Lesson plan

using the STEAM method of teaching.

Topic: How do you place the house of your dreams on your plot of land?

LESSON PLANS

Lesson 1: The straw house - a STEAM perspective

Introduce:ion: 10 minutes We tell the pupils that today we are going to work on a challenging project: how to build a house taking into consideration the following aspects: environment, climate, topography and orientation. We start from the plan of the house, designed during a previous acfivity, and we apply the knowledge they gained in the mathemaf:ics classes, in order to calculate the volume of a building, based on the indicators shown in the table. We show students the plans of the houses from the previous acfivity and we ask them to say what they can remember about the little architects from their walk in the gallery tour
(Science - brainstorming) - Watching the MOVIE "The Three Little Pigs"on YouTube: 8 minutes Which of the three little pigs would you like to be your friend or your neighbour? Why or why not? We hand out to the pupils the STEAM journals in which they will write the acfivity fitle.
Overstaffing on jobs related to the building industry: 7 minutes Which are the jobs that are related to building a house? If you could have any of these jobs, which one would you choose and why? The pupils will write down their individual answers and then they will share them in pairs.

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ImpIementaf:ion: 20 minutes

Geography - Part 1. The impact of the orientation and climate

Which side gets more heat and light from the Sun in the Northern hemisphere, including in our climatic area? The Southern part.

What should we do so that our house receives as much sun as possible?

We built the house facing south.

Which rooms in our house should face south?

Those we use the most.

Which rooms do we mostly use in your family?

The most frequent answers can be: the living room and the kitchen.

In regards to the things discussed so far, what can we say about the Southern hemisphere (for example Australia)?

Here, the North is more exposed to the Sun, so the rooms facing north benefit from the sun all day long during winter.

To conclude, how can we decrease the cost we pay for heating the house?

By proper orientafion of the house.

How can we solve the issue of a hot house during summer?

We can shade the house with wide eaves. We can also plant deciduous trees.

What other clime-related issues should we keep in mind when we build a house?

Prevailing wind and breeze.

Why is it important to know their direction?

They help us position the house in a way that allows us to obtain its passive cooling.

Part 2. The impact of the environment and topography

Let us assume that we want to build a house in a mountain area.

How should we choose the plot of land in order to benefit from the sun?

The plot of land should be oriented towards the South.

In which part of the slope should the building be placed? (we will ask supplementary quesfions: at the top, in the middle or in the valley?)

In the middle part of the

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slope. What can happen

otherwise?

If we placed it at the top, the building would be exposed to the wind shear, while in the valley some drainage problems could occur

How can we solve the problem of a house which is too hot in summer time?

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The best solution would be to plant broadleaf forests to the South, as they are full of leaves in summer, shading the house, while in winter, when they lose their leaves, they will let the sunlight enter the building. To the West, in order to block the strong afternoon sun, the best solution is to plant conifer trees. We have to bear in mind that trees should be planted at a certain distance from the house, in order to avoid the risk of harming the foundation of the house, but, at the same time, the building should not harm the roots of the trees.
Interactive game Wordwall: hftps://wordwaII.net/resource/53899540
Art's - Ending. Each team will draw its own prototype house, taking into consideration specific climate, orientation, topography and environmental conditions. If a company used your ideas in order to build a house, which would be your strong points? What would you change about your house?

Lesson 2: The house made of sticks - based on the theory of mulfiple intelligences

Discovery, experimentation, trial, courage, teamwork are all possible in the classroom. The more attractive and motivating the learning process, the nicer it is. The more senses involved in the learning process, the more motivated the children are to learn and remember what they have discovered. When children build, create and

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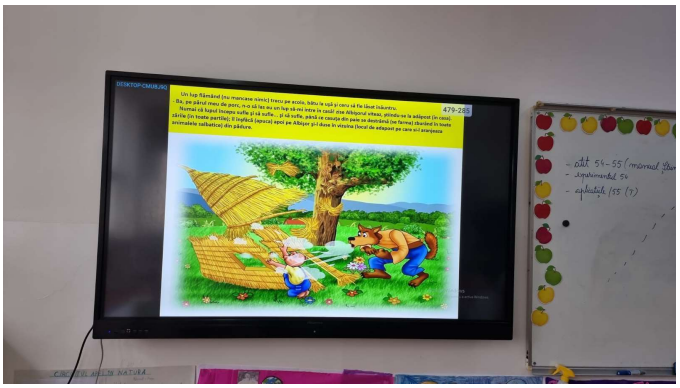
explore, learning makes sense to them.

