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tea time

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This magazine is a summary of the activities carried out during a summer camp that took place from 26 August until 6 September 2019 with Albert and Ricard.

Hydraulic arm

How to learn Pascal's law in practice

Geocaching

Discovering hidden treasure with GPS

STEM EDUCATION

Unlocking teenager's creativity through science and technology.

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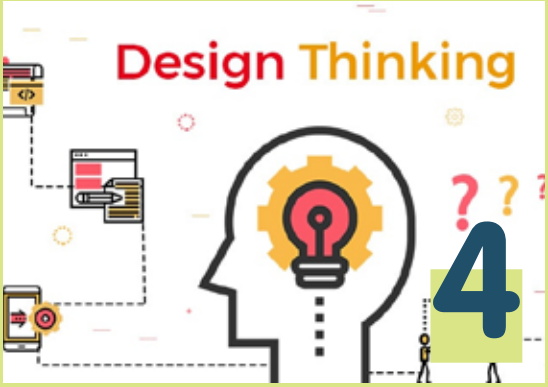


What is STEM EDUCATION?

Conducting an experiment is a great opportunity to learn. On Monday, our scientists received real lab aprons, protective glasses and gloves. Then, they learned how to plan, conduct and evaluate the experiments and started with the first experiment - measuring the reaction time.

STEM is an abbreviation that stands for **science, technology, engineering, and mathematics**. STEM is an interdisciplinary approach to learning where academic concepts are coupled with real-world lessons. Students apply science, technology, engineering, and mathematics in contexts that make connections between the classroom and the world around them. STEM education and the application of technology empowers every student to use their creativity and develop their critical thinking skills. Since English is the language of scientific reserearch around the globe, STEM education is often implemented in English. Such approach allows students to learn English in a natural way, react to the events around them and use English for a specific purpose, rather than answering teacher's questions.

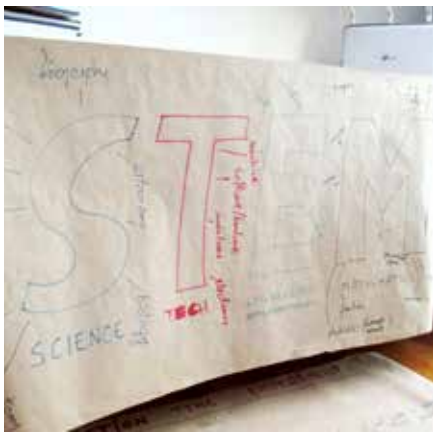
The first thing we did was to get to know the **scientific method** - a process for experimentation that is used to answer questions to which we don't know the answer. The goal of scientific method is to discover cause and effect relationships by asking questions, stating hypothesis, carefully gathering and examining the evidence, and seeing if all the available information can be combined in to a logical answer.

For each experiment, Albert and Ricard filled in the **Scientific Method Form** which guided them through the experiment along the following **seven steps**:

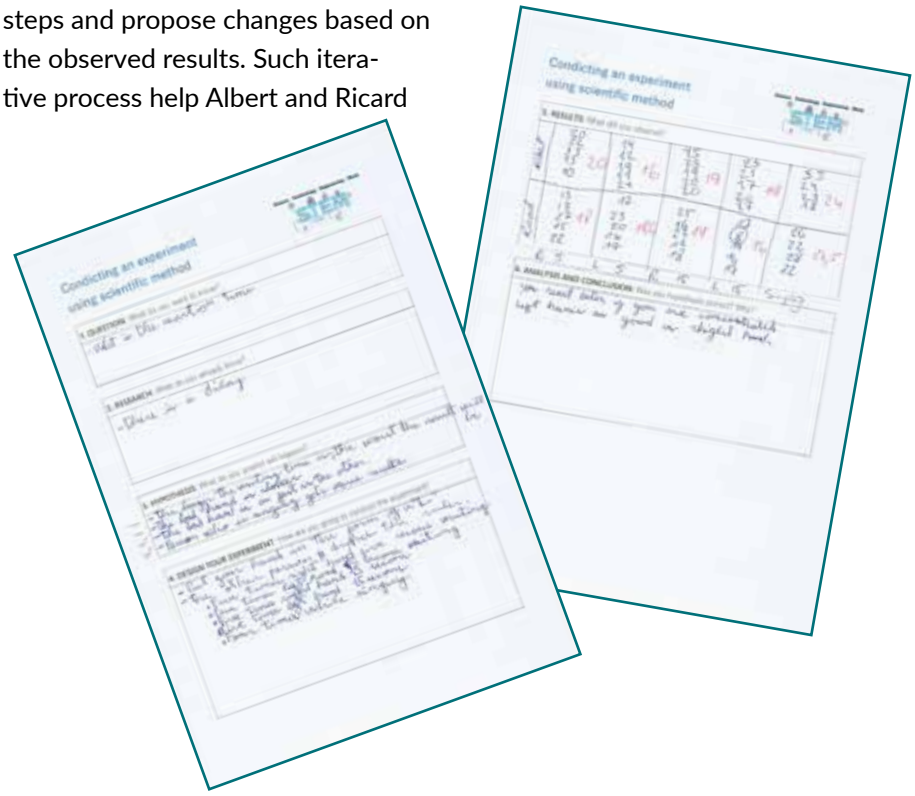
1. Asking the right question?
2. Researching the information
3. Stating hypothesis.

