SMART HANDS

Lesson Plan Portfolio

way of arts WOA

AGRUPAMENTO DE ESCOLAS JOSÉ ESTÊVÃO

COLEGIUL NATIONAL „EMIL RACOVIȚĂ" CLUJ-NAPOCA

HOUSE OF DES/GN

Singelland

UNIVERSITY OF EASTERN FINLAND

OULUN OMPU

scientifica

OPEN EDUCATION COMMUNITY

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

INTRODUCTION

Welcome to the Smart Hands Lesson Plan Portfolio. A digital publication that encourages cross subject cooperation between teachers in secondary schools and engage pupils in multidisciplinary assignments. In the following sections you will find readymade assignments for you as a teacher to adopt right away, inside and outside the classroom. Also you will read about experiences of other teachers, work field professionals and the pupils themselves implementing the Smart Hands way of organising education in daily practice.

SMART HANDS

This Portfolio of Lesson Plans provides secondary school teachers concrete assignments to succesfully combine HEAD and HANDS subjects in school. Teachers benefit from widely tested materials developed by their peers from across Europe to enrich and improve their courses.

This portfolio of lessons, exercises and assignments was compiled in 2020-2022 during the global COVID-19 pandemic – a strange and difficult time for us all, but also a period which has massively accelerated the uptake of digital tools and application for communicating, learning and planning. Educators and learners alike have been introduced to new digital ways of working, but we've also been reminded how valuable face-to-face experiences can be, especially when used alongside digital ways of working.

Many of the lesson plans in this portfolio we have tested in online workshops, with pupils from various countries together in a virtual meeting room. The circumstances of the past years actually stimulated us to find ways to work together internationally remotely, and to organise content centred online exchanges for pupils. And we still do, also now, as they are so enriching for both pupils and teachers!

Other assignments in this portfolio were developed and tested in practice during our international learning weeks abroad. Secondary school pupils from our partner schools in Romania, Finland, Portugal and The Netherlands came together for STEAM workshops, always based on local circumstances and issues.

We hope that you're inspired by the examples collected here to start using our Smart Hands lesson plans inside and outside your classroom! And if you are interested in adding an international component to your lessons, our school partners are keen to connect with you and do lessons together, virtually or in real life.

The Smart Hands initiative

Smart Hands is an Erasmus+ project bringing together partners from across Europe.

Smart Hands has a clear objective: We aim to create a recommitment to the vocational arts, in education and in life. Students learn to follow the path of their tendency and talent. By challenging students to take their time, perform trial & error activities, we appeal to them to be clever and crafty. This also includes prolonging their attention span and be able to work in a focused manner on long term assignments, viewing an assignment from all angles.

Our ambition is to educate skills in a cross subject manner to create context for pupils. The combination of alpha, beta and gamma subjects in one task challenges students to be more exploring, creative, ingenious and inventive.

Lesson Plans

This lesson plan portfolio is based on the practical experience and knowledge of education and work field professionals from across the European continent as collected by the partners of the Smart Hands project.

For your benefit, the lesson plans in this portfolio are based on the experiences of the teachers, work field professionals and pupils themselves, so any recommendations and practical tips come from straight from them!

Teacher Guide

Like to dive deeper into the pedagogical perspective behind Smart Hands and how our approach affects you as a teacher? Have look at our Smart Hands Teacher Guide and learn about the pivotal position you as a teacher have and become a Teacher Leader. Our Teacher Guide demonstrates how you can work effectively with your fellow teachers and the work field for the benefit of the pupil. Furthermore, it addresses school management support and parents' involvement.

Smart Hands Kit

Excited about our multidisciplinary lessons in this lesson plan portfolio and working together with your fellow teachers from other school subjects? Maybe creating your own multi-disciplinary lessons or workshops is then right up your alley!

In addition to this portfolio of ready-to-go lesson plans and our Teacher Guide, we have develop a handy deck of cards we like to call the Smart Hands Kit. It enables you to quickly develop your own STEAMy lessons covering various school subjects. It comes with instructions how to use it so you can get started right away. Please see the final section of this Lesson Plan portfolio for more details and an introduction to how to you the Smart Hands Kit. Already convinced?

➔ Download or order a deck of cards from our www.smarthands.school website right away!

Erasmus+

Smart Hands is funded by Erasmus+

KA2 – Cooperation for innovation and the exchange of good practices

KA201 – Strategic Partnerships for school education

Smart Hands: KA201-31F6A59A

Agreement no.: 2019-1-NL01-KA201-060449

Opportunities

Erasmus+ is the European Union programme for education, training, youth and sport. Their support allowed us to come together, work together, learn together and develop together to adopt our Smart Hands approach at our school partners. We happily share our results with other schools and education enthusiasts to benefit from directly and inspire them to take on a HEAD-HANDS-HEART approach.

Organisations involved

Smart Hands was developed by workfield professionals and schools working together.

Our international partnership:

Workfield:

- House of Design (NL)
- Way of Arts (PT)
- Scientifica (RO)
- Open Education Community (EU)

Schools:

- OSG Singelland – VO Surhuisterveen (NL)
- Colegiul National Emil Racovita (RO)
- University of Eastern Finland (FI)
- Kummun koulu Outokummun kaupunki (FI)
- Agrupamento de Escolas José Estevão (PT)

School cooperation

Our school partners not only benefitted from the Smart Hands approach to education, they also unlocked the potential of international cooperation with each other and they are keen work with other schools from other countries as well. Whether it is doing a school assignment together online or organising a pupil exchange, or anything in between. Do you get in touch with them via our website:

www.smarthands.school

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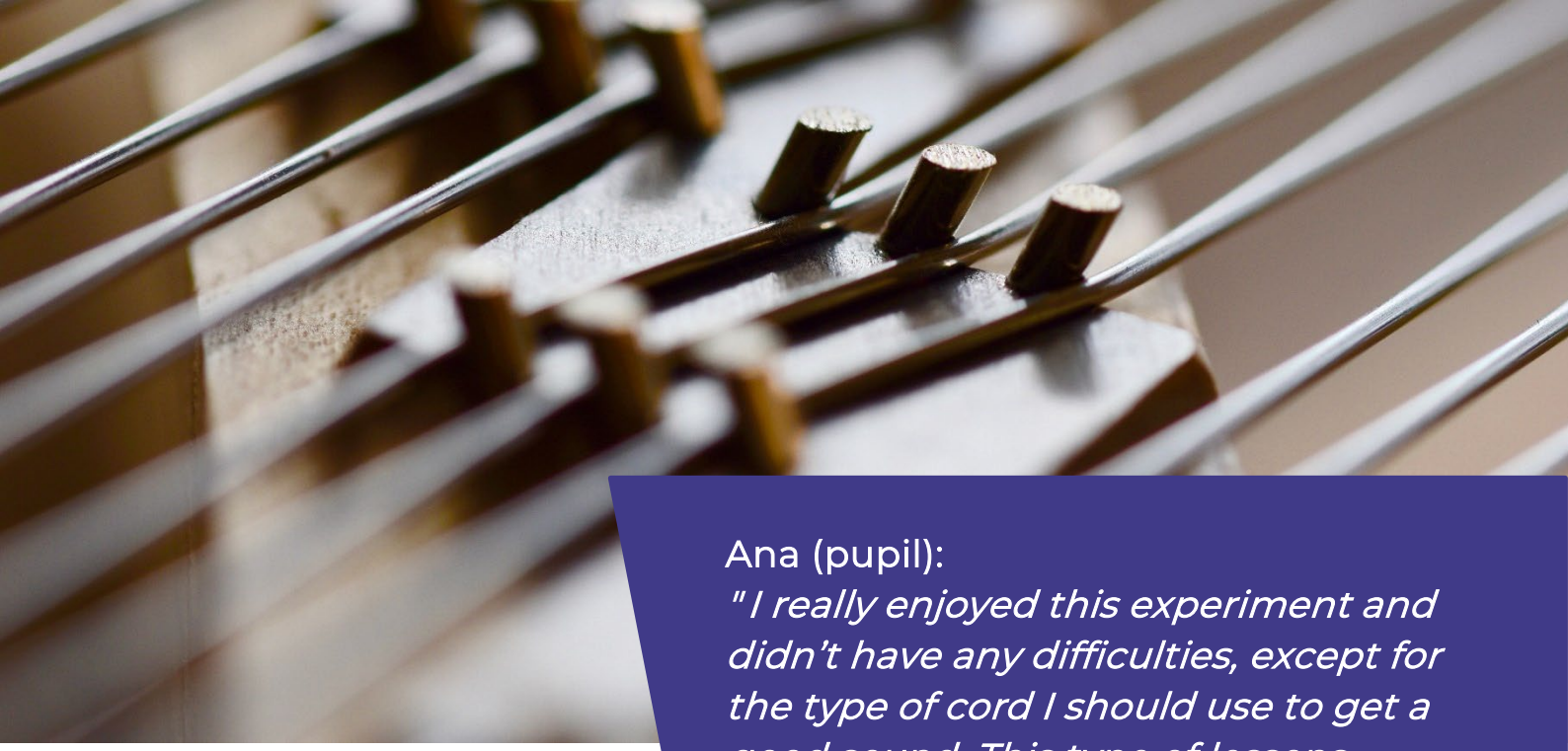
SMART HANDS

PORTFOLIO OF LESSONS



Ana (pupil):
"I really enjoyed this experiment and didn't have any difficulties, except for the type of cord I should use to get a good sound. This type of lessons makes me understand maths better."

MAKE IT SOUND

[Music] [Mathematics] [Physics] [History] [Crafts]

Lesson objectives

A workshop on how to make your own music instrument. The workshop teaches pupils about how sound is made, how it may be transformed into music and how our attraction to music has made it one of our oldest forms of expression.

