

TRAINING FOR KINDERGARTEN EDUCATORS

The Superhero Lab: Engaging Children as Scientists to Explore Sustainability

Accompanied by a pedagogical handbook and
instructional videos.



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This training gives early childhood educators the confidence to use simple science experiments that encourage children to ask questions, explore, and learn about sustainability.

The course aim



LEARNING OBJECTIVES

By the end of this training, participants will be able to:



Confidence

Feel confident leading Superhero lab experiments with young children.



Inquiry

Encourage children to ask questions, make predictions, explore, and discover through hands on activities.



Design experiments

Create their own Superhero lab style experiment using safe, everyday materials.



Sustainability education

Connect experiments to children's everyday experiences and sustainability topics.



Reflect

Reflect on their own practice and identify ways to encourage more curiosity and exploration in their kindergarten.



Adaptation

Adapt experiments for younger and older children, mixed age groups, and different learning needs.



Agenda

Day 1



The Superhero lab methodology and connection to sustainability



Experiencing Superhero lab experiments



Supporting children's scientific thinking through stories, questions, and learning design



Reflection and planning



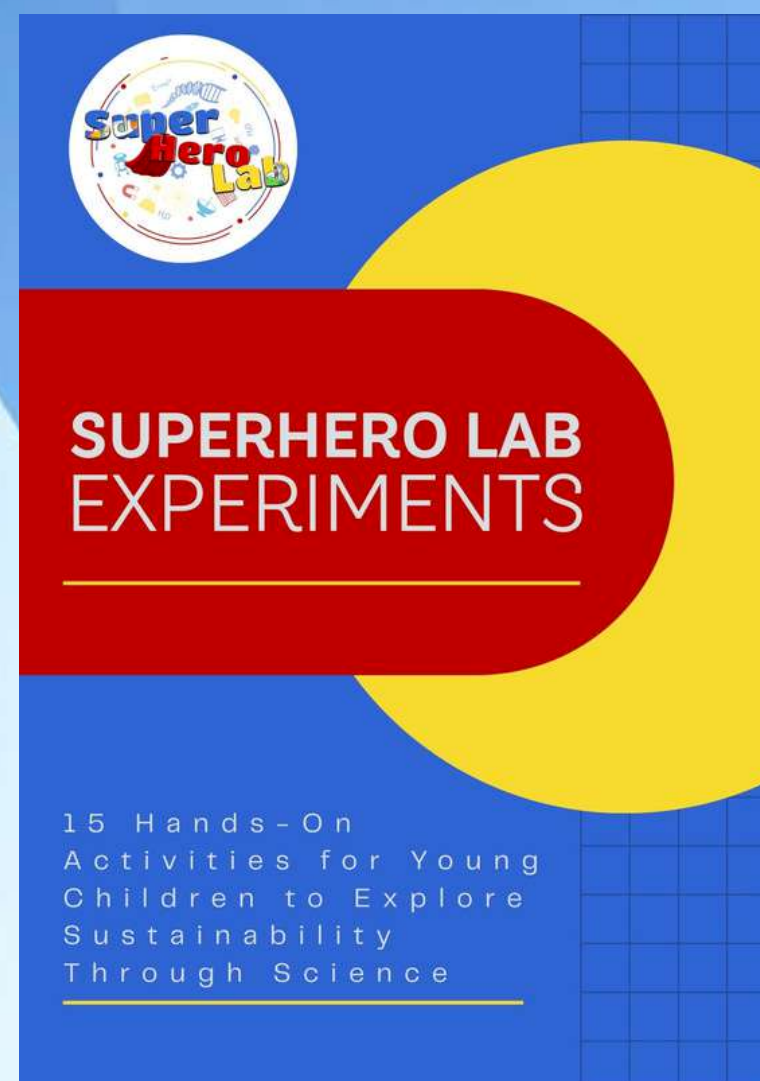
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Video instructions