4. Designing the experiment in a way to obtain useful information.
5. Gathering results.
6. Analysing the results and writing the conclusions.

One of the most important lessons that we learnt is that **there are still many questions that hasn't been answered** yet. We also learnt that **it's ok to say "I don't know"** when somebody asks a question to which we don't know the answer. The Scientific Method focuses on **facts and data** and, therefore, requires from students to **think critically** and to formulate well-grounded answers that are based on **good evidence**.



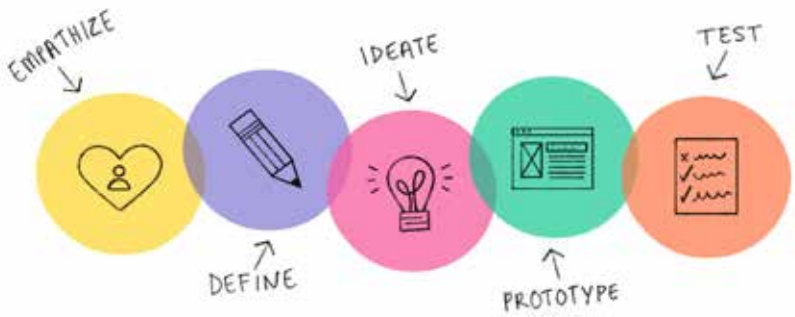
Such competence is crucial in a world flooded with bogus inormation, fake news and worthless opinions. Additionally, Scientific Method allows students to **fail**. Not all the experiments went as we had expected. We had to repeat the steps and propose changes based on the observed results. Such iterative process help Albert and Ricard see that things are rarely created perfect at the first attempt and that improvements can only be done by repeating the process using the new information.



During the camp we filled many forms like the one you can see above. They helped us remember the steps of the experiments and keep all the information together.

DESIGN THINKING

Design thinking is a process for creative problem solving. It starts with identifying a driving question that inspires you and your team to think about who you're really designing for, and what they actually need. Next, you gather inspiration—what other solutions out in the world can help you rethink the way you're working? Use that to push past obvious solutions, and arrive at breakthrough ideas. Build rough prototypes to make those ideas tangible, and find what's working and what's not. Gather feedback, go back to the drawing board, and



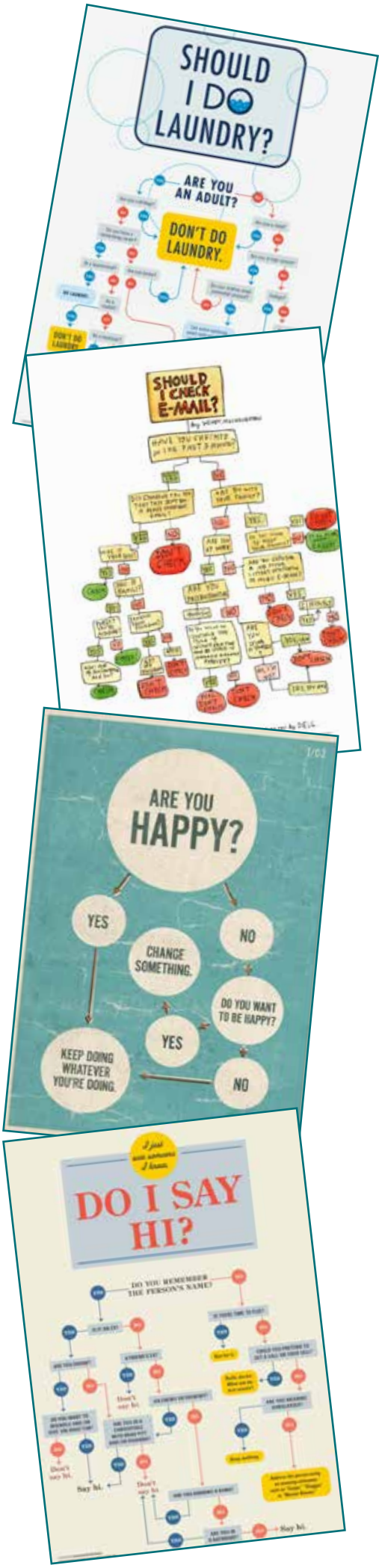
keep going. And once you've arrived at the right solution, craft a story to introduce it to your colleagues, clients, and its users. Some of those steps may happen several times, and you may even jump back and forth between them. But that roadmap can take you from a blank slate to a new, innovative idea. Ricard and Albert used design thinking method especially while they were working on their biggest project during the camp - hydraulic robotic arm.