To enhance learning we can choose to apply the principles of **multiple intelligences** through the story "The Three Little Pigs".

In order to develop their **linguistic intelligence,** the children read the story and have a debate about the materials used by the piglets, they express their opinion about how each house has been built, what the building rules are, where the houses are built and the boundaries of the plot of land on which the houses are built. They talk about the conditions that have to be taken into consideration when building actual houses and about the fact that the law imposes certain construction regulations.



In order to develop their **logical-mathematical intelligence** the children formulate predictions based on various theories and come to the conclusion that we do not build by chance. There are several rules that must be followed when building. Therefore, we put ourselves in the shoes of an architect and build constructions from recyclable materials: skewers, biodegradable plastic straws, matchsticks, puffs, pasta, plasticine, marshmallows.

They will conduct an experiment to prove how stable and durable a building is if made from-materials such as skewers, biodegradable plastic straws, matchsticks, puffs, pasta, plasticine, marshmallows, pencils. The children will work together to build a house, being encouraged to collaborate and help one another. It might be necessary to provide certain models or solutions to children. The time required to finish their constructions might vary. Thus, straw houses will probably be ready much faster than pasta and matchstick houses. Those who build pencil houses will want to make sure that their houses will be durable, so they would probably stick the pencils together with paper tape.

We will encourage collaboration, teamwork and interaction. They will help each other, will measure the built surface, will count how many sticks they will need and use, will design sketches of the building.

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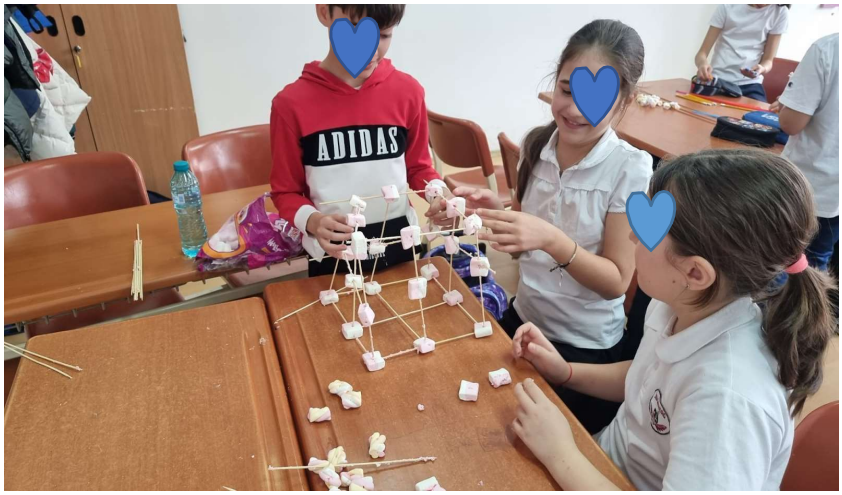

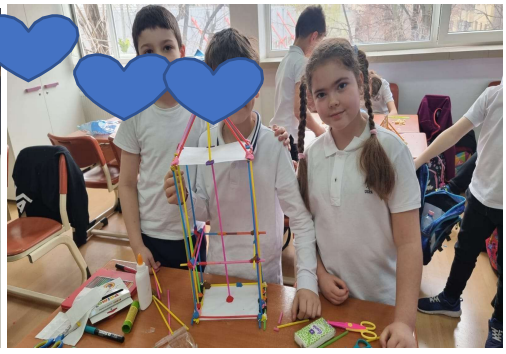

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Then an endurance test is conducted in front of the classmates. The easiest to tear down will be the straw construction. Second will be the house made of matches. Other constructions are more difficult to destroy. The construction made of pencils held together with paper tape is the most solid. After conducting such an experiment, you want to be like Naf-Naf, that industrious and intelligent pig who built himself a sturdy little house.

Our activity was carried out during several class periods. However, the children were involved, delighted and excited throughout the way. Involvement, collaborafion, and experimentation helped to carry out the constructions.

