trying playdough circuits is one of the best and easiest ways! We love this activity. The students learn a bit about electricity, drawing circuits, and try making fun creative 3D circuits with playdough.

Key Learning Outcome(s): Students will

- understand the basics of electrical circuits and be able to draw them.
- understand and recognise simple components and their functions.
- connect the components and operate a circuit.
- design and make creative 3D circuits using play dough.





Resources Required:

-Playdough - a small tub or two per student is good but they can share to have more colours.
Any make of playdough you can buy should work, or you can make your own conductive playdough with flour, water, salt - see video link below.

-One 3v coin battery to demonstrate a really simple circuit
-LEDs [at least 2 or 3 per team of children]
-9V batteries and battery clips [one battery and clip per circuit - they can work in pairs or teams]
-Other components can be added such as buzzers - but you can start with just LEDs no problem.
-Blue tack or lollypop sticks can be used as an insulator to allow you build more complex 3D circuits.

Activity 2

Links to Supporting Content:

Lesson Powerpoint by STEAM: **In here**
Make your own conductive clay: e.g.
https://www.instructables.com/How-to-make-conductive-play-dough/
Simple playdough circuits videos online e.g. this one by STEM-Dola:
https://youtu.be/VcdqBmFETNw

Key Competencies Activated: Mathematical, science, technology and engineering, personal, social and learning to learn.

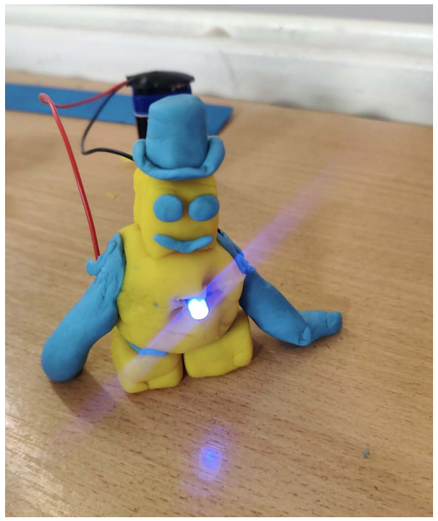
Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application

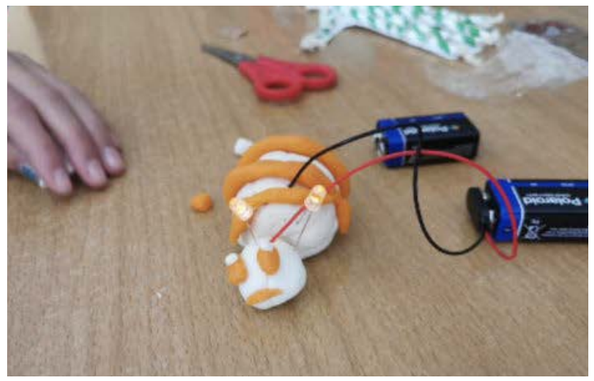
Skills: Design & Making [circuits], Thinking and working with STEM subjects, Mechanical and technical skills, Problem Solving, Creativity.

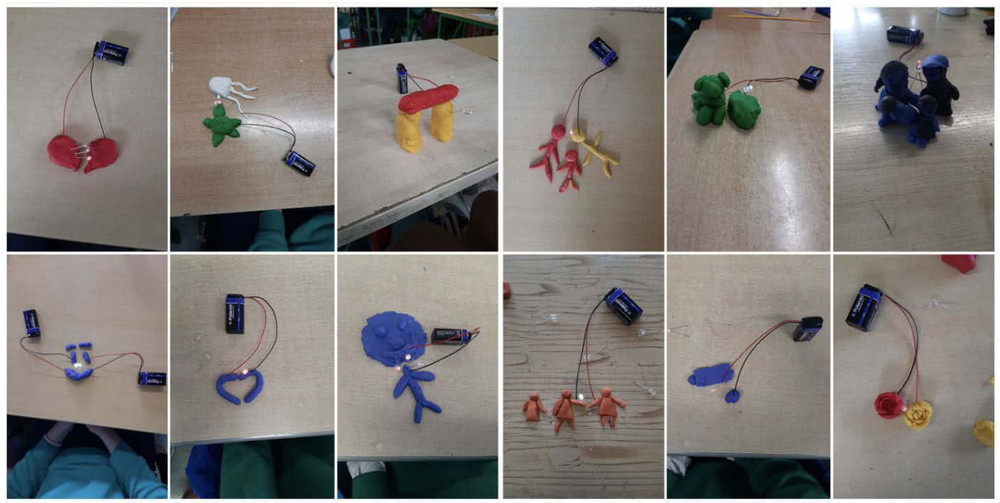
Attitudes: Reasoning, Understanding, Enthusiasm for learning, Appreciation of aesthetic qualities.