FLOWCHARTS

A **flowchart** is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task.

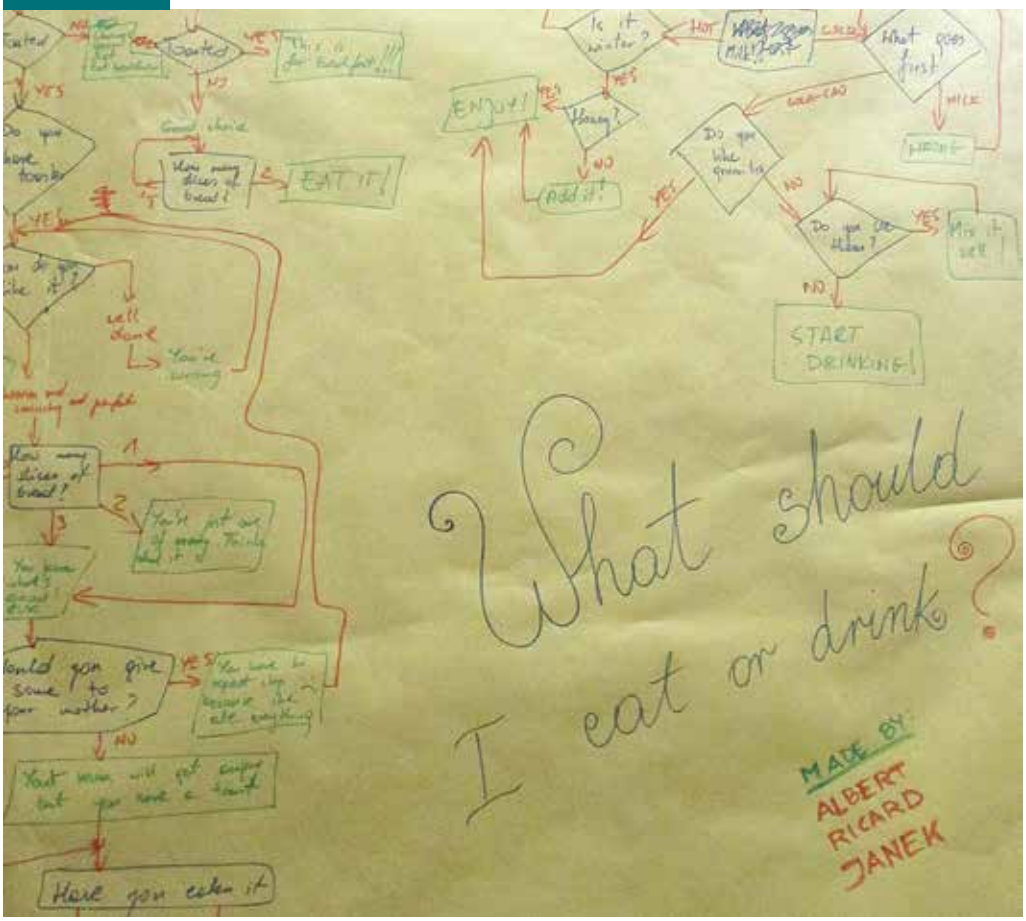
The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields. Nowadays flowcharts are used for describing computer algorithms.