Activities

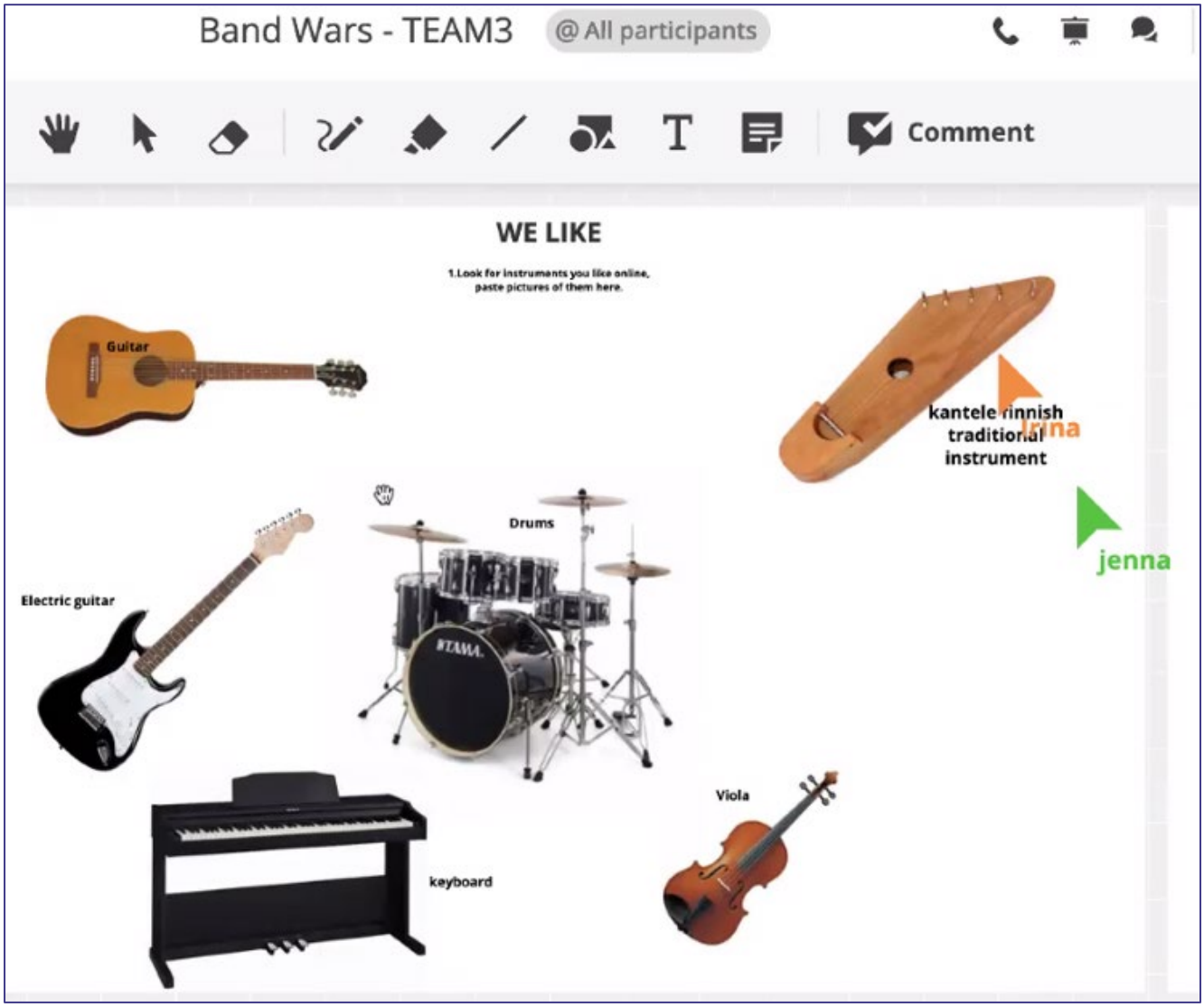
- 5 min - Short intro into the theme, explanation of sound, vibration, different music instruments and sound outcomes.
- 20 min - Workshop: Build your own monochord music instrument.
- 10 min - Discussion: Instrument showoff / discussion / funtime
- 15 min - Break Out in groups using Padlet, Conceptboard or Jamboard: Look for traditional instruments. What are they made of? / which is your favourite / how does it sound? Why is music important?

- 20 min - Small Presentation of findings. 2-3 min presentation per group.

Materials needed?

- 1 piece of straight wood, preferably hardwood of 70-100 cm length, about 10 cm broad and 2-5 cm thick/ worse case a wooden broomstick
- 1 guitar string preferably or a nylon wire 1-2 mm
- 2 nails
- Hammer
- 1 empty metal can
- 1 piece of round metal, 0.5-1cm thick (for instance a screwdriver, also a thick knife might do)
- A pencil

Image below: Impression using Jamboard



Make it Sound in practice in Romania

We integrated the ”Make It Sound” international Smart Hands workshop in the maths lesson Ratios, proportions and mean (arithmetic and harmonic mean) for the 9th graders from Colegiul National Emil Racovita in Cluj, Romania.

The lesson started with a structured discussion around the following questions:

1. Do you know any string instruments? Do you know anything about the arithmetic or geometric mean of 2 positive numbers? Or the harmonic mean of 2 positive numbers? What about the octave, quint or quart?
2. Is there any connection between the 3 means of 2 positive numbers (or just one of them maybe) and the octave, quint and quart? If so, which is the connection?

Then, the students were asked to make monochords (like described above) with different string lengths: 90cm string length, 45cm string length, 60cm string length, 67.5cm string length and to compare the sounds produced by the 4 monochords.

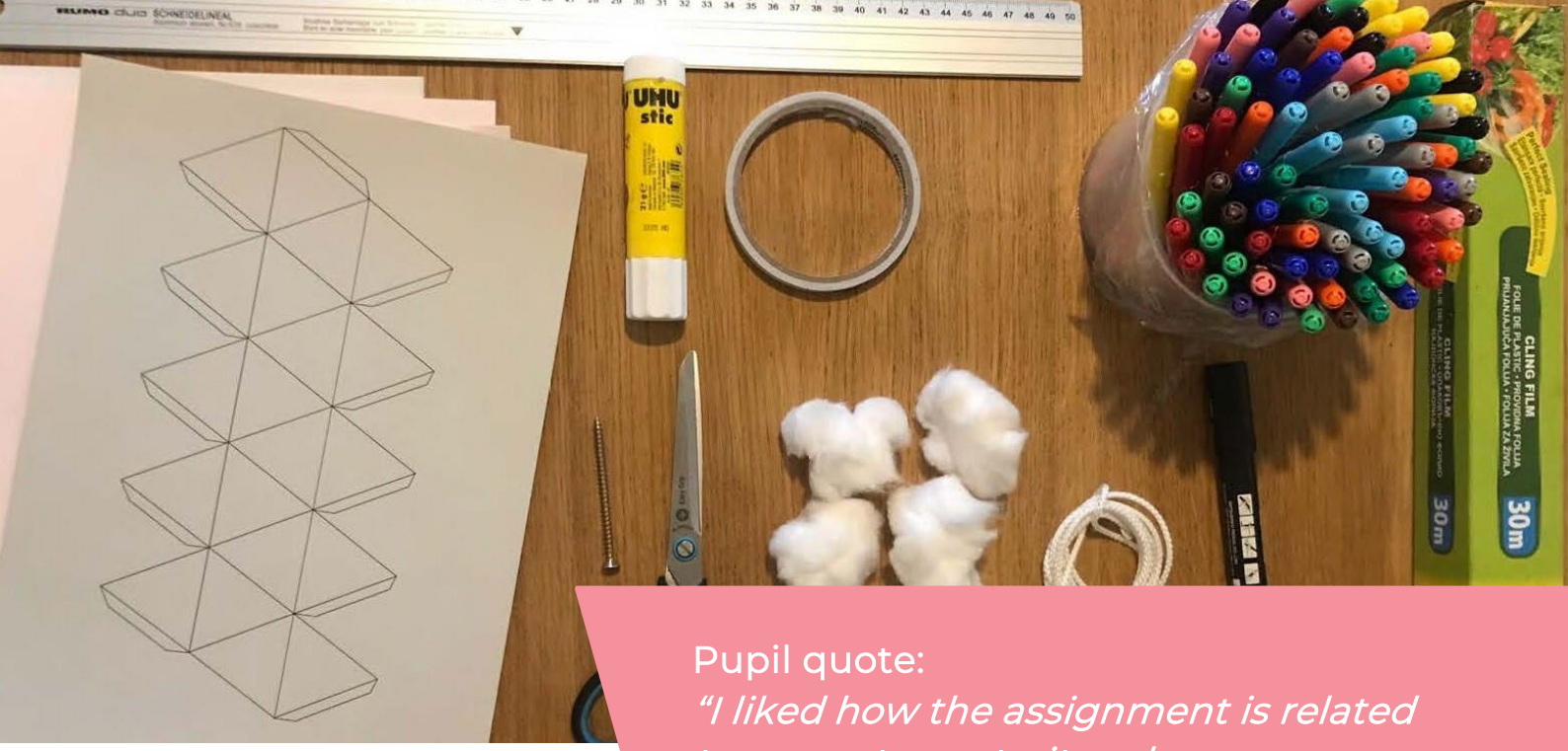
In groups of 4 (each student in the group had a different string length for their monochord) the students worked together to investigate the connection between the sound and the length of the string and to identify different properties of musical

proportion. During the group work activity, the students solved the tasks related to the musical proportion, the relationship among the musical proportion and the proportion made with 2 positive numbers, the arithmetic mean and their harmonic mean, harmony of sounds, the frequency of the sounds produced by the 4 monochords (they used FizzIQ app to measure the frequencies) and the relationship between the musical notes and the string frequency.

The lesson ended with the students' reflection on their work. What do pupils actually say about this lesson?

Amelia:
"Throughout the lesson I learnt about the way in which the length of a cord could influence the frequency of the sounds it emits. I also received information about a thing I had known nothing up to that moment: the musical proportion; I find it very interesting that maths plays an important role even in music. I was amazed by the way in which we can find the length of the cord that emits an octave, a fifth or a quartet of a sound by using a basic calculation.
I also enjoyed working in a team, which allowed us each to focus on an exercise and take the necessary time to think about it."

Ana:
"Using our four-string monochords, our team found out that when the strings vibrate together, they produce 4 sounds, the shorter strings having the highest pitch(an octave) and the longer string having the lowest pitch.
I really enjoyed this interesting experiment and didn't have any difficulties, except for the type of cord I should use to get a good sound. This type of lessons makes me understand Maths better."



Pupil quote:
“I liked how the assignment is related to current events, it makes you understand what is going on.”

ARCHITECTURE OF A VIRUS

[Biology] [Mathematics] [Crafts]

Objective

This lesson takes on one of the biggest scientific problems today: the understanding of a virus. It shows how observing and modelling can help scientists understand their subject better and how the collaboration between different sides of science can lead to great breakthroughs.

The pupils will have time to model a virus and discuss what makes its structure so stable and efficient. They will also learn concepts of modelling, structure, patterns, scale and symmetry.