Suggested Duration of Activity:

1 to 2 hours



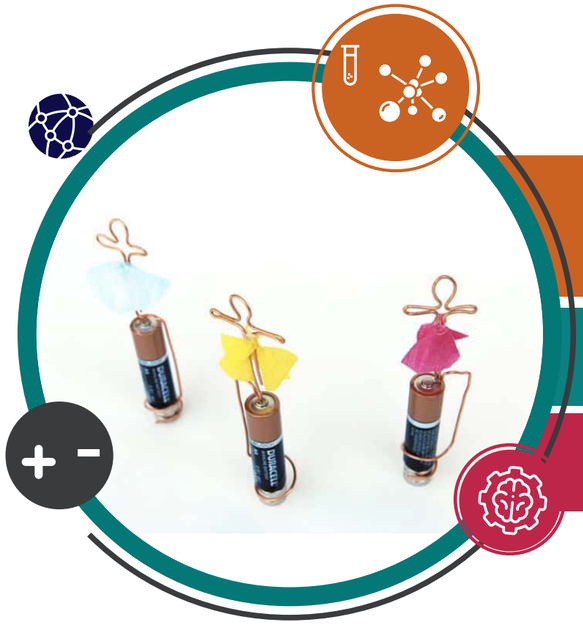




Steps involved:

1. Download the powerpoint presentation to show the students
2. The first section is an introduction to electricity and electronic circuits with a simple demo of a coin battery and LED circuit.
3. Then the students explore how to draw electric circuits in a simple way
4. Then using conductive playdough and LEDs students create fun circuits or all shapes and sizes!
5. If you have buzzers or other components they can be added in.
6. If you have bluetack or lollypop sticks or other simple insulating materials they can be used in circuit design.

Health & Safety: Do not connect a 9v Battery directly to a 3v LED or you will blow the LED!



Activity 3

Bylinedu Presents

Dancers with motors!

Description of Activity:

Build a ballerina or a dancer with a motor, assembling the simplest motor that can be made: the homopolar motor. In this way, girls and boys learn basic concepts about electricity and electromagnetism with a simple STEAM activity.

Key Learning Outcome(s): Students will be able to

- List the electrical components necessary to assemble the motor.
- Describe the functions of the different electrical components,
- Interpret the template with a basic electrical diagram
- Connect the components and understand the basics of a circuit.

Resources Required:

Copper wire, 12mm diameter x 6mm thick N42 Neodymium Disc magnets, Battery, Wire cutters, Electrical scheme template, Colored tissue paper.

Links to Supporting Content:

A few versions of Homopolar Motor Videos on Youtube in English, with Neodynium magnets, and in Spanish **https://babbledabbledo.com/steam-project-tiny-danc-ers-homopolar-motor (english)**

Source: Fuente: babbledabbledo https://babbledabbledo.com/steam-project-tiny-dancers-homopolar-motor

Activity 3

Space Suggestions:

Any learning space is suitable, you can organize it in a way suitable for team work.

Key Competencies Activated: Mathematical, science, technology and engineering.

Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application.

Skills: Design & Making [circuits], Thinking and working with STEM subjects, Mechanical and technical skills, Problem Solving.

Attitudes: Reasoning, Understanding, Enthusiasm for learning, Appreciation of aesthetic qualities.

Suggested Duration of Activity:

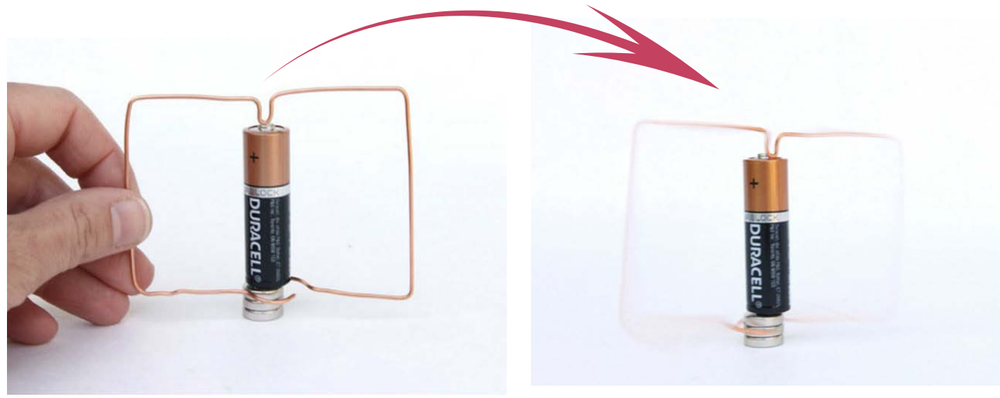
2 sessions of 45 minutes each.