We started the activity by looking at different flowcharts to understand the way they work. It's very common to show everyday activities or decisions in the form of a funny flowchart, like 'Should I talk to that girl?', 'Should I do the laundry?' or 'Will I be the first man on Mars?'.
Albert and Ricard proposed the following question: What should I eat or drink? Than, they started drawing options and planning the loops, dead-ends and funny results. The activity seemed easy but it was actually quite time-consuming. Below you can see the extract of our flowchart and on the right side, you can see some of the flowcharts we looked at.



Step-by-step approach

A flowchart is a visual representation of the sequence of steps and decisions needed to perform a process.



The Kitchen Institute of Technology

Benjamin Franklin once said: " Tell me and I forget, teach me and I may remember, involve me and I learn". This wise words were our inspiration to start learning science by doing experiments and learning English by solving problems.

The only experiment we didn't do was dropping a Mentos into a Coco-Cola. Why? Because everybody has seen it on-line and the outcome is obvious. We decided to concentrate on questions to which we hadn't know the answer (or at least we were not sure about the outcome). First, we looked at water in different state of matter and what properties it has. Then, we also included fire.

Once we had a question to investigate, Ricard and Albert looked for information about our problem. Then, they stated the hypothesis and designed the experiment. Sometimes, they were so impatient that I had to remind them that without good preparation the experiment will most probably fail. After that, boys conducted experiment and gathered data.

Hot and cold water not mixing?
One of the most impressive experiment was to place a glass of hot water on top of a glass of cold water. Surprisingly, the liquids didn't mix!

What is worth mentioning is that they were proposing changes in the procedure to investigate some additional aspects which they hadn't thought about beforehand.

On the right side you can find selection of photos taken by Janek during the experiments with some questions we asked ourselves. These are not all the experiments we did because we were so busy that we forgot to take photographs.

Is it possible to stick a pin into a ballon filled with water?

Can we stick more pins?

Why a drop of water stays spherical on the sooty glass?

What is the black substance that appears on things which are placed over fire?

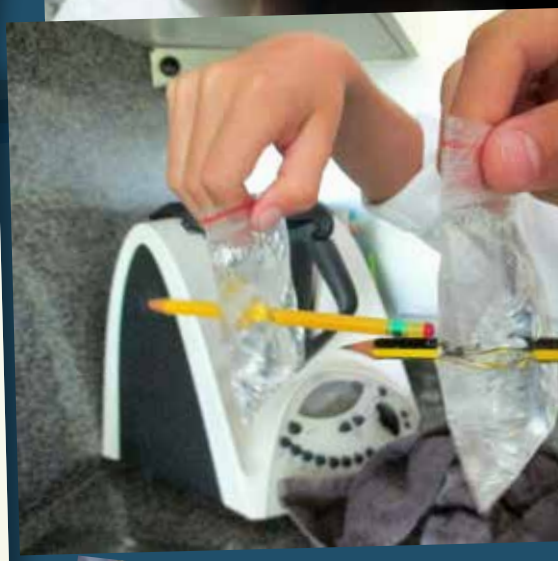
Is it possible to stick a pin into an inflated ballon?

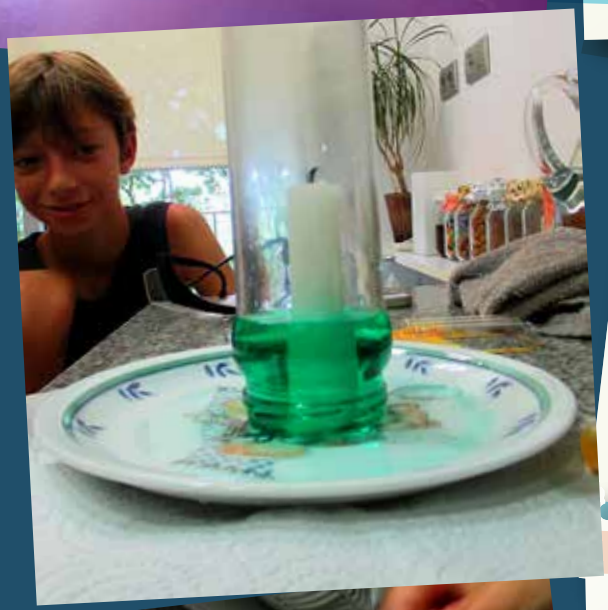
Is it possible to stick more pins into a ballon?

Is it possible to stick a pencil into a zip bag?