Activities

5 min - Intro viruses

When Scientists first heard of the novel coronavirus their first reaction was to model it. All it took them was 12 days, a super powerful microscope and some heavy computational power. This is what they came up with:

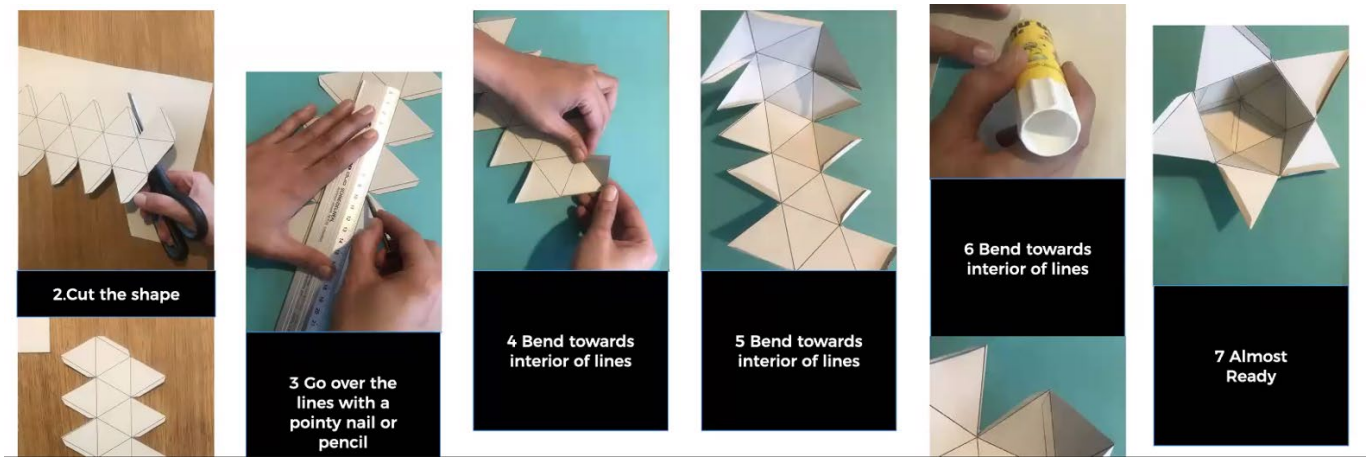
https://analyticalscience.wiley.com/do/10.1002/was.00020069

Now let's try to model our own little virus and see what we can learn from it.

15 min - The workshop

Cut the shape and fold the triangles to make a packaging to enclose the yarn and the cotton balls. Hands-on Icosahedron making.

What's going on: Viruses are composed of nucleic acid genomes (RNA/DNA) - which tell the virus what to do (something like a computer program), surrounded by a protective protein "skin" called a capsid - which protects it. Instead of making the capsid out of one giant protein, viruses typically utilize many identical copies of the same protein that combine together to form this outer shell. This way, the virus can be economical, using one gene repetitively to make many small proteins instead of devoting a large portion of its genome to making a large protein coat. Most viruses are thought to be composed of triangular sub-units that associate to form an icosahedron—. This shape helps the virus to minimize its surface-area-to-volume ratio, which allows it to carry the most genetic material inside a given protein shell. The icosahedral structure is one way of doing that, another one is the helical structure (SARS-COV-2) but there are also viruses that use both or are more complex.



Free Discussion

Pupils are encouraged to reflect on what they did and share information. What did we do? Was it easy to make the icosahedron? How many sides does it have? How many edges does it have? How many vertices? What do you think makes this shape unique? Is it symmetrical? How many ways can you rotate it, without seeming to change appearance. What does it resemble to? What do you think makes it so stable?

➔ These icosahedral structures exhibit rotational symmetry: 5-fold symmetry at the vertices, 2-fold through the edges and 3-fold through the center of each triangular face. It can be rotated in 60 different ways without seeming to change in appearance.

5 min Going Further: Model Comparison

Some viruses have an extra lipid membrane, meaning the virus is encased or enveloped. The infectivity of these viruses is mostly dependent on the envelope and it's proteins. But the lipid membrane also makes the virus sensitive to soap. Sound familiar? Do you know a virus that is killed by soap?

What can we learn from this 2 models? How is it different from ours? How can we make our model better? What do scientists concentrate on? Can a model be dependent on what the scientist is looking for?...

*Note even if not seen in this model the inner structure of SARS-COV-2 is helical shaped

MATERIALS/EQUIPMENT/ICT NEEDED BY STUDENTS:

- attached template printed on A4 heavy paper (120gr)
- some cardboard support for cutting and glueing
- ruler
- (60–90 centimeters) of yarn
- six extra-large cotton balls
- scissors
- double sided tape or paper glue (tape works best)
- plastic foil
- (optional) a screw or something pointy
- (optional) colored pens, markers, permanent marker

PREPARATION TASKS / KNOWLEDGE NEEDED IN ADVANCE BY STUDENTS:

Print out the model on a thick A4 paper (we used 120gr.)

REFERENCES OR WEBLINKS:

Based on: https://www.exploratorium.edu/snacks/viral-packaging

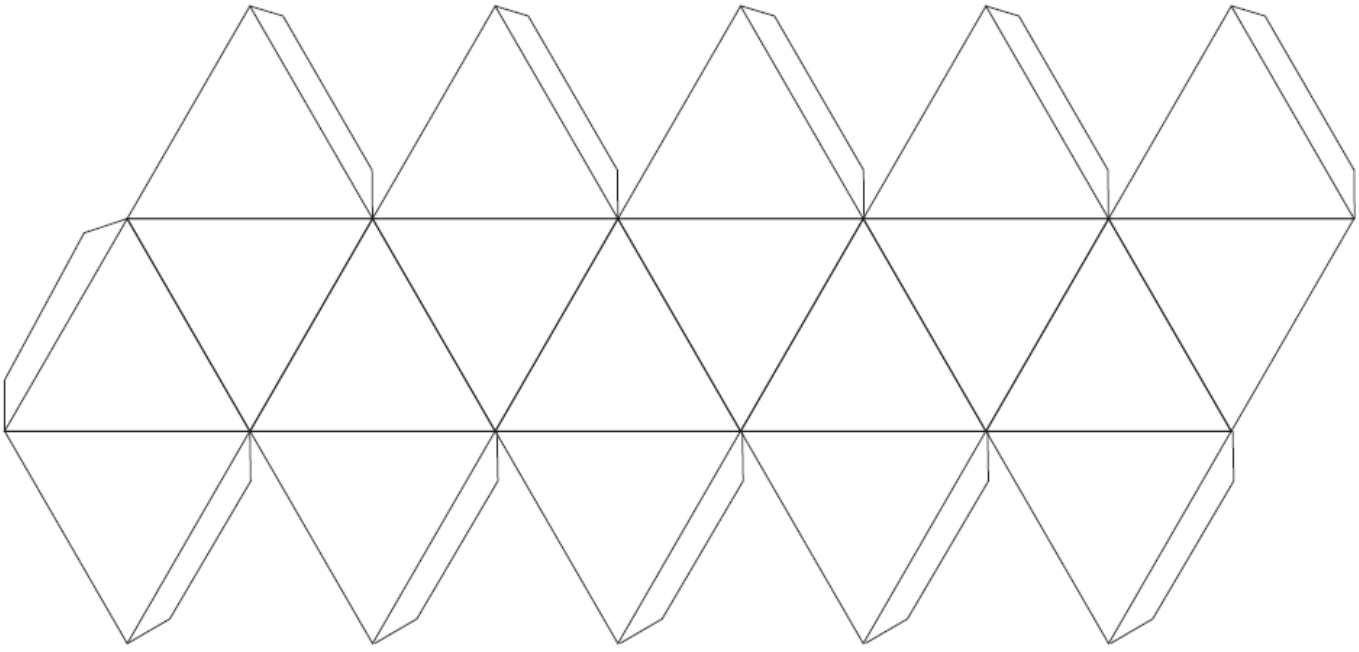
More references:

- https://www.quantamagazine.org/the-illuminating-geometry-of-viruses-20170719/
- https://viralzone.expasy.org/8577#:~:text=The%20Caspar%2DKlug%20Theory%20
- https://morgridge.org/outreach/teaching-resources/virology-immunology/virus-structure/
- https://news.ucr.edu/articles/2018/11/02/physicists-explain-how-large-spherical-viruses-form
- https://www.scientificamerican.com/article/are-viruses-alive-2004/
- https://dfw.cbslocal.com/2020/10/16/covid-cure-14-year-old-frisco-girl-national-award/
- https://learn.genetics.utah.edu/content/cells/scale/

FOLLOW UP AFTER ASSIGNMENT:

Explore more about the symmetry of viruses by building these models at home: https://pdb101.rcsb.org/learn/paper-models/quasisymmetry-in-icosahedral-viruses#:~:text=Viruses%20come%20in%20many%20shapes,protein%2C%20arranged%20in%20icosahedral%20symmetry

You can start drawing the “skin” of your virus, make sure to keep it symmetrical :).



Maaike Bergsma (teacher):
“Combining head and hands topics in one assignment always increases my pupils’ interest and motivation”

NO SEW SHIRT BAG

[Crafts] [Civic Education] [Mathematics] [Chemistry]

Lesson Objectives

This lesson shows you the value of a material, in this concrete the value of a t-shirt.

Introduction

Clothes are made from natural material or synthetic material. Most of our clothes are made from cotton. Cotton is a plant that gives a fluffy fiber that is used to make clothes. The plant grows in tropical and subtropical regions in South-America, Africa, Egypt and India. Other natural materials are wool (from sheep), linen (flax plant), hemp (plant).

Synthetic material that is used to make clothes is plastic: acrylic, polyester, nylon. This material creates plastic soup!

Our clothes are more valuable than we know! Say we buy a shirt for 20 euros. One t-shirt from cotton takes 2.700 liters of water. People on the other side of the world earn 5 cents per t-shirt, the factory 22 euro cents. The shop that sells the shirt earns 12 euro

per t-shirt. The trade earns 5 euro, the cotton costs 1,40 euro. Rest is administration, shipping and taxes.

So take care of your old t-shirt! In this lesson we want to show you how you can make something useful from an old t-shirt without needing a sewing machine. You make your own unique bag!

Materials needed:

- Sharp scissors for cutting fabric
- Old T- shirt

Step 1: Cut Off the Sleeves

Cut off the sleeves. To make the cuts even, fold the t-shirt in half and cut both sleeves at the same time. Cut the fabric just past the seam where the sleeves are sewn to the body of the shirt.

Step 2: Cut Off the Neckline

Take your scissors and free hand cut off the collar of the shirt. It is recommended to cut a slightly oval shape as opposed to a round one. Make sure the back and front of the shirt line up and are cut to the same distance. This step is where the straps of the tote bag are finished.

Step 3: Determine Depth of the Bag

Turn the shirt inside out. Decide how deep you want your bag to be and line it up. Anything under the line will be used to close the bottom of the bag.

Step 4: Cut the Fringe

Start by cutting the left and right side of the shirt from the bottom up to the tape line, separating the top half from the bottom half of the shirt. Next, use your scissors to cut fringe on the bottom of the bag. Cut both the back and the front layers of the shirt together so they line up. Cut the slits from the bottom of the shirt to the tape line and make them about 1,5cm inch apart.

Step 5: Tie the Fringe

Take the first pair of fringe and tie it into a knot. Then tie two more pairs. Grab one of the strands from 2 and tie it to one of the strands from 1. Next take the other strand from 2 and tie it to one of the strands from 3. Tie another pair of fringe next to 3 and then take the remaining strand from 3 and tie it to your new knot. Continue to do this for the whole bag. The purpose of tying the two strands of fringe together like this is to close the gap between fringe pairs.

Note: a pair of fringe means one piece of the front and one piece of the back of the shirt. They should sit one on top of another if the shirt was cut correctly.