Steps involved:

1. Print the template: https://cdn.babbledabbledo.com/wp-content/uploads/2015/03/Homopolar-Motor-Templates.pdf
2. Cut a long piece of copper wire and, using the template, create the shape of the dancer.
3. Place the magnets on the negative side of the battery and connect them with the wire.
4. The dancer or ballerina will begin to spin.
5. You can dress or customize a costume for the figure with colored paper in the shape of a skirt.
6. What if you prepare a competition for the students to choose the best dancer accompanied by music?

Health & Safety: Copper wire should be collected and stored away from batteries before and after the activity and also monitor for heat during the activity. Thin wire does not work! Keep the forms as symmetrical as possible!

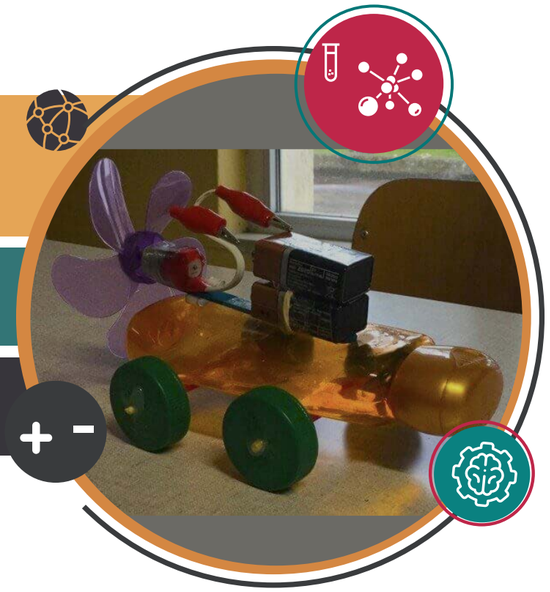
This activity requires strong magnets to work. We use 12mm diameter x 6mm thick N42 Neodymium disc magnets (4.3kg Pull). Be very careful with these magnets - do not let children use them unsupervised.



Activity 4

Talent Presents:

Make a Mini Motor Car



Description of Activity:

Firstly you introduce an Electrical circuit and how it works. You can build one by adding a 3V motor to a battery.
Next creativity: you should guide your students to build the body of the car with a bottle and other recycled materials.
Finally you can connect the circuit to the car by connecting the motor to the electric wires at the edges of which the crocodile clips are located. Insert the rotating shaft of the motor into the propeller - that is the most difficult part of the job: students can try to make it by hand but the use of recovery propellers (i.e. from old toys) could certainly make it easier.

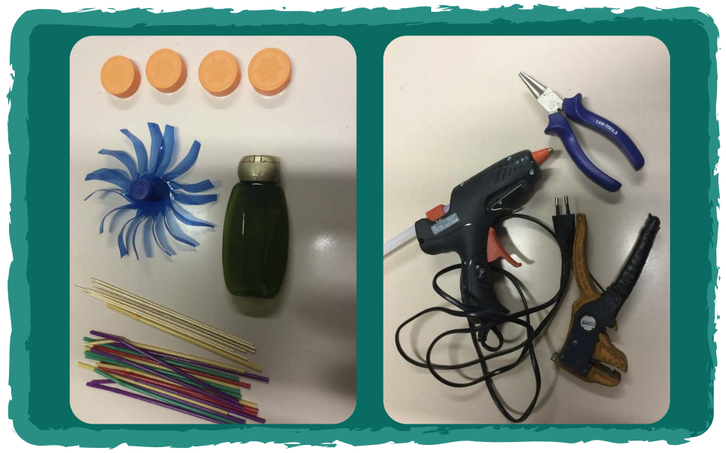
Key Learning Outcome(s): Students will understand:

Electricity and circuits: the basic concepts
The characteristics of the air: resistance
Application of design skills

Space Suggestions:

Any learning space is suitable. You can organize it in a way suitable for team work. Some clear floor space to test you cars is good to have.

Resources Required:



Electronics: 3V electric motors, batteries, electric wire? small alligator/crocodile clips.
Tools: wire stripper, scissors, pliers, hot glue gun.
Others: insulating tape, straws, large plastic caps, wooden sticks (skewers), wooden slats, rubber bands, empty plastic bottle, propeller, recovery material [from recycling/ upcycling].

Activity 4

Links to Supporting Content:

The original activity was published by Alessandra Valdarnini, an Italian Teacher, here:
www.weturtle.org/dettaglio-progetti/42/gran-premio.html

Key Competencies Activated: Mathematical, science, technology and engineering.