In order to develop the **musical intelligence,** each team will try to find the rhythm of the construction and make a splash, clapping their hands on the table, humming, stomping their feet on the floor, clapping. The children may conclude that each construction has its own rhythm waiting to be discovered. In music the rhythm is heard, in construction the rhythm is seen. Music expresses rhythm in time, and in construction it expresses rhythm in space.

For the development of their **body-kinesthetic intelligence** the children will have the challenge of repairing a building that has collapsed and come up with ideas for a more solid structure.

The children will create metaphors and visual analogies about their constructions in order to develop their **spatial intelligence.**

For the development of interpersonal intelligence the children shall work in teams, collaborate, exchange ideas about the importance of recycling and make creafive constructions from recycled materials.

Evaluation: https://wordwall.net/resource/53816327

Even though this whole process is quite demanding, the enthusiasm and joy are equal to the challenge. The children's creations can be impressive, impressive are also the ideas shared during learning, the help they offer to each other. They will work hard, but will be delighted with the result of their work.

Lesson 3: The brick house

Option 1

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How should you place the house on your plot of land?

STEAM lesson based on the premise of building the most durable house made by one of the three little pigs.

Geography: Where should you place the house and what kind of house is best suited for you?

We all know that the safest road is the one you know. Therefore, the best place to start building a house is in the geographical area you live in, as you know the weather, the soil, the heating necessities, the social needs and interactions of the people. Some geographical clarifications about climate are also required and are presented below.

Continental climate

Temperate continental climate is usually specific to the inner parts of the continents, where there are large areas of land spread in all directions, and it is sometimes determined by the orientations of mountain ranges.

Other features are:

- Summers are hot (average monthly temperature during summer is 20 to 30 degrees C);
- Winters are harsh (average monthly temperature during winter is -1to -40 degrees C);
- Annual precipitation of approximately 500-800mm, especially in summer and spring;
- The west winds are blowing,
- It has 4 seasons.

The climates of Europe:

Continental environments are present in the central parts of the continents, located at great distances from the oceans, most of the time being framed by high mountain systems. These environments are widely spread in Eurasia and North America. Temperate-continental air masses are predominant here, but other air masses (arctic, dry tropical, etc.) also influence the climate. The annual amount of precipitation is below 500 mm, and in the regions interspersed with high mountains severe droughts are recorded.

The large land mass amplifies the effect of the continental climate in both heat absorption and heat loss.

There are different types of climates:

1. Equatorial climate;
2. Temperate-continental climate;
3. Tropical-dry climate;
4. Polar climate.

An important aspect to consider in choosing the place for building a house is the fact that most of our planet's

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human population lives in temperate zones, and especially in the northern hemisphere.

Source:https://prezi.com/p/56zabrgcmp8t/clima-temperat-continentaIa/#:":text=CIima%20temperat%2DcontinentaIa%20se%20caracterizeaza,temperaturi%20medii%20Iunare%20sub%2000C.

Even though choosing the familiar climate to place the house of your dreams has a big impact on placing the house, it is also important to study some house models around the word.

Some of the most spectacular houses around the world are the following: (The following material is available in a PPT, annexed to this material).

Palafito

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These houses are built on stilts/pillars and can be found in lagoon areas, lakes or even on the coast; they are specific to Argentina, Colombia, Benin, Chile or Peru.

Ruca

It is the traditional house of the Mapuche tribe, who live in Chile and Argentina.

They are built from reeds or straw, using only natural materials. They are always oriented to the east.

In the past, building a ruca required the permission of Ngen-mapu spirit.

Igloo

It is generally dome-shaped and constructed of snow blocks, used in frozen areas such as Antarctica and Alaska. They were usually built by the Eskimos as temporary shelter for hunting reasons, but there are also igloos that serve as permanent houses. There are also igloos with several rooms or groups of small or medium igloos linked together by tunnels, which are permanent. These types of shelters are a proof of human adaptability to living in harsh weather conditions.

Also, ruca houses are a proof that the human being has always been preoccupied with the environment, as the houses are built from natural materials, with little impact on the environment.

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https://orca.cf.ac.uk/69730/1/whitrm.

Tipi

It consists of a cone-shaped tent covered with animal skins and fixed with wooden sticks.

The most important thing is that it is a transportable house, which made it perfect for the way of living of these villages. This type of housing was used by the indigenous peoples of the Great Plains and the Canadian Prairies of North America.