Step 6: Finish Your Bag

Once all the fringe is tied, remove your tape and turn your bag inside out. Finish the bag by tying knots at the tops of the handles or tie some of the scrap fabric on as embellishments. If you want the fringe to be part of your bag, skip the part where you turn the t-shirt inside out.

REFERENCES OR WEBLINKS:

- shirt: https://happiestcamper.com/how-to-make-a-no-sew-t-shirt-bag/
- textiles & the environment: https://www.tes.com/teaching-resource/sustainable-textiles-ppt-and-research-activity-6142932
- teach ethical fashion: https://www.theguardian.com/teacher-network/2017/apr/06/want-to-teach-ethical-fashion-to-kids-heres-how
- lesson plan sustainable fashion: https://static1.squarespace.com/static/579095c1b8a79bc4629250d1/t/5d8f23d095f70c20d4e45eed/1569661922239/Get+Redressed+Lesson+Plan.pdf
- true cost of one t-shirt: https://www.purnaa.com/post/what-is-the-true-cost-of-a-t-shirt

FOLLOW UP AFTER ASSIGNMENT:

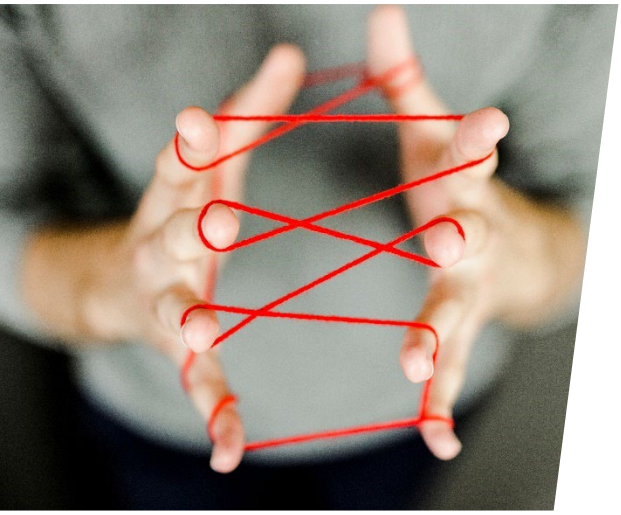
- You can pimp your shirt by drawing on it with markers or make an embroidery on it.
- Also you can try to make a 3D print on your shirt.

- Count the amount of t-shirts and blouses from your family and yourself
- Ask them how many they almost never wear
- Calculate how much % this is

Eileen Blackmore (workfield professional):
"Start out by asking pupils to read the label of the shirt or sweater they are currently wearing. What is it made of and where in the world it actually made?"

VALUE AND COST OF A SHIRT

[Mathematics] [Natural Sciences] [Economics]



Lesson Objectives

Raising awareness of the importance and applicability of data when calculating the cost of a product in a sustainable economy.

Activities

- Identifying information in tables and diagrams.
- Processing the components that make up the cost of a T-shirt into tables, graphs or diagrams in order to be included in a presentation.
- Analysing the cost of two T-shirts with data organisation elements.
- Converting the two situations into an adequate representation.

Materials: textbook, online resources

Procedures: case study, role play, modelling, observation, heuristic conversational approach, pair work

Class 1

- Introduction of the context, study case, role play and stages of the lesson. Context: What is a sustainable economy and how can we support it? Are we aware of the steps in the making of a T-shirt made of natural or synthetic fibres? What is the difference between the two? (one uses 2,700 litres of water in the making process, the other forms the 'plastic soup')

- Study case introduction: Bangladesh and Purnaa textile industry comparison: https://www.purnaa.com/post/what-is-the-true-cost-of-a-t-shirt

- Role play: Imagine you have just got the position of Cost Manager in a textile factory. Some of you work in Bangladesh for a company based on a consumption economy, others work in Purnaa for a company based on a sustainable economy. The company CEO asks you to modify the price of the T-shirts to be more competitive on the marketplace, so that the company makes bigger profits. In order to do that, you need to know what the cost consists of.

Stage 1: We study the cost components/elements of a T-shirt and organise the data in a table using the information from the case study.

Stage 2: We determine the % that each element has in the final cost of the T-shirt (the final cost is the price we pay for the T-shirt when we buy it)

Stage 3: Being a new employee, you need to consult with a specialist in order to make the best adjustments to the price. You have just learnt that an old classmate works for a competitor company in the textile industry. You meet and exchange data.

Organise the comparative data in a diagram.

Stage 4: Homework

Using Excel, make 3 diagrams that will help you make a comparative analysis of the elements that form the T-shirt cost. Print the diagrams or post on online space.

Class 2

Stage 5: make at least 3 adjustments/modifications to the price of the T-shirt so that it brings more profit to the company and it is more competitive on the marketplace.

Consider the following:

- Sustainable or consumption-based economy
- Existence or absence of an employee protection policy in the company
- Finding partners that contribute to the cost, more or less expensive
- Lowering or not the profit
- other

Stage 6: Homework

Write a note to the company CEO informing them of the new cost and present the arguments in favour of your choice. (at least 3 arguments)

Write your note in Word in ½ - 1 page and post it on Classroom or equivalent online space.

Allotted time: 1 week.


SMART HANDS

Minna Haataja (teacher):
"If we value our culture and see how it speaks to us, we can make new innovations from old cultural paths"

CULTURAL TREASURES, photos of heritage

[Art] [History] [Technology] [Culture]

Lesson Objectives

This lesson aims us to notice and value our cultural heritage and marks in our environment. Sharing cultural elements with each other.

Summary of the Lesson

At our homes & environment, schools we have marks of our own culture. We can see these marks in architecture, handicrafts, arts, design & different kind of materials we will find out from environment.

Search your cultural marks at your school or home. Take photos of these in good light & sharpness, quality of photo.

Materials needed:

- Photo camera (traditional, smart phone or tablet)
- Padlet.com or a likewise platform

Find:

1. A handicraft object someone has done
2. Wooden thing
3. Metallic thing
4. Ornament from the fabric or wallpaper
5. Detail of architecture
6. Detail of the floor
7. Detail of the roof
8. A door
9. The surprise photo of yours

Then select three best photos and share these to Padlet, an online platform.

Main conclusions

If we value our culture and see how it speaks to us, we can make new innovations from old cultural paths. We'll have more treasures for innovations if we know other cultures, traditions and friends.

International and online top up

Have a Zoom or Microsoft Teams sessions with schools abroad. The photos can be added online to Padlet, in this way, the pupils see the environment of their European peers and hear the story behind it. You focus on your own environment more consciously and also immediately see how it is with others. We notice that it works well to get perspective.

Find secondary schools to work with via eTwinning or the Smart Hands website.

Maria Gloria Leite (deputy school leader):
"The value of internationalisation is not only going abroad, involving pupils extensively when you host foreign guests makes sure you get a wide impact."

Souvenirs, Smart Hands international exhibition

[Crafts] [Art] [Geography] [History]

Lesson Objectives

- You learn that things are of value. Even garbage!
- You get to learn the heritage/cultures of other countries
- You get to practice other language(s)

Summary of the Lesson

We are going to make a souvenir for another country. You will look at the culture of the country you are going to explore. In the end, a "Smart Hands exhibition" will be created with all of your work!

Find secondary schools to work with via eTwinning or the Smart Hands website.

Step 1

Make a souvenir by choosing an object from the country you are going to research. You will use materials available in your own surrounding for this purpose. What you make, you can choose yourself. The only 3 mandatory requirements are;

- Choose a minimum of 2 different materials,
- Make a souvenir inspired by the country you have been assigned to above,
- The work you make has to be 3D.

Step 2

Upload a picture of your work to an online platform such as Padlet or eTwinning. Your teacher will provide you with the instructions how to do this.

Step 3

During the online workshop, you will present your work. You have to prepare 2 questions to ask about the other's students souvenir/work.

MATERIALS/EQUIPMENT/ICT NEEDED:

Natural and/or recycled materials to make the souvenir, available from your own direct surroundings: your house, the garden, the park, or at school.

Ville Eronen (teacher):
“Typically youngsters are very handy when it comes to using online programs and 3D modelling. Being digital natives, they tend to intuitively find out how it works pretty quickly.”

Tinkercad

[ICT] [Mathematics] [Crafts] [Technology]

Lesson Objectives

Learn to 3D model an object.

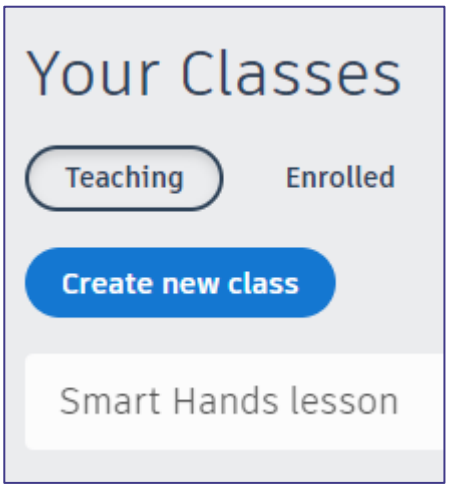
Introduction

Tinkercad is a free-of-charge, online 3D modeling program that runs in a web browser. Since it became available in 2011 it has become a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools!

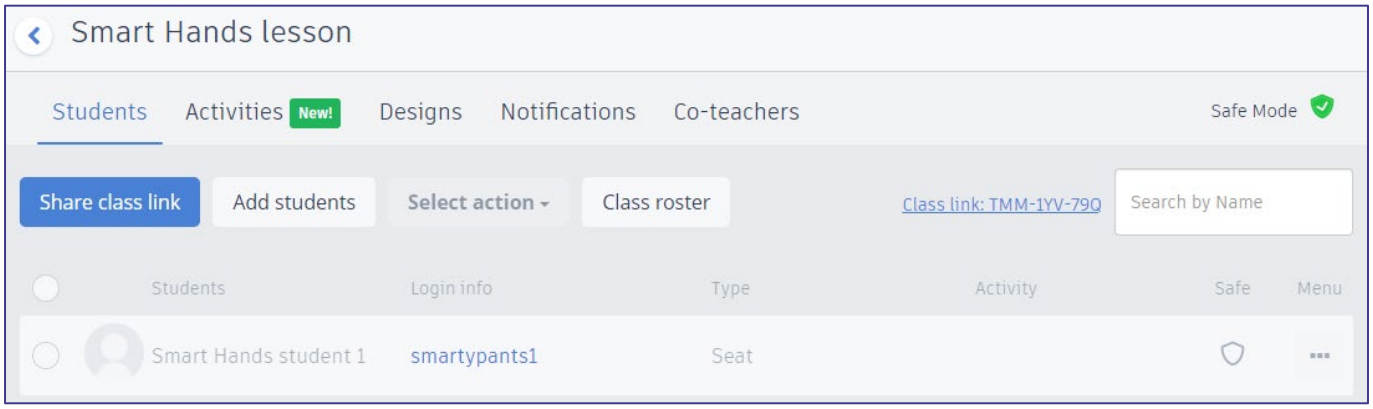
Tinkercad was founded by former Google engineer Kai Backman and his cofounder Mikko Mononen, with a goal to make 3D modeling, especially the design of physical items, accessible to the general public.