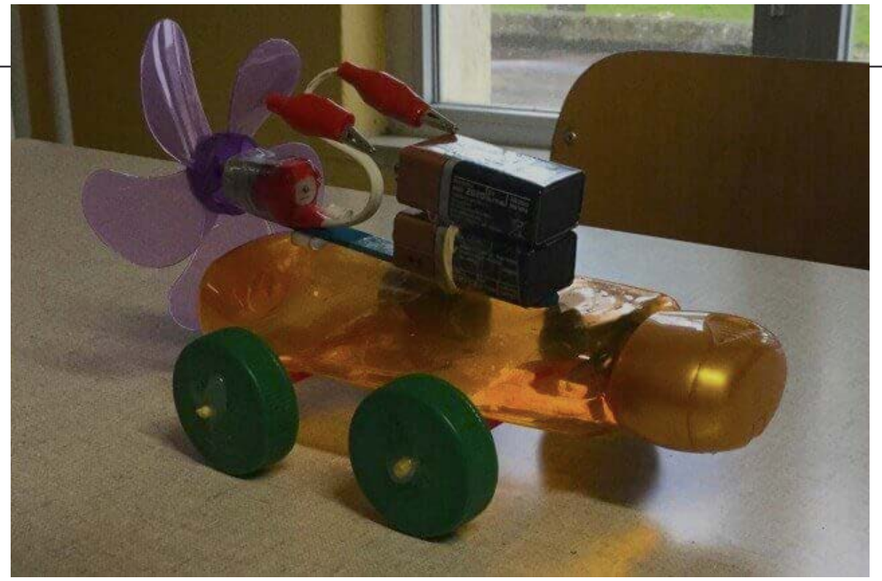
Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application.

Skills: Design & Making [circuits], Thinking and working with STEM subjects, Mechanical and technical skills, Problem Solving, Communication and collaboration skills, Ability to seek support.

Attitudes: Reasoning, Understanding, Enthusiasm for learning, Collaboration & teamworking, Initiative and Inventiveness.

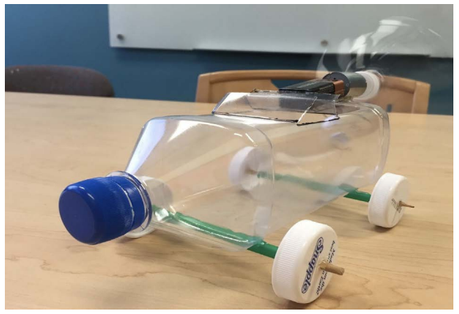
Suggested Duration of Activity:

1 to 2 hours



www.weturtle.org/dettaglio-progetti/42/gran-premio.html

How To Make Bottle Mini Car Toy at home - Diy Air Powered Small car - Sanu Tech



https://www.instructables.com/Electric-Bottle-Car/

Health & Safety: Copper wire should be collected and stored away from batteries before and after the activity

Activity 5

I.C. “Simone De Magistris” Presents:

Building a Smart City

Description of Activity:

Build a three-dimensional model of a sustainable city using electricity kits and recycled or everyday materials. In this way, pupils learn basic concepts about electricity and sustainability. The activity is inspired by the Goal 11 of the 2030 Agenda: Sustainable Cities and Communities.

Key Learning Outcome(s): Students will be able to:

- List and use the electrical components necessary to assemble the wind turbine.
- Describe the functions of the different electrical components.
- Design and implement a model of a city according to sustainability criteria.
- Describe how to carry out the process of connecting the components.
- Describe the functioning and benefits of renewable energies for the environment.

Resources Required:

- Students’ logbooks
- Mini solar panels
- Propellers
- Mini electric motors
- Battery
- Recycling materials
- Electrical circuit scheme
- Scissors, glue, colours, etc.

Links to Supporting Content:

https://youtu.be/Awu3JJC3A0k

Activity 5

Space Suggestions:

Arrange the desks in islands to facilitate the construction of the artefact and collaboration between peers.

Key Competencies Activated: Mathematics, science, technology, art, geography and engineering.

Skills: Connect, Cut, Design circuits, Design and build an artefact.

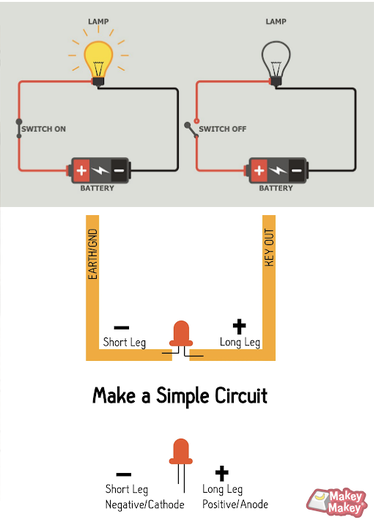
Soft Skills: Problem solving, Collaborate and share, Self-evaluate.

Suggested Duration of Activity:

2 sessions of 2 hours each.