This type of house is a classic of western films and it originates from the native peoples of the United States. The tipi house is the equivalent to a mobile home showing the fact that man has always sought the comfort of houses that can be moved.

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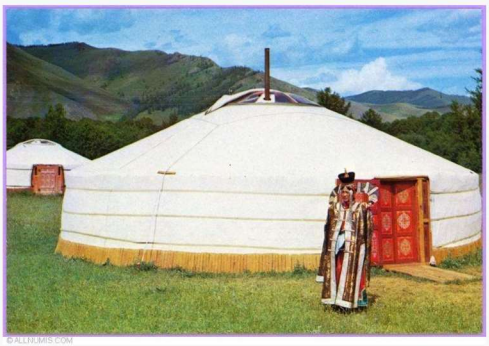
Iurta

Another type of house that can be transported and is easy to disassemble is iurta, used by the nomadic peoples of Asia. It has a rounded shape and is covered with waterproof material. In the past it used to be covered with wool and straw.



The criterion of easy transportation is an important aspect in building these houses, reaffirming that houses have always been a natural extension of the human being.

Wigwam

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Another ecological house is the wigwam, used by American Indians. It had the shape of a dome and the roof was made of grass, bush, bark, clothes, mats, reeds, skins or cloth. It was not portable like the tipi house or iurta house.

Hanok

The traditional house from Korrea is a very durable one and it is made of natural material such as mud, wooden beams, tiles and nails.

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Minka

It is a Japanese country house built in traditional manner, using simple materials such as bamboo, earth and straw. The Japanese, aware of the disappearance of rural architecture, have refurbished villages with such houses (Ex; the village of SHIRAKAWA-GO)

Trullo

This is an old rural building with stone masonry walls.

The houses had a conical shape and were decorated with figures that referred to the spiritual and magical. They can be found in the region of Apulia, Italy and have dry stone masonry walls.

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Underground houses

Used frequently during the oil crises in the United States, but also found in other regions around the world, this type of house is similar to creating your own cave, but keeping as much as possible the appearance of a normal house. It takes advantage of the geological formations of earth to make great walls that protect it against extreme temperatures.

Wikipedia

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Izba

Traditional Russian houses made of wood. In the past, the boards were fastened with ropes and there was a rather large stove in the house. As the winters were very cold, people used to sleep on boards built on the top of the stove.

Mudhif

This house is the traditional home of the Madan (Arabs who live in the swamps of southern Iraq). It is made of cane.

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Houses from totora

They can be found on the floating islands of Lake Titicaca in Peru and are built from totora.

Source:

http://incredibleshouses.com/different-types-of-houses-around-the-world

httns'//www Drofudeeeoara eu/wn-content/uDIoads/2021/09/Palafitos_de_Castro-scaled ine

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Maybe one of the reasons why we call our houses “homes” is because an emotional bond is established, perhaps due to the benefits it brings.

After deciding on the location and the shape of the house, some basic knowledge about building a house is needed.

Science and technology - construction elements, conceptual definitions.

Depending on the position relative to the ground level, the buildings have three parts:

- The foundation - located below the natural ground level. This offers safety and stability; it is made of reinforced concrete with steel bars or nets. Natural materials (sand, gravel, water) and cement (as a binder) are used to lay the foundation of the house;
- Elevation - located above the natural ground level, consisting of walls, slabs, pillars. The walls are built from brick, autoclaved cellular concrete (BCA), large prefabricated panels, soil or clay (ecological material), wood (natural material), glass and others. The pillars are made of reinforced concrete, wood or masonry. The floors separate the building vertically or close it at the top and are made of reinforced concrete or wood;
- The roof- the element that closes the building in the upper part.

Also, there are aspects about **Quality in construction** that need to be taken into consideration.

The quality of the constructions resides in their behavior during the entire exploitation period. Quality constructions must correspond to their destination, protect people's lives and their goods, be useful to society and not affect the environment. It must also comply with rules regarding strength and stability, hygiene, people's health, fire and earthquake safety, noise protection, thermal insulation, waterproofing and energy saving, restoration and environmental protection.

Safety and Security in construction is an important aspect, too.