Tinkercad uses a simplified constructive solid geometry method of constructing models. A design is made up of primitive shapes that are either "solid" or "hole". Combining solids and holes together, new shapes can be created, which in turn can be assigned the property of solid or hole.

Getting started (guide for teachers)



1. Go to www.tinkercad.com
2. Click register or sign in (top right)
3. Make an account or use your account as a Teacher and login
4. Create a new class by pressing the blue button.
5. Add activities to the lesson by using the corresponding button.
6. When ready, go to the button ‘Add students’.
7. Enter the names and user names (aliases) of the students.
8. Then use the blue button ‘Share class link’ to share the lesson with your students.
9. You will get instructions from Tinkercad that you can forward to your students how they can login with their nickname and class code.



Getting started (guide for pupils)

1. Go to www.tinkercad.com
2. Click sign in (top right)
3. Click students join your class (teachers also do this!)
4. Use the class code provided by the teacher
5. Choose join with nickname and use the nickname provided by the teacher
6. Start with the assignment(s). Click ‘create a new design’ and start your trip to 3D world!

3D Modelling inspiration

How to make a key chain:
https://www.youtube.com/watch?v=hkAguLad3Wc

How to make a teddy bear:
https://www.youtube.com/watch?v=z8pI0B7uLNU

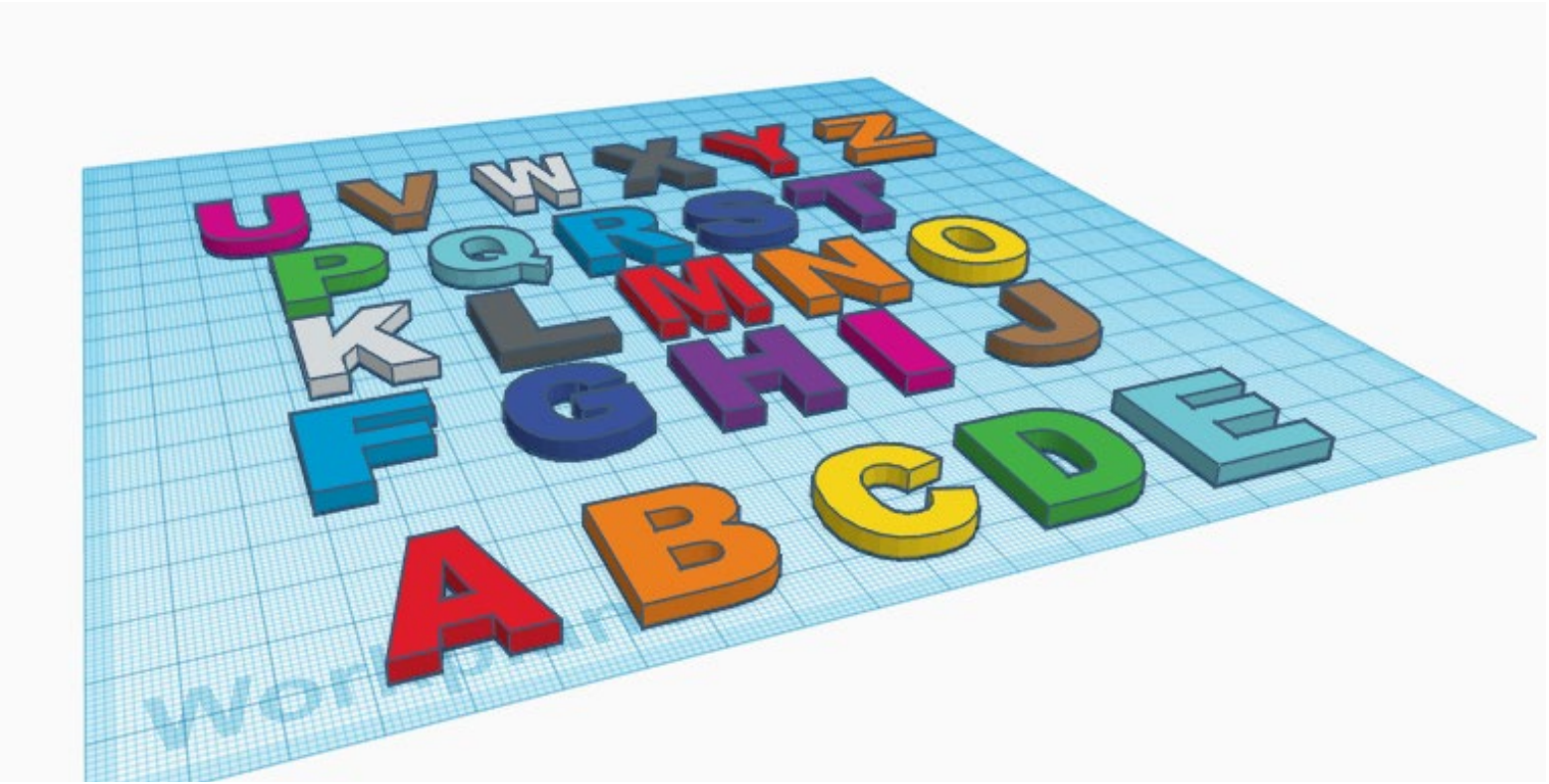
How to make Among Us character:
https://www.youtube.com/watch?v=KgViNud47fE

3D printing

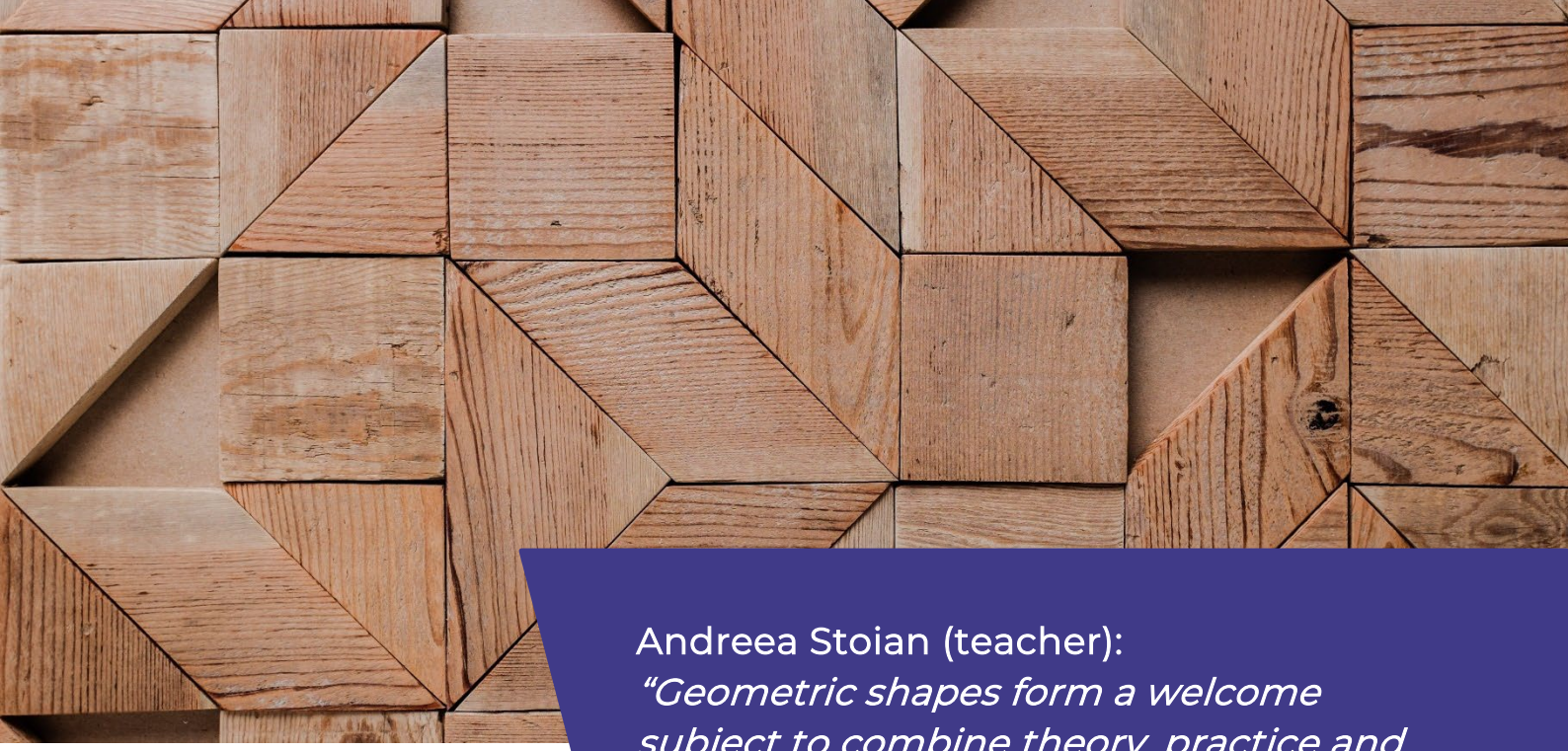
You can 3D print from Tinkercad pretty easily in a couple different ways.

1. If you have a 3D printer at school or at a local makerspace, just download the STL file from either your dashboard by clicking the model thumbnail or from within the editor. Just click Export, then choose the STL filetype. STL is the standard file for most printers. Then you can import that STL into your printer's slicing application to create the Gcode your printer understands to make the 3D print.

2. You can also order a print from one of the Tinkercad partners from within the 3D editor. To see your options, click "Export", then click the 3D Print tab to see the options. You can set the print settings on the print partner's website for your Tinkercad design.



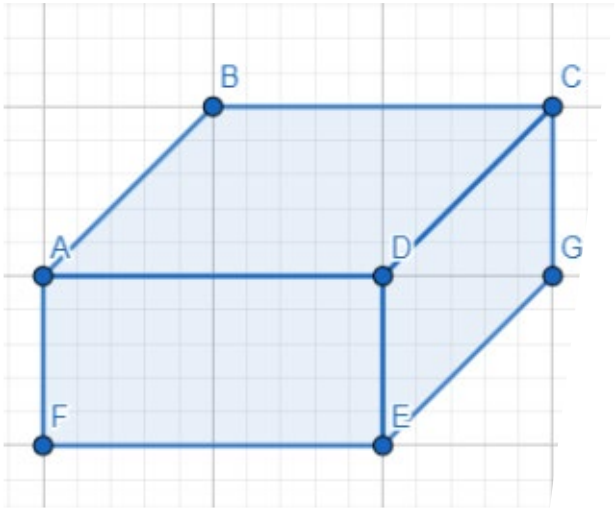

SMART HANDS



Andreea Stoian (teacher):
"Geometric shapes form a welcome subject to combine theory, practice and ICT."