Steps involved:

1. Introduction to the functioning of electrical circuits and experimentation with mini solar panels, LEDs, propellers, and mini electric motors;
2. Introduction to the Goal 11 by watching the video (flipped classroom model);
3. Plenary discussion on the Goal 11 and the renewable energies;
4. Presentation of the challenge;
5. Planning of the map of the city in groups (in the logbooks) according to sustainability criteria: draw the project, list the materials and indicate the arrangement of the solar panels and/or wind turbines;
6. Collection of useful recycled materials for the construction of the three-dimensional model;
7. Construction of the model with the collected materials and electricity kits provided by the teacher;
8. Presentation of the models to the other groups;
9. Plenary discussion to highlight strengths and weaknesses;
10. Self-evaluation in the logbooks.



Activity 6

Co.Meta srl Presents:

Create an animated story with Scratch

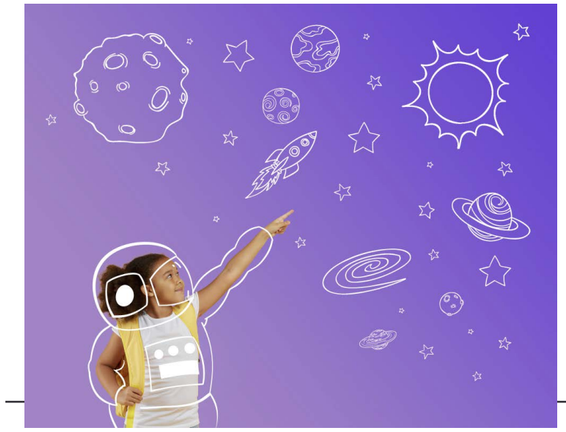
Photo by **Chris Hardy** on **Unsplash**

Description of Activity:

Learners will create an animated story using Scratch. The activity required basic knowledge about Scratch. If you have never used it, it is very easy to download and the official website provides easy tutorials.

Key Learning Outcome(s): Students will

- Be able to understand the key elements of the story (characters, storyline, stage)
- Be able to design an animated story
- Be able to understand and apply the basics of programming and coding



Space Suggestions:

Classroom or space with tables

Resources Required:

- Scratch **(https://scratch.mit.edu/)**
- PCs/tablets
- Internet
- Storybook copybook or plain paper

Activity 6

Key Competencies Activated: Literacy, Digital, Personal, Social and Learning to learn, Cultural awareness and expression.

Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application in Language, Arts & Technology.

Skills: Literacy skills [understanding texts, analysing a story], Critical Thinking and Reasoning,. Digital & Programming skills, Collaboration.

Attitudes: Creativity, Enthusiasm for learning, Self motivation, Teamwork.

Suggested Duration of Activity:

3 hours [Can be divided into shorter sessions]

Activity Steps:

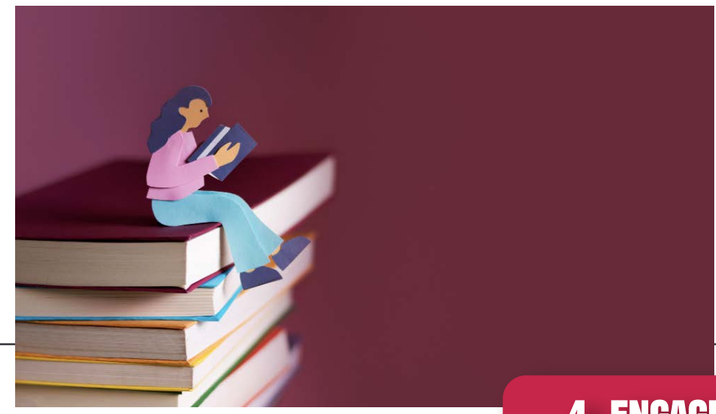
Creating Characters, Setting, Story:
- Teacher or students choose a short poem or story, they read and analyse [25 minutes].
- Teacher helps students to define the characters, storyline, and setting for use in Scratch (30 minutes).
- Drawing characters and setting: Students draw their characters and setting & the teacher digitises the images to be uploaded on Scratch.Images should be saved as any of the following: (.svg, .png, .jpeg, .bmp, and .gif). (30 minutes) .
- Story Design and Creation (120 minutes): Students represent their story on Scratch following the steps below.

Using Scratch:

1. Teacher downloads Scratch; Teacher helps students download Scratch onto their devices
2. **Students CREATE THE PROJECT** by Launching app and clicking on the Home icon to start a new project.
3. **UPLOADING YOUR CHARACTER**. When you start a project, the default Scratch sprite will appear. To upload your own sprite, select the "Choose a Sprite" button underneath the stage, click on the "Upload Sprite" option, then select a sprite file or desired image in a supported format (.svg, .png, .jpeg, .bmp, and .gif).
4. **UPLOADING YOUR STAGE.** To upload a costume or backdrop, select "Upload Costume" or "Upload backdrop" in the paint editor and choose the desired image file in a supported format (.svg, .png, .jpeg, .bmp, and .gif).
5. **RUNNING THE CODE.** The teacher should briefly present the programming blocks to create the script by clicking the 'Code' tab at the top of the screen to open the workspace. Now it's time to do some programming. Students should take this time to explore the programming blocks and start creating their story.