Safety in constructions refers to their ability to protect people, animals and material goods existing inside or around them, so that they are not in danger. Safety during the use of buildings takes into account:

- the safety of pedestrian traffic, which involves protection against the risk of injury by: slipping, hitting or falling;
- safety regarding the risks arising from the electrical, thermal, ventilation and sanitary installations, which implies protection against the risk of injury through: electrocution, explosion due to gas accumulation, intoxication with harmful substances, burns or scalding;
- burglary security.

Security in constructions refers to their ability to respond to the risk of certain phenomena or processes such as fire,

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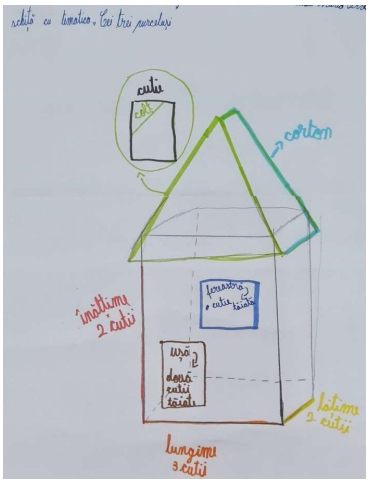
earthquake, strong wind, floods.

Arts: Model for the house

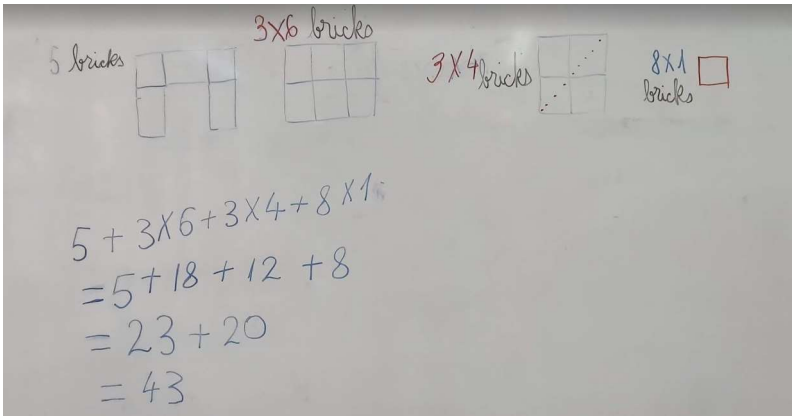
The model represents the scaled realization of an object, which can be real or built.

It is built at a scale 1:20 model of the house with the dimensions 4x8 cm and the height of the walls of 2.50 m.

It starts from the plan in the drawing:



The calculation is made considering the number of boxes needed to build the model. Example in the figure:



The model will be mounted on a pedestal (approximate dimensions 50x45 cm).

The scale construction of this model will be based on the following technological sheet:

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Technological sheet

The name of the product	The building model of My dream house
The image (sketch) of the product: attached figure, scale 1:20	 
Necessary materials and tools: match boxes, ruler, pencil, scissors, cutter, glue, matchsticks. Pay attention! Any suitable materials from used objects can be used.	
Technological operations: - The building plan is made in 2D	

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- Molds are made of 4 boxes (2 sets for the side walls), 5 boxes (1 set), respectively 6 boxes (2 sets for the roof, 1 set for the floor, 1 set for the back wall) which are glued	   

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together using glue. They represent the walls, the floor and the roof. - The walls are glued to the base and placed vertically.	   
- From a mold of 4 boxes 2 triangles are cut off for the roof.	
- Glue the 2 triangles in the roof area and join them with 2 molds of 6 boxes each.	 
- You can choose the option of making the respective triangle from another material. See the attached design.	 

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- Add at least 8 boxes around the house to make the pedestal. -	  
Technical quality control: the dimensions of the model ~~are checked.~~	
Financial budget, time budget, sales price: - The financial budget is calculated, taking into account that most materials come from used objects; of - The time budget is calculated; The sale price is determined, possibilities reinvestment of the benefit obtained by selling the model are considered.	

Other layout options:

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Application for home, or for working in pairs:

1. Starting from the current lesson, build a house with several floors. Start from the sketch and write down all the necessary materials.

2. Knowing that 19 boxes were used for the walls with the width of 4 cm and the length of 8 cm, and that the spine of a box has a width of 2 cm, calculate the required polystyrene for cladding the house.

Side walls:

We mention that the spine of the boxes is used only on the side walls.