2D and 3D Geometric Shapes

[Mathematics] [Natural Sciences] [ICT]



Lesson Objectives

Raising awareness of the importance and applicability of the geometry elements in everyday life situations.

Resources Needed

Materials: Math textbook, GeoGebra site (www.geogebra.org), scissors, cardboard, tape.

Procedures: experiment, modelling, problem solving, observation, heuristic conversational approach.

Activity 1 (10min)

Students are asked to observe and identify the 2D and 3D geometric shapes from the textbook and write them down in a table as follows:

2D geometric shapes	3D geometric shapes

Activity 2 (5 min)

Students have to observe and identify/draw in their notebooks the 2D shapes that form a 3D geometric shape and complete the following table:

3D geometric shapes	Corresponding 2D shapes

Activity 3 (10 min)

Students are asked to observe and identify specifically the number of 2D shapes that form a parallelepiped. They are encouraged to identify the parallelepiped in everyday life context and notice the difference between how this geometric shape presents itself in reality and how it is represented on a flat/plane surface. Students should be able to identify on the plane surface the 2D shapes that form the 3D geometric shapes.

Activity 4 (10 min) Practical application

Project theme: build a box with a round whole on one side when we know the size of all the 2D geometric shapes that form the box.
Students are put into 2 groups: one will build the box and the other will use the GeoGebra platform to do the same.
The teacher explains the project theme to the students.

Group 1:

1. Cut 6 pieces from an old cardboard box and specify what 2D geometric shapes they are:
- 4 pieces of 10x5 cm each
- 2 pieces of 10x10 cm each

2. Make a whole in the centre of one of the 10x10 cm pieces and specify what 2D shape this one is.

3. Use all the 6 pieces of cardboard to build a box; use tape to glue them together. You can decorate the box as you wish.

4. Assign a practical purpose to the box.

5. Take a picture of the box and upload it on Classroom, mentioning what 2D geometric shapes each side of the box is.

Group 2:

On GeoGebra, draw a representation of the box, with a round whole on one side. Adapt the requirements mentioned for Group 1 so that they can be used on GeoGebra; consider the way in which a parallelepiped is represented on a plane surface. Use different colours for similar 2D shapes.
Save your project as an image, and post it on Classroom, mentioning what 2D shapes you have used to draw the parallelepiped (what do the square, the rectangle and the circle turn into when we want to represent them in a 3D dimension?)

Individual Projects

Homework: Practical applicability of Geometry elements in everyday life situations - Building a box with a round whole on one side.

Resources: cardboard, scissors, tape, the GeoGebra platform (www.geogebra.org)
Time allotted: 1 week

Impression of student work

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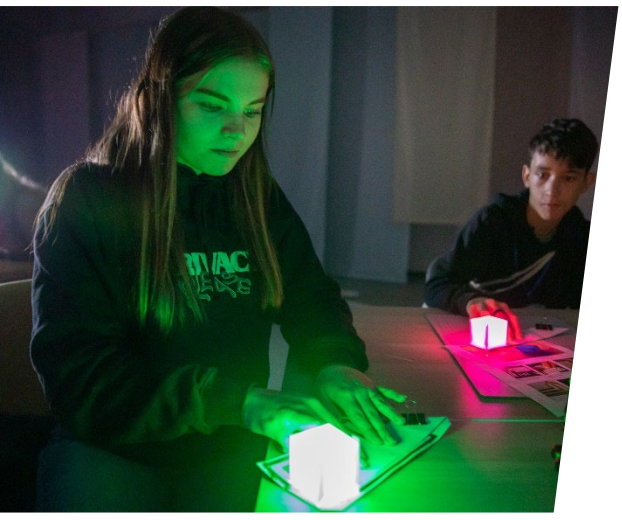
Miruna (workfield professional):
“Making the assignments real, tangible and visible tends to help youngsters to understand the theory behind the practice.”

Light Cube

[Physics] [Crafts] [Technology]



Lesson Objectives

Explore touch-sensitive paper circuits and RGB LEDs.

Materials Needed

- an RGB LED
- a three volt button cell (i.e. CR2032)
- conductive tape with conductive adhesive
- two 100 Ohm resistors
- a binder clip
- the printed template (see next pages)
- scissors, glue and/or transparent tape

Smart Hands youngsters carried out this assignment while having their international learning week in Romania, hosted by our partners Scientifica and CNER secondary school. You can see in the pictures how they did it, and this is what they did:

Step 1 : Cut out the template of the circuit. Score and fold all edges.

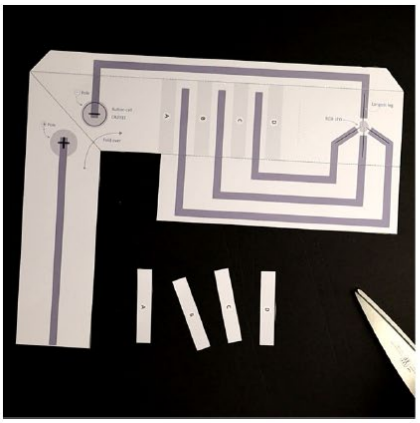
Step 2: Trace the circuit with conducive tape.

Step 3: Attach the longest leg of the RGB LED to one track and the other three legs to the other tracks. Make sure the four tracks do not touch each other!

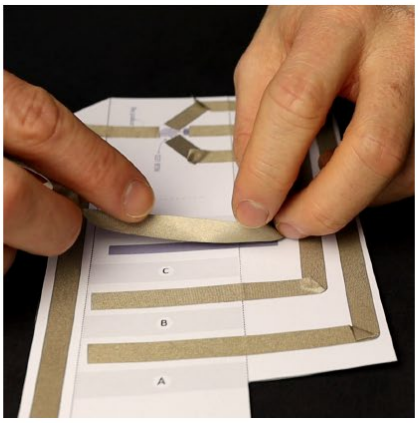
Step 4: Cut a gap and add a small resistor (e.g. 56 Ohm) in front of the "red leg".

Step 5: Add a button cell to the circuit and test it! When it is working, it is time to turn it into a light cube!

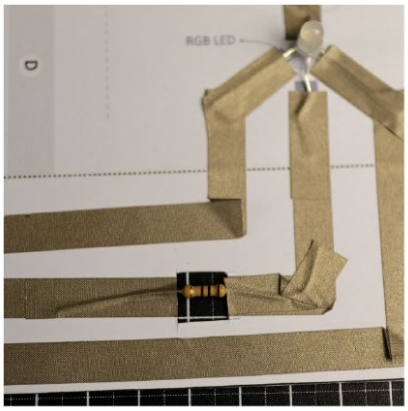
Step 1



Step 2



Step 3



Step 4

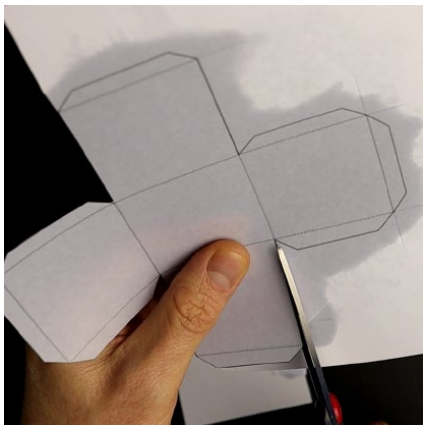
Step 5

Step 6: Cut out the template of the cube.

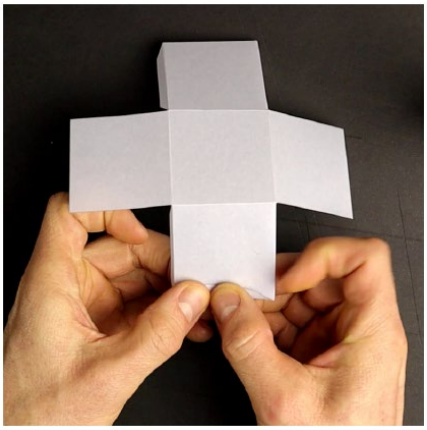
Step 7: Prefold every edge.

Step 8: Glue the cube together. Glue the cube on top of the RGB LED.

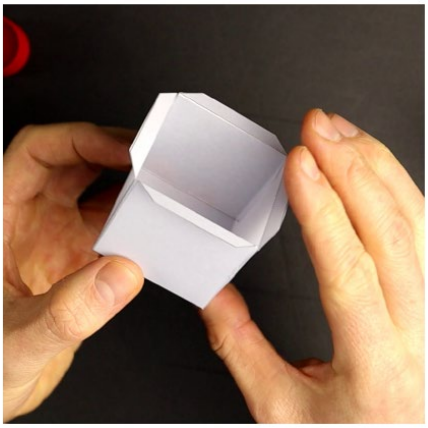
Step 9: You have a colour changing light cube, test it out in the dark!



Step 6

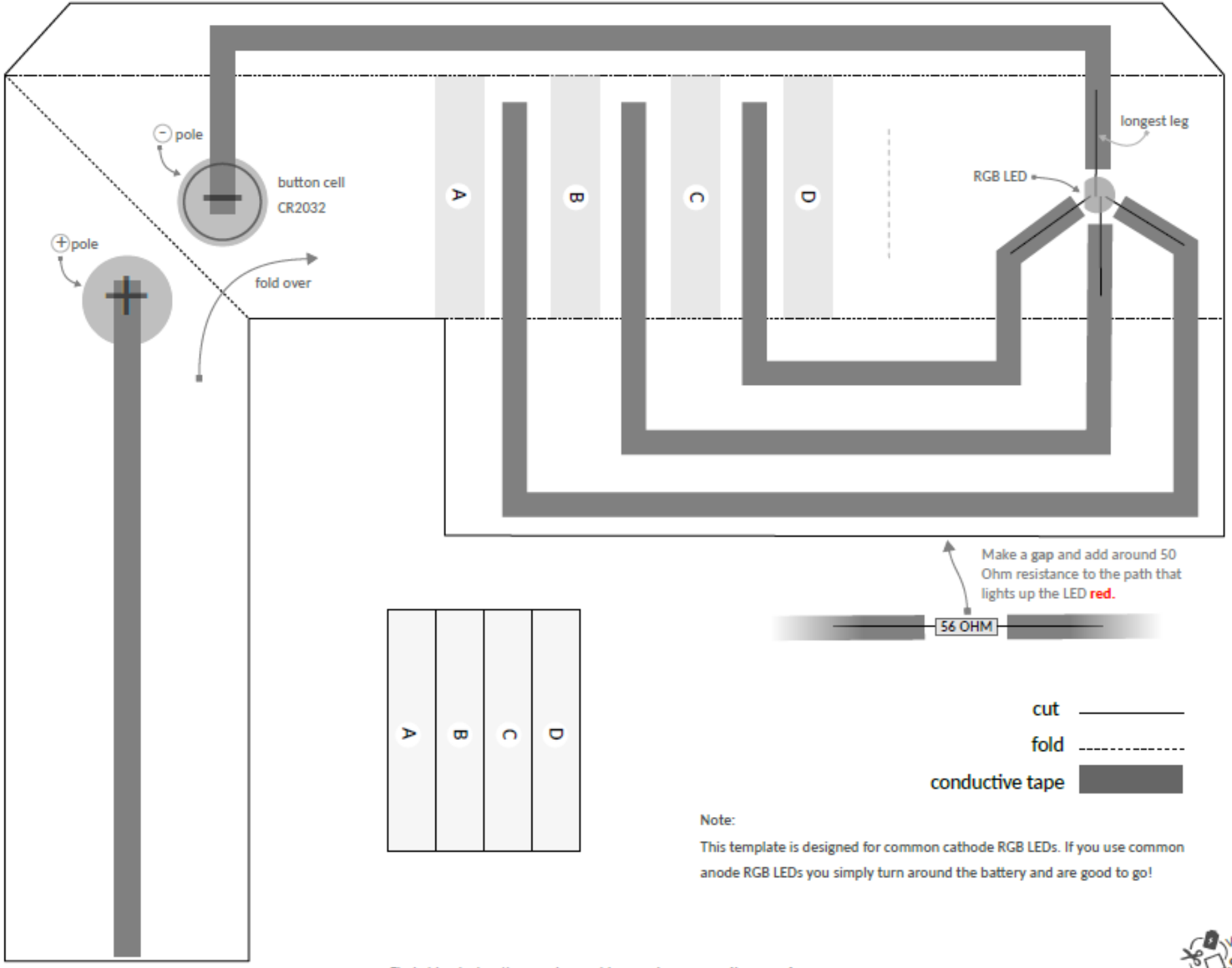


Step 7



Step 8

Step 9: test it out in the dark!