It is recommended to go to the 'Events' section and drag a 'when green flag clicked' block to the workspace. This will be how you will start the animation.

6. **Sharing (15 minutes):**
Students should be encouraged to share their stories. They should explain what is occurring in their story, and where the idea for their story came from.



Activity 7

La Comarcal Presents: STEAM Introduction to programming languages with Bluebot Robots

Key Learning Outcome(s): Students will:

- be able to understand and apply the basics of programming and coding
- be able to write logical sequences, analyse and recognise errors, and plan for improvement
- understand and research the possibilities of robotics
-work collaboratively and with students at different levels

Space suggestion:

A corner of the Classroom - we designate this 'STEAM corners'

Resources Required:

- Bluebots
- PCs/tablets
- Internet
- Paper and pens/markers
- Everyday classroom objects

Links to Supporting Content:

- Bluebots Programming Guides
- About the Activity in Spanish/Catalan

Activity 7

Duration of Activity:

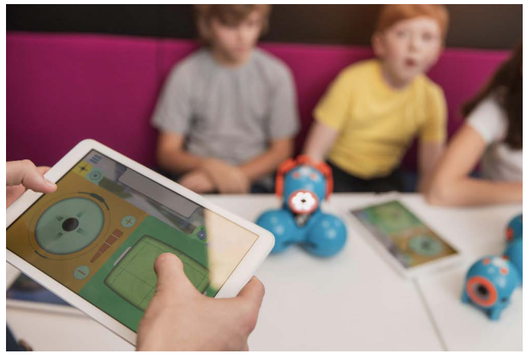
We do this activity weekly (5 h) throughout all three terms. The last term is usually an organised inter-level approach

Key Competencies Activated: Mathematical, science, technology and engineering, Literacy, Digital, Personal, Social and Learning to learn

Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application in Language, Arts & Technology

Skills: Critical Thinking and Reasoning, Digital & Programming skills, Collaboration

Attitudes: Creativity, Enthusiasm for learning, Self motivation & Evaluation, Teamwork



Steps involved:

Step 1: Designate a corner of the classroom for the activity.

Step 2: Introduce the Bluebots and the idea of programming languages.
Step 3: Start with the question: "How does this device work?" The challenge is to create a circuit using pieces of wood and other everyday classroom elements.

Step 4: In order to collect the information on this process, the students are asked to fill in an activity diary where they have to write the sequence that had to be programmed for the robot to achieve the challenge. This diary has to collect the previous versions with the wrong sequences to make students aware of the improvements produced on each new attempt.

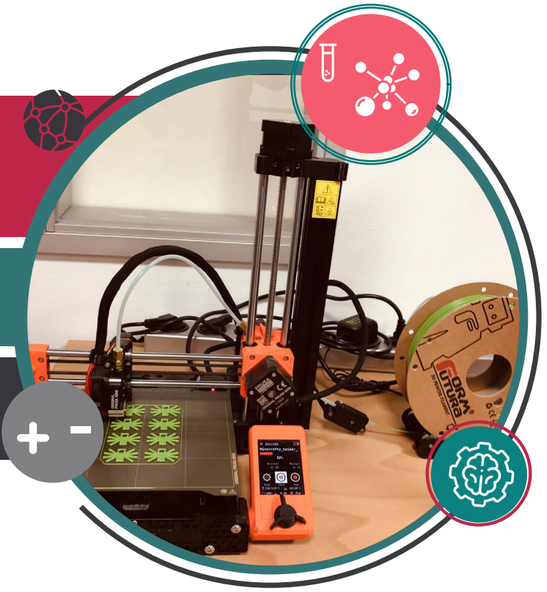
Step 5: Students from mixed levels can teach each other.

https://blog.teaching.com.au/introduction-to-the-bee-bot-and-blue-bot-in-the-classroom

Activity 8

FabLab München Presents:

Start 3D modelling with TinkerCAD - build a tiny house!