Why doesn't the ballon blow?

Why doesn't the water leak?





What happens when we put a jar over a lit candle?

Why does the water get into the jar which is placed over a lit candle?

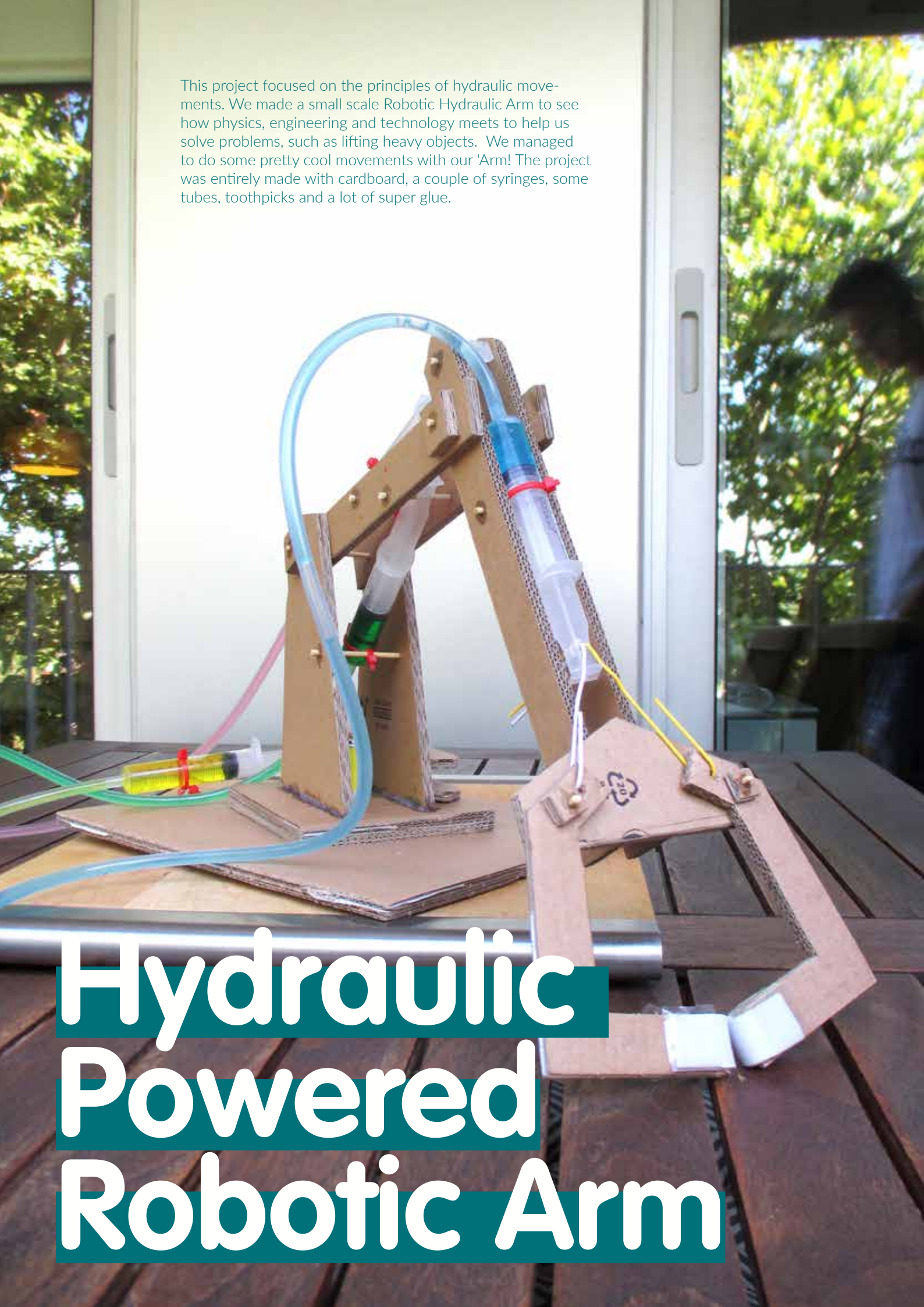
Why does an empty ballon blow if placed over fire and a ballon filled with water doesn't?

Why does the match go out in a glass filled with bakind soda and vinegar?

Why does the CO_2 stay inside the glass and do not mix with the air in the kitchen?

What is oobleck? Why does it behave like solid and liquid at the same time?