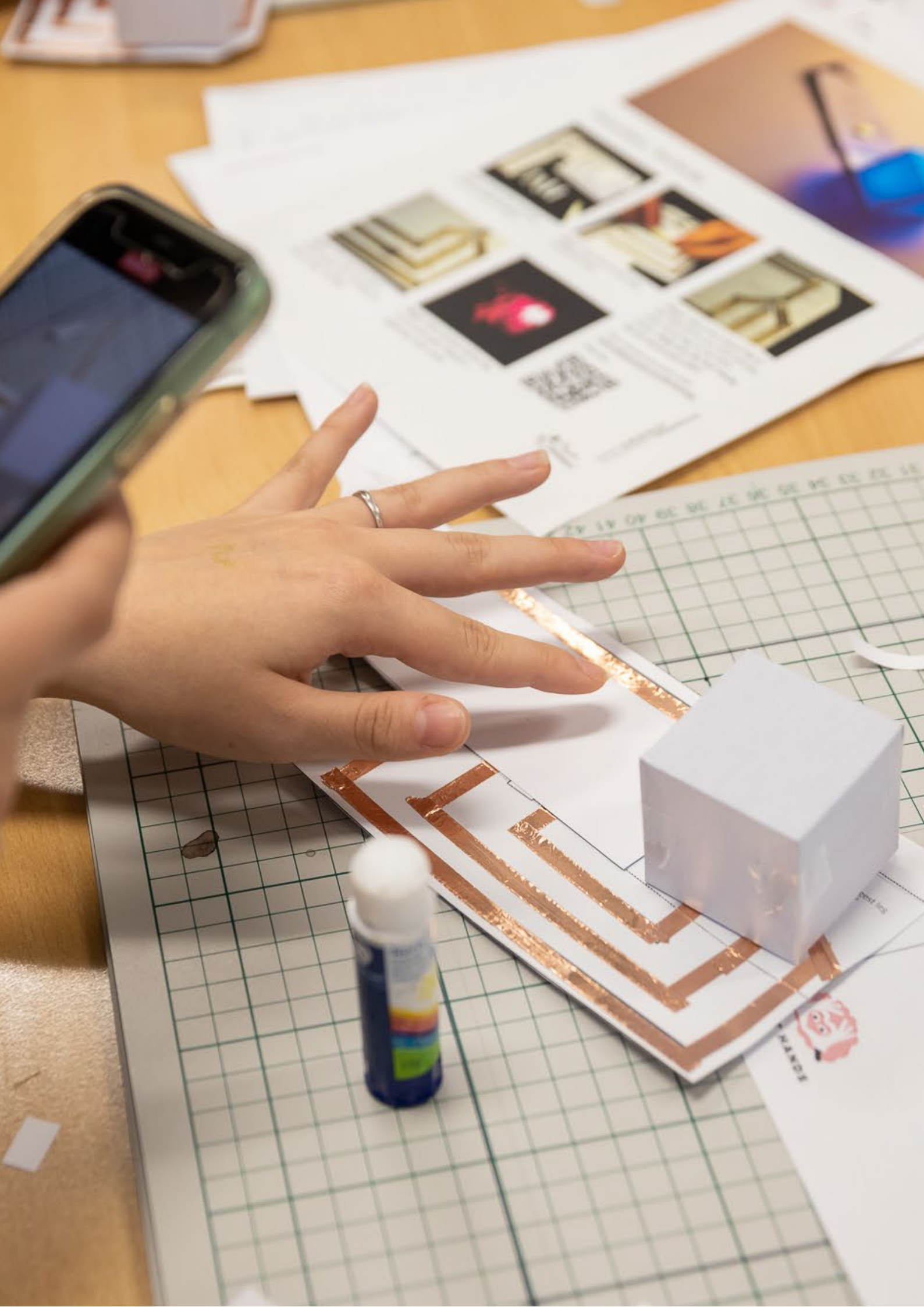


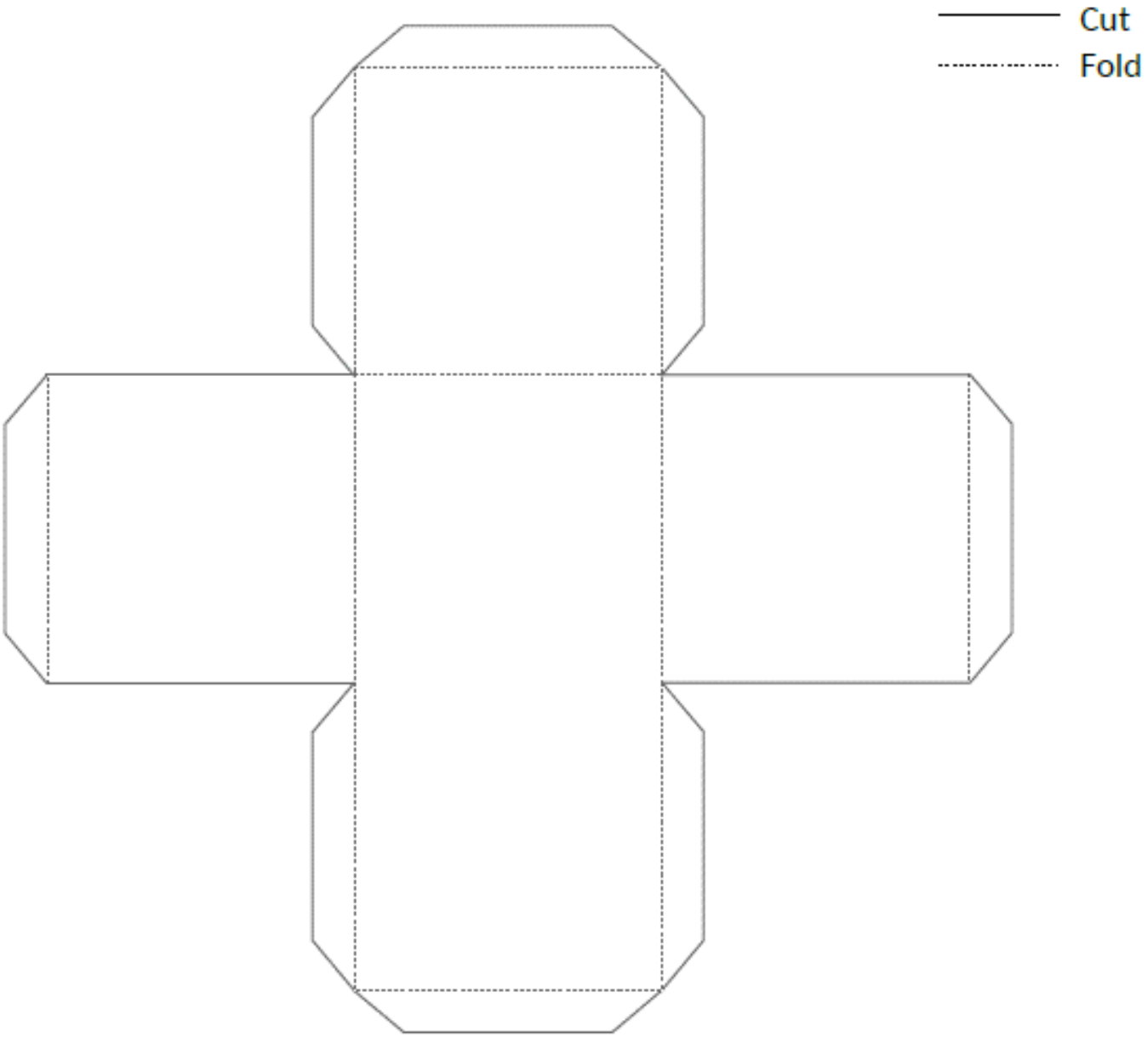
Note:

This template is designed for common cathode RGB LEDs. If you use common anode RGB LEDs you simply turn around the battery and are good to go!

Find video instructions and more ideas under www.voltpaperscissors.com

volt. Paper. Scissors!




Cut
Fold

Eileen Blackmore (workfield professional):
“I have run this workshop quite a few times within the Smart Hands context , it gives the teacher a engaging basis to easily add elements from the existing curriculum subjects to. ”

Make you own soap!

[Biology] [Crafts] [Civic Education] [Home Economics]

Lesson Objectives

Get a better understanding of microbeads, plastic based and biobased materials. Learn to develop own everyday products from natural materials.