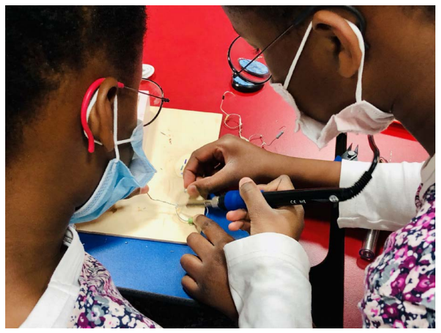


Description of Activity:

For this activity you need PC's or Laptops or Tablets, Internet access and the programme Tinkercad to work with your students to learn the basics of CAD software and 3D Modelling.
The students will learn how to programme a tiny house to 3D print! This activity is all done in the programme - if you want to actually print your tiny houses you will need access to a 3D printer. You could check for a Fab-Lab in your area. Or is you are really enthusiastic and have a budget we have a link below to a reasonably priced good printer.

Key Learning Outcome(s): Students will:

- learn how to use a free and easy to use CAD Software
-develop skills to orientate in a three dimensional space and use different geometrical shapes to build a house
-learn how to cut holes and do the measurements with the programme



Space Suggestions:

You need a room with computers, or laptops or any room with tablets with access to internet.

Resources Required:

Internet, laptop or tablets
Tinkercad account at **www.tinkercad.com** - a free, easy-to-use web app that equips the next generation of designers and engineers with the foundational skills for innovation: 3D design, electronics, and coding.

Activity 8

Links to Supporting Content:

www.tinkercad.com
Tinkercad PDF instructions
Low price reliable 3D printer for entry level: e.g. Prusa Mini

Key Competencies Activated: Literacy, Digital, Personal, Social and Learning to learn, Cultural awareness and expression

Knowledge: Literacy, Understanding Fundamental concepts, Communication and Application in Language, Arts & Technology

Skills: Thinking and working with Technology, Digital & Programming Skills, Collaboration, Communication skills

Attitudes: Creativity, Innovation, Initiative, Persistence, Understanding, Self motivation, Teamwork

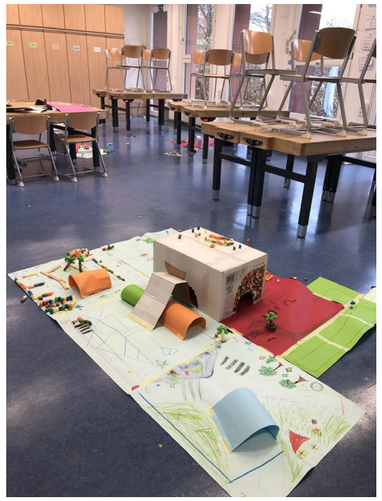
Steps Involved:

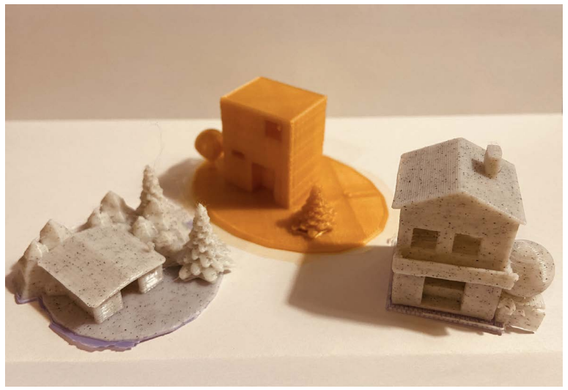
1. Create an account at **www.tinkercad.com** and assist students to do the same on their own

2. Explain the basic moves of tinkercad [use pdf of Tinkercad Overview] like getting basic shapes, scribble, enlarging, hole cutting, grouping, deleting, changing colour, measurement etc.

3. Present the challenge to your pupils to build a small house on their own with the following parameters:
4 to 6 cm as floor space, with maximum 6 cm high, at least for example 3 windows, a door, a roof and a chimney with smoke coming out, to include all the basic moves.

4. Help every pupil individually in case they need help. Soon you will get experts for different steps, so they can be a tutor for other pupils.





STEP 5: STEAM SUCCESSES - EVALUATE & CELEBRATE

STEAM-H
Science - Tech - Engineering - Arts - Maths - Humanities

STEAM SUCCESSES - EVALUATE & CELEBRATE

It is important to reflect on and assess your STEAM activities, to get the most out of them for yourself and your students. We invite you, as teachers who are new to STEAM, to participate in our Evaluation of this STEAM-H project overall and this particular output!

We hope that you enjoy it and that you will provide us with valu-able feedback to ensure that primary teachers are as well support-ed as we can manage in this project.

There are two options:

Option 1: DIY - Choose an activity, test it with your class, and use the simplified planning, reflection and evaluation sheets to reflect on your efforts!

Option 2: Participate in our more comprehensive evaluation of the activities, the Handbook, and the relevance and use of this STEAM H project overall to you and your students.
We would be very grateful for your participation. The evaluation sheet for the more comprehensive evaluation is available here - you can fill it in online or download and submit.