This project focused on the principles of hydraulic movements. We made a small scale Robotic Hydraulic Arm to see how physics, engineering and technology meets to help us solve problems, such as lifting heavy objects. We managed to do some pretty cool movements with our 'Arm! The project was entirely made with cardboard, a couple of syringes, some tubes, toothpicks and a lot of super glue.



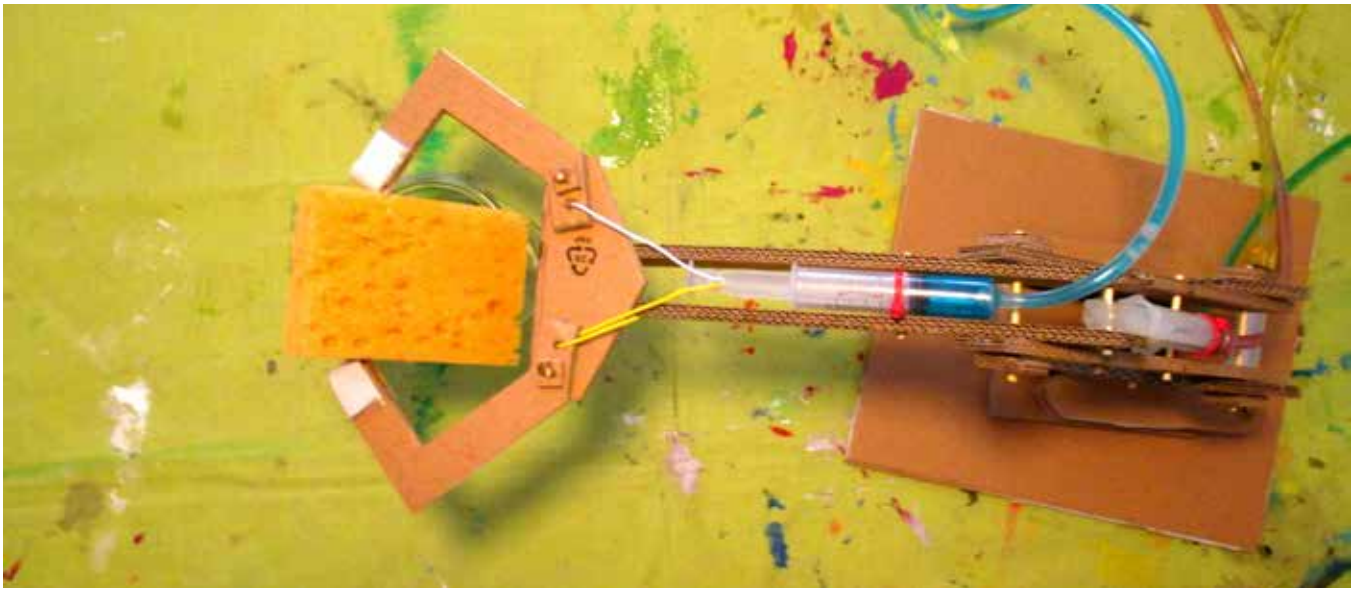
Hydraulic Powered Robotic Arm

THE PROCESS

The workshop started on Monday morning with a short introduction to Design Thinking. Boys quickly grasped the concept and we... didn't start building. We started **planning our work**: we read the instructions thoroughly (16 pages in English!). We checked if we had all materials and tools. We tried to visualize where each piece goes and how to connect them. Only then, we started cutting out the pieces.

Here came the first difficulty. We used some recycled cardboard, so we had to think how to fit all the elements on the limited resources we had. What's more, the cardboard was very thin so we had to strenghten it by adding the second and third layer. Albert's responsibility was to make a blueprint and Ricard was responsible for cutting. **Cutting** was also tricky because Ricard had to cut the cardboard without making pressure to avoid bending which would make the model weaker and look sloppy. After 3 hours, all the pieces were ready for assembling.

Next day, we started **assembling** the pieces and, right at the beginning, we made a huge mistake so we had to start again. Fortunately, the glue was still fresh so we could disassemble the arm easily. At the second attempt, it went much better. Since the instructions were not very precise, we had to improvise a little bit. Luckily, Youtube is full of videos of people assembling a hydraulic arm, so we could look for help on-line. At the end, we mixed food coloring with water and filled the four controlling syringes. Then we connected all syringes with plastic tubes. Finally, the arm was **ready and working**!