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Option 2

STEAM Activity — Thermal insulation of a house

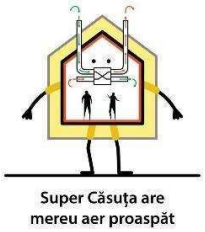
This lesson approaches the PASSIVE HOUSE concept. Our goal is to understand how to use the natural resources responsibly, as over time they will run out, and to build sustainable houses using indoor and outdoor thermal insulation.

1. FOCUS

Super House not have thermal bridges

Super House does charges from the sun

Super House



Super House protects you from the cold

Super House protects you from the wind

Science: Super house — How do we build

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the future differently?

(https://www.youtube.com/watch?v=sl_t8T6VpzA)

What is a passive house?

(https://www.youtube.com/watch?v=C3M7du8NqX0&t=147s)

Super House

always has fresh air

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2. DETAILING

PROBLEM —

SOLUTION

- MARKET GAP

Natural building materials will soon become exhausted.

- CLOSE THE GAP

Offering greener alternatives to building materials, but with a plan for energy efficiency.

- TARGET AUDIENCE

Gen Z (14-18 years old)

Gen Alpha (0-9 years old)

- COST SAVINGS

Reduce expenses for electricity and air conditioning.

- EASY TO USE

A simple building that gives customers the space they need without the high cost of building maintenance.

3. DISCOVERY

The sustainable materials we can use to thermally insulate any home:

- Expanded polystyrene;
- Rockwool;
- Polyurethane foam.

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Poss›ve House S|ondor d

A passive house needs almost no energy for heating and cooling, consuming 90% less energy than a typical house.

100

But where does the passive house get the other 10%? from? And what are the benefits? Huge savings, high comfort and a healthy planet for everyone?

4. IMPLEMENTATION- engineering

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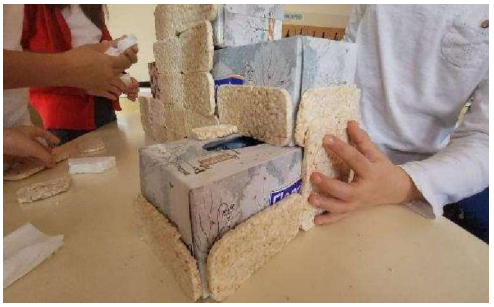
The outer walls are built from cardboard boxes, the binder between them being hot silicone.

The final product is left for a few minutes for the binder between the boxes to dry.

The corner of a room is formed by assembling 6 cardboard boxes.

The exterior walls will be insulated with expanded polystyrene, with the whole team assembling the resources provided.

5. PRESENTATION



GROUP 1 - Polyurethane foam insulation (student resource: medical wool)

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GROUP 2 - Rockwool insulation (students' resource: rockwool, leftovers from house construction, purchased with parents' help)

GROUP 3 - Expanded polystyrene insulation (student resources: expanded rice, liquid glue)

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CONNECTION (materials to be posted in online classes)

https://www.youtube.com/watch?v=CddO5lxVjmY

https://www.youtube.com/watch?v=5G3XOtCpD3I

https://www.youtube.com/watch?v=FcHOTDku0fQ

Homework

#infostudents

#ErasmusProject

#ComfyHouses

Model of letter for students:

Dear students,

We discussed about the PASSIVE HOUSES on Friday. Do you remember the advantages of a passive house? Watch the video, remember that not only the cottage will be one fit for the future, but you are at the right age to build the future: yours, those around you, those who will be born in the future. I am pretty sure that at this point at least one grandparent is waiting for one of you to build a cottage, just like he built in his youth, only now you can show him how much house building has evolved and how few resources you can use.

You can also use the materials provided by our friend, Marius Soflete: https://youtube.com/watch?v=sl_t8T6VpzA&feature=shares

And here are all the resources that we can use:

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https://www.youtube.com/watch?v=C3M7du8NqX0&t=147s

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

Based on the models you saw in class, in the groups you formed with your classmates, using the materials your parents helped us to get to know, I invite you to create MINI-HOUSES (mini, yes?) whose walls you can thermally insulate (remember what thermal insulation is used for? what does it provide in winter? But during the summer?). You don't need to build a roof, just put up the walls of the mini-house and insulate them with whatever materials you want.

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