Introduction

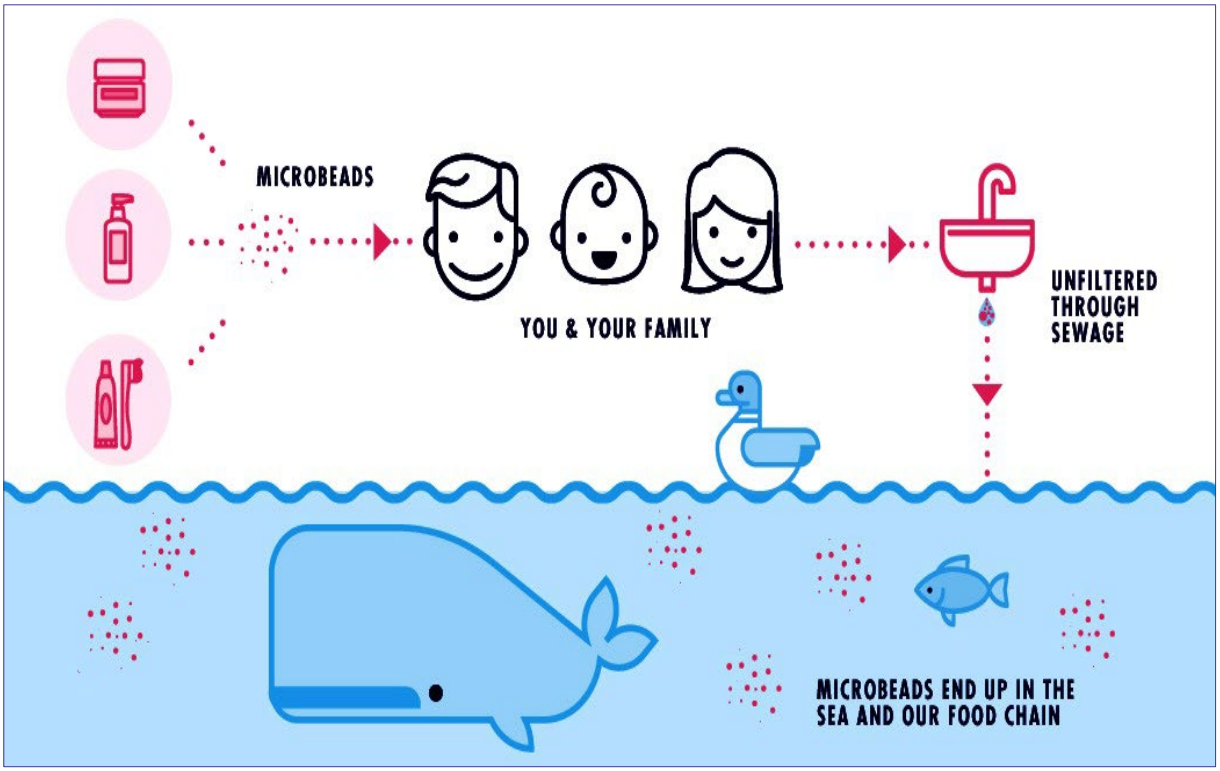
Everywhere you look, you see plastic. From 1950, this material radically changed the way we live. It is in our clothes, cosmetics, toys, smartphones and cars. Everyone knows it, but what is it actually? The raw material of most plastics is oil.

We make plastic from about ten percent of the oil, and we convert the rest into petrol or fuel oils, for example.

Now what is the relation between plastic and microbeads? Microbeads are manufactured solid plastic particles of less than one millimeter in their largest dimension. They are most frequently made of polyethylene but can be of other petrochemical plastics such as polypropylene and polystyrene. They are used in

exfoliating personal care products, toothpastes and in biomedical and health-science research.

Microbeads can cause plastic particle water pollution and pose an environmental hazard for aquatic animals in freshwater and ocean water. Unfortunately, roughly one third of all plastic produced worldwide consists of packaging.



To get the full picture, some further background on personal care products:

- Liquid shampoo not only produces a lot of plastic waste, but an enormous amount of water is also used in its production. Shampoo consists of more than 80 percent water.
- We use an average of 11 (plastic) bottles of shower gel and 10 bottles of shampoo per year.
- According to dermatologists, exfoliating is one of the worst things you can do for your skin. But scrubbing is also bad for the environment because the creams contain small pieces of plastic.

Now, what can you do to reduce plastic in personal care products?

Workshop: Make you own soap

Step 1: Choose our own ingredients - investigate what can be put in the soap

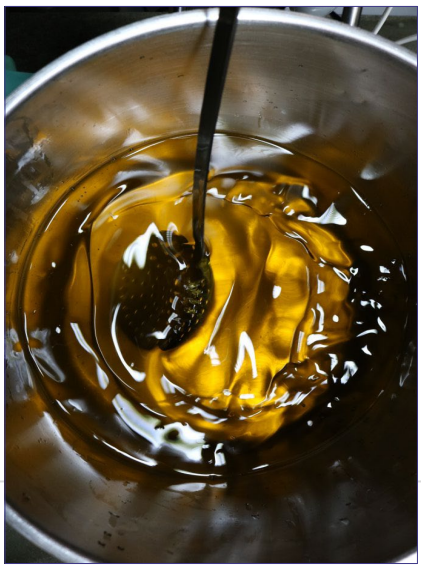
Step 2: Pour soap, warm up and pour (see detailed instructions on the next page)

Step 3: Add natural ingredients

Step 4: Let the soap dry

Step 5 : Cut packaging (see detailed instructions on the next pages)

Step 6: Make your own name / logo on it.

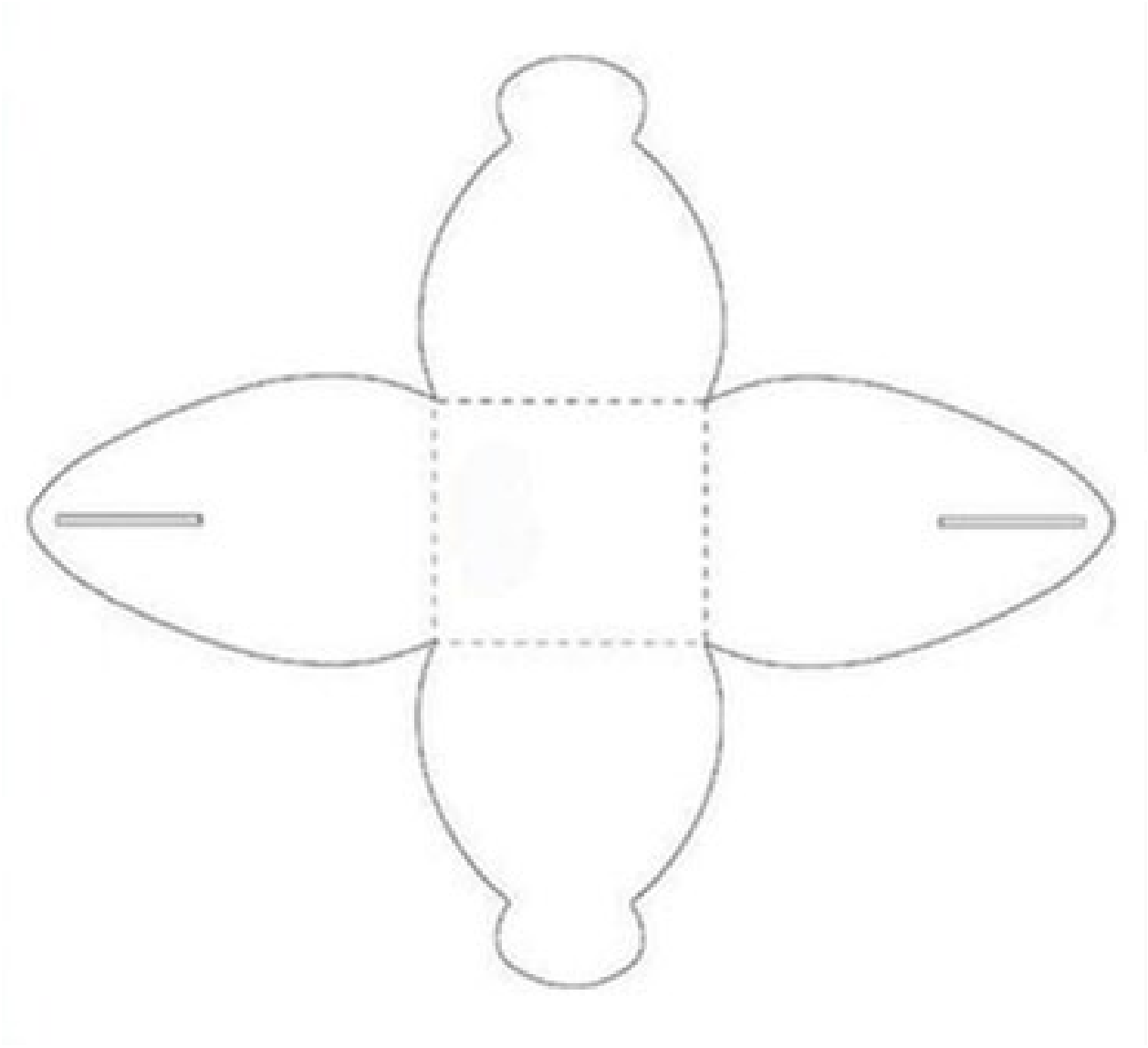


Details of Step 2: the soap pouring process

- Pour soap block into plastic container
- Cut the soap into small pieces
- Heat your bars of soap in the pan to an oil
- Stir gently until you have a nice smooth mixture
- Do not stir too hard otherwise lots of bubbles in the soap
- Gently remove from pan (CAUTION! HOT!)
- Pour it into your mould
- Put your chosen natural ingredients in or through it.
- Stir gently (if the mould contains ingredients).
- Now it's time to wait....

Details of Steps 5 and 6: make the packaging

- Get the mould (example below)
- Trace this one
- Cut it out
- Note the fold lines
- Then fold it together
- Think of a name or logo for your soap
- Mark this on the packaging




SMART HANDS

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SMART HANDS KIT

Create your own lesson plans in an instant

Smart Hands Start Kit

➔ *download or order from www.smarthands.school*

Excited about our multidisciplinary lessons? Did you like working together with your fellow teachers from other school subjects? Maybe creating your own multi-disciplinary lessons or workshops is then right up your alley!

We have develop a handy deck of cards we like to call the Smart Hands Kit. It enables you to quickly develop your own STEAMy lessons covering various school subjects. It comes with instructions how to use it so you can get started right away. Like to receive a set? Do get in touch with us via www.smarthands.school !

Smart Hands Cards instructions

Why do we suggest you use these cards? These cards can be used to brainstorm together with other teachers teaching other subjects to create multi-disciplinary lessons or workshops. The main focus of using these cards is to combine the head to the hands, make lessons more tangible and easier to understand.

Ideas when to use the cards

- To set up a up a workshop or a series of lessons in which you would like to work multi-disciplinary;
- To work together with stakeholders on a societal or regional matter;
- To add some extras to your existing lesson to inspire and motivate your pupils;
- To add a practical lesson within your curriculum to teach more craft skills;
- To add some A to STEM lessons or add practice to theory.

The four categories of cards available

1. Theme: cards about themes of the different subjects that are taught like geometry, brain, light.
2. Material & Technology: these cards will make the task visible and tangible.
3. Action: what will be done with material & technology, what will be the outcome.
4. Bigger Picture: these cards represent society. What are the issues in the world or in your region?

* Joker: you can add this card to your selection to focus more on a subject that you are working on or link it to a question from the work field.

* Empty Card: you can also add your own theme, action, material & technology and bigger picture card.

"If we would sit together for another hour, I'll surely have a complete lesson plan ready!" one participant said enthusiastically. "You make very different combinations than usual, very inspiring" said another."

Feedback from workshop with teachers

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

WWW.SMARTHANDS.SCHOOL

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