We saw on Youtbe that some people built a control panel to steer the robotic arm. We liked the idea, so on the third day, we made a **controller**. It was particularly difficult because we didn't have any instruction or dimentions. Albert and Ricard made everything by coping the video on YouTube. Have a look! The colors of the water correspond with the color of the controller!

We thought that Hydraulic Robotic Arm would be easy but it was not as easy as it may seem.

It was a great opportunity to learn some physics and engineering and improve our English!

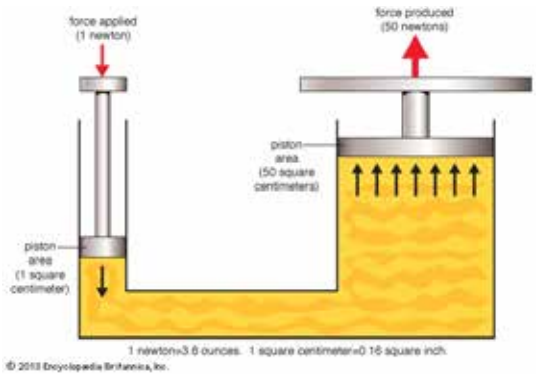
The first test
Right after assembling the tubes with water boys tested the arm with a sponge.

Pascal's law

Hydraulics make it easier to move heavy objects. For example, car mechanics can use a small amount of force to create a larger force that will lift a car into the air.

Pascal's law says that in a fluid at rest in a closed container, a pressure change in one part is transmitted without loss to every portion of the fluid and to the walls of the container. According to Pascal's principle, in a hydraulic system a pressure exerted on a piston produces an equal increase in pressure on another piston in the system. If the second piston has an area 10 times that of the first, the force on the second piston is 10 times greater, though the pressure is the same as that on the first piston.

This effect is exemplified by the hydraulic press, based on Pascal's principle, which is used in such applications as hydraulic brakes.



Carbon dioxide in the kitchen

We learned that we can make some CO_2 by mixing baking soda and vinegar. Why is CO_2 such an important ingredient in the kitchen? Because it makes cakes grow!

INGREDIENTS

- *2 to 3 very ripe bananas, peeled (about 1 1/4 to 1 1/2 cups mashed)*
- *1/3 cup melted butter, unsalted or salted*
- *1 teaspoon baking soda*
- *Pinch of salt*
- *3/4 cup sugar (1/2 cup if you would like it less sweet, 1 cup if more sweet)*
- *1 large egg, beaten*
- *1 teaspoon vanilla extract*
- *1 1/2 cups of all-purpose flour*

No need for a mixer for this recipe! Clean-up is easy too, if you want, you can mix everything in one mixing bowl. The best bananas to use for banana bread are those that are over-ripe. The yellow peels should be at least half browned, and the bananas inside squishy and browning.

Preheat the oven to 350°F (175°C), and butter a 4x8-inch loaf pan.

In a mixing bowl, mash the ripe bananas with a fork until completely smooth. Stir the melted butter into the mashed bananas.

Mix in the baking soda and salt. Stir in the sugar, beaten egg, and vanilla extract. Mix in the flour.

Pour the batter into your prepared loaf pan. Bake for 50 minutes 175°C, or until a tester inserted into the center comes out clean. Remove from oven and let cool in the pan for a few minutes. Then remove the banana bread from the pan and let cool completely before serving. Slice and serve.

Perfect for merienda!
Moist and delicious banana bread recipe. Easy to make and no need for a mixer!

Albert showing the globe
Our task was to draw the continents on the paper lamp. keeping the proportion shown on the flat map.

It may come as a surprise to hear that there is no truly correct way of representing the earth as a flat image.A world map projection is a visual representation of this challenge using a grid composed of lines of longitude and latitude. Depending on the purpose of the map, some distortions are acceptable and others are not; therefore, different map projections exist in order to preserve some properties of the sphere-like body at the expense of other properties.

Together with Albert and Ricard we looked closely at both maps and globes. First, we tried to visualise what pieces of paper we would need to build a globe. Then we tried to draw the continents on the globe and see whether we can get it right using the unusual map projection Janek showed us. This activity required a lot of visual imagination!!!

Are all maps wrong?

Is it posible to represent a surface of a sphere on a flat surface? This was the question with which we started a workshop about map projections.

We compared two most comon map projections - the one with Greenland as big as Africa and the other where Africa seems to be stretched. It was quite surprising to find out that neither of these maps shows the real size of continents and countries.