Evaluating How Well STEAM Activities Worked For Your Students

OBSERVATION OF STUDENTS	EVALUATION OF THE LEVEL ACHIEVED BY STUDENTS IN THE CLASSROOM				NOTES
DIMENSIONS	**Advanced**	**Intermediate**	**Basic**	**Initial acquisition**	**Additional Comments**
CHALLENGE: Understanding and managing the challenge	Students understand and autonomously manage the challenge and perform it well, even in new situations /with new parameters added.	Students understand and autonomously manage the challenge and performing well.	Students understand and manage the challenge and show competence in carrying out the basic steps.	Students understand and manages the basic challenge with support.	
CONTENT & CONTEXT: Understanding the content, context and being motivated to learn	Students understand the content and context very well, are motivated to learn and seek additional information and challenges.	Students understand the content and context well, were well motivated to learn.	Students understand the content and context well, and were motivated to learn.	Students understand the basic content and context and were motivated to learn with support .	
LITERACY: Knowing and using specific vocabulary: -use appropriate language -organise information in coherent texts and diagrams	Students understand and use the vocabulary specific to the discipline[s] very well, arrange the materials with awareness, and communicative effectiveness.	Students understand and use the vocabulary specific to the discipline[s] well, arrange the materials with awareness, and communicative effectiveness.	Students understand and use the vocabulary specific to the discipline[s] to some extent.	Students need help to understand and use the vocabulary specific to the discipline[s] and relationship to materials and how to communicate.	
LEARNING OBJECTIVES	All Learning Objectives were achieved to a high degree	All/most Learning Objectives were achieved quite well.	All / most Learning Objectives were achieved well.	Most Learning Objectives were achieved to some degree.	
MATERIALS & RESOURCES: -analyse and choose materials to be used -make informed choices relevant to the task	Students identify and select information and materials autonomously and confidently, making informed choices.	Students Identify and select information and materials autonomously.	Students Identify and select only some information autonomously.	Students identify and select some information and/or materials with the support of a guide.	
ICT - TOOLS & HIGH TECH: Knowing and using the main computer, ICT Tools, apps and multimedia procedures relevant to the task	Students autonomously and consciously use the ICT tools and apps relevant to the task, confidently use them at the basic level directed, and pursue further knowledge, applications, tools etc	Students autonomously and consciously use the ICT tools and apps relevant to the task.	Students use the ICT tools and apps relevant to the task, but need the teacher's help in the personal revision phase.	Students use the ICT tools and apps relevant to the task, but need constant guidance from the teacher throughout.	

OBSERVATION OF STUDENTS	EVALUATION OF THE LEVEL ACHIEVED BY STUDENTS IN THE CLASSROOM				NOTES
DIMENSIONS	**Advanced**	**Intermediate**	**Basic**	**Initial acquisition**	**Additional Comments**
CREATIVITY SKILLS:	Students approach activities challenges in interesting, innovative and creative ways, that are original to them, & go beyond the basic instructions.	Students approach activities challenges in creative ways, with original aspects.	Students engage in creative skills and will push the boundaries with encouragement and assistance from teacher.	Students need a constant encouragement to go beyond basic creative skills.	
SPEAKING IN PUBLIC: -master communication techniques -control emotionality -solve the unexpected	Students handle communication/presentation independently and confidently. Are in full control of emotions and able to resolve unforeseen situations promptly.	Students handle communication/presentation independently. Control emotions and resolve unforeseen circumstances.	Students manage communication and presentation well and control emotions, with some assistance.	Students need support to manage their communication and presentation skills.	
COLLABORATION SKILLS: Learning together: -respect tasks, roles and time -support and listen to others -collaborate	Students respect tasks, roles and times, support the work of others, promote cooperation and listen to everyone. Support the group in a proactive way.	Students respect tasks, roles and times, collaborate and listen actively.	With somoe difficulty students respect tasks, roles and times; not very active in collaborating and listening.	Students take a passive and unproductive attitude. Need guidance to meet commitments and work with others.	
STEAM H:	Students understand links, overlap of subjects, broader context and seek further information.	Students understand links, overlap of subjects, broader context.	Students understand some links and overlap of subjects, and broader context with some assistance.	Students need assistance to understand links, overlap of subjects, and broader context.	

CELEBRATE!

Thank you for reading our Handbook.

We hope you try all the activities!

STEAM-H
Science - Tech - Engineering - Arts - Maths - Humanities

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

in collaboration with

cometa
consulting firm

ByLinedu
tecnología inclusiva

Grundschule Lehrer-Viehl-Straße

la Comarcal
la nostra escola

steam
Education Ltd.
www.steam-ed.ie

TALENT

fablab München

Istituto Comprensivo Simone De Magistris
C Camporotondo
B Belforte
C Caldarola
S Serrapetrona
C Cessapalombo

www.steamh.eu

STEAMH.Project

Follow us on the web
using #STEAM_H