Where is the hidden treasure?

I'm sure you know "escape rooms" in which a team of players discover clues, solve puzzles, and accomplish tasks to escape from the site of the game. But have you ever heard about Geocaching? It's a world-wide game in which you have to find secret boxes hidden everywhere around the globe. Sant Cugat is full of them waiting fto be discovered.

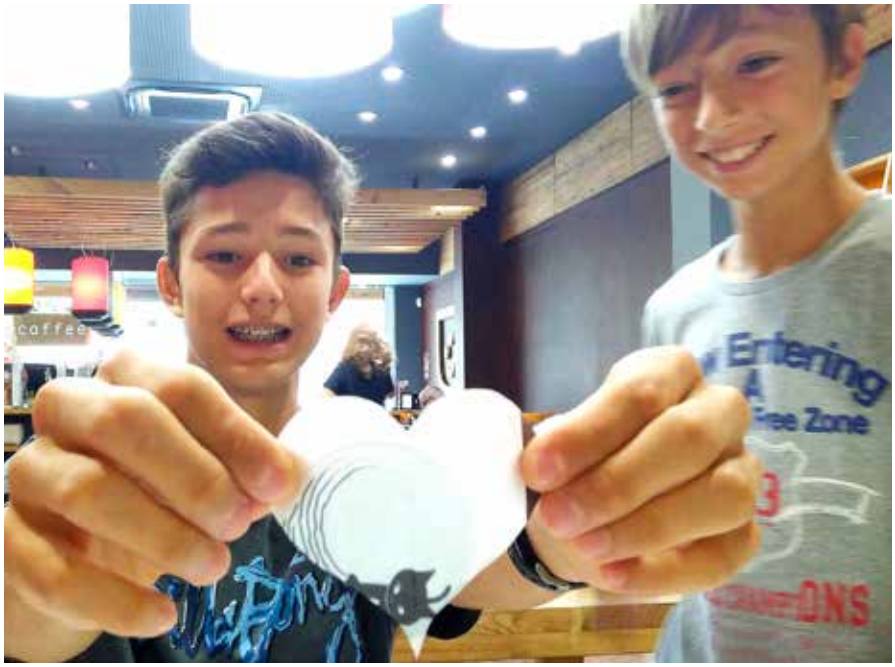
Geocaching is an outdoor recreational activity, in which participants use a **Global Positioning System (GPS**) receiver or mobile device to hide and seek containers, called "geocaches" or "caches", at specific locations marked by coordinates all over the world.
A typical cache is a small waterproof container containing a logbook and sometimes a pen or pencil. The geocacher signs the log with their established code name and dates it, in order to prove that they found the cache. After signing the log, the cache must be placed back exactly where the person found it. Geocaching is legal in every country except North Korea (where GPS and all other mobile devices are illegal to possess) and is usually positively received when explained to law enforcement officials.

OUR EXPERIENCE

Before we took our bikes and left in search of caches hidden in Sant Cugat, we had learnt a bit about the GPS system which allows the game. We used the mobile application to locate the caches. The nearest were located in Mira-Sol, Hospital General and Valldoreix. In total, we went to seven locations but we managed to find only four caches. The most unusual was in the shape of a coffin!

Work in progress
Decorating two mugs took them 3 hours! The most difficult was to make a decision what to paint.

CERAMICS? How is it made?



COLOR IT is a new concept of creative space in Sant Cugat, where you can paint ceramics and take something from a cafeteria. It is designed for all ages, kids and adults, though adults usualy come there alone to relax after work and forget about day to day problems. Children have an opportunity not only to express themselves artistically but also to learn about different decorating techniques and technological process of firing and glazing ceramics.

Albert and Ricard decided to decorate two mugs because their grandparents are soon going to celebrate 50th anniversary of their wedding. They covered both mugs with red colour and painted two halves of a heart on them. When placed next to each other, the two halves make one big heart. In order to do that, they had to use different brushes, sponges and stamps. They had to cooperate because, otherwise, the mugs might not match.

There was a group of kids who participated in a workshop when we entered. They though we are from England and started making comments about us in Catalan!

STEM represents science, technology, engineering and maths. However, a veriation of this term exists. **STEAM** represents **STEM plus the ARTS** – humanities, language arts, dance, drama, music, visual arts, design and new media.

Children and adults learn English better
in real communicative situations
which triggers emotions.
That's how we teach.

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A nice cup of English