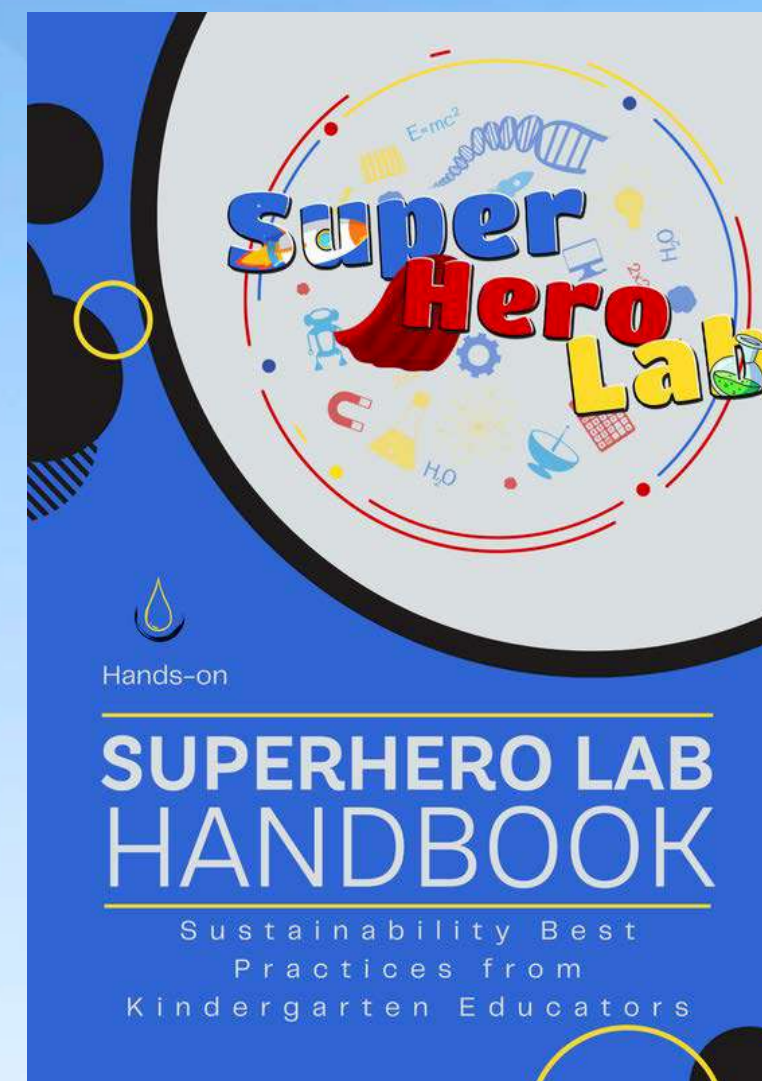
YT channel

SuperHeroLabProject



Collection of
experiments with
lesson plans

superherolab.eu



Sustainability
education good
practices

Resources available to download free of charge.

GETTING TO KNOW EACH OTHER BINGO

Who among the
participants has
a dog?

Who likes spicy
food?

Who prefers
winter over
summer?

Who likes
pineapple on
pizza?

Who has a
favourite movie
they have
watched at least
10 times?

Who knows how
to create and
edit videos?

Who has
travelled alone?

Find someone who
has a strong sense
of gratitude.

Who has a good
sense of
humour?

Who could easily
live for a month
without a mobile
phone?

Who prefers going
to the mountains
rather than the
beach?

Who was very
persistent as a
child?

In Superhero lab, the educator is not the only source of knowledge.

The educator creates the conditions for children to ask questions, investigate, and discover.

Icebreaker



Icebreaker

Transform the statements into one that encourages inquiry.

A

Let me show you how.

B

This is what happens.

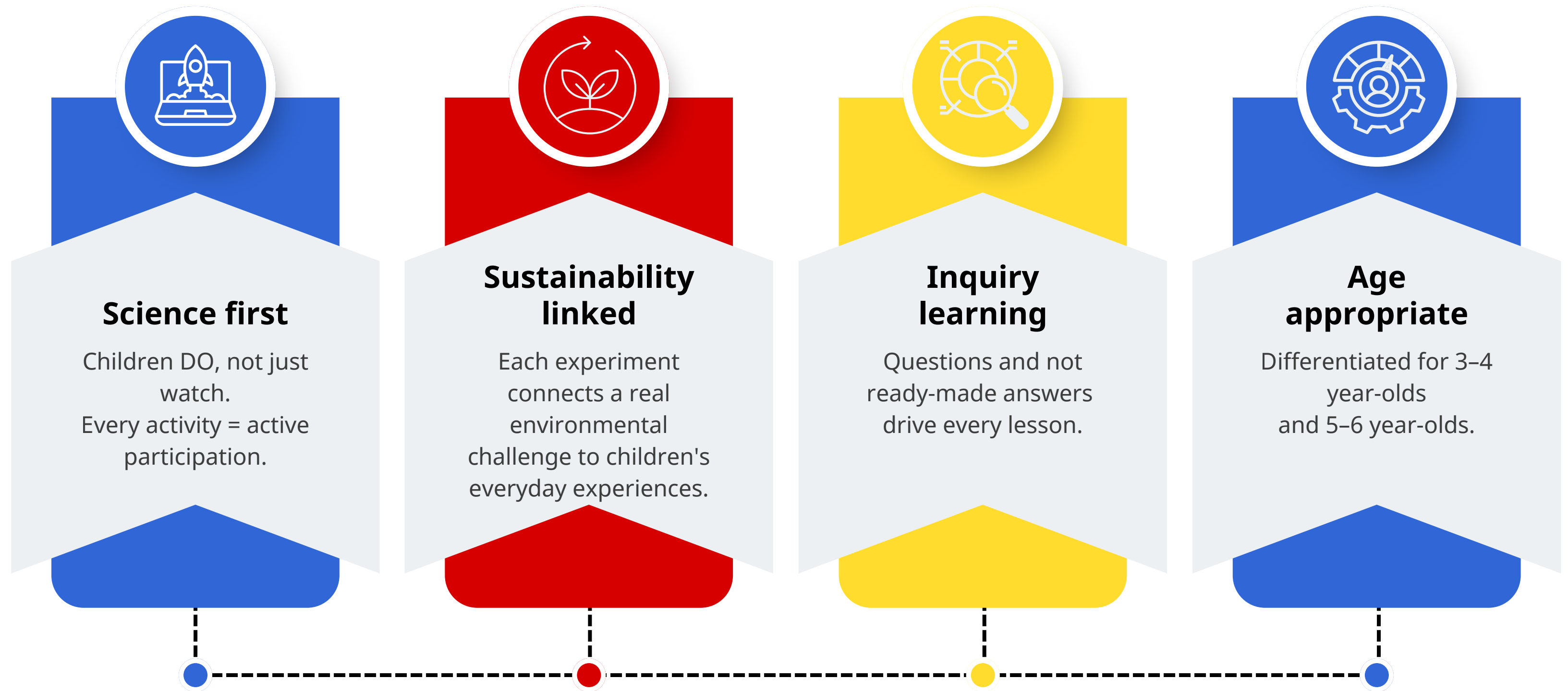
C

No, that's not why.

D

Watch me.

15 EXPERIMENTS FOR CHILDREN



CURRICULUM ALIGNMENT



Recycling & reusing

Invisible ink
Solving dried markers

Earth pollution

A pirate's fatal mistake (oil spill)
From rain to flood



Green energy

Paper rocket
Solar pizza oven

Health & sustainability

Droplet Watty (water filtration)
Lemon bubbly experiment



Caring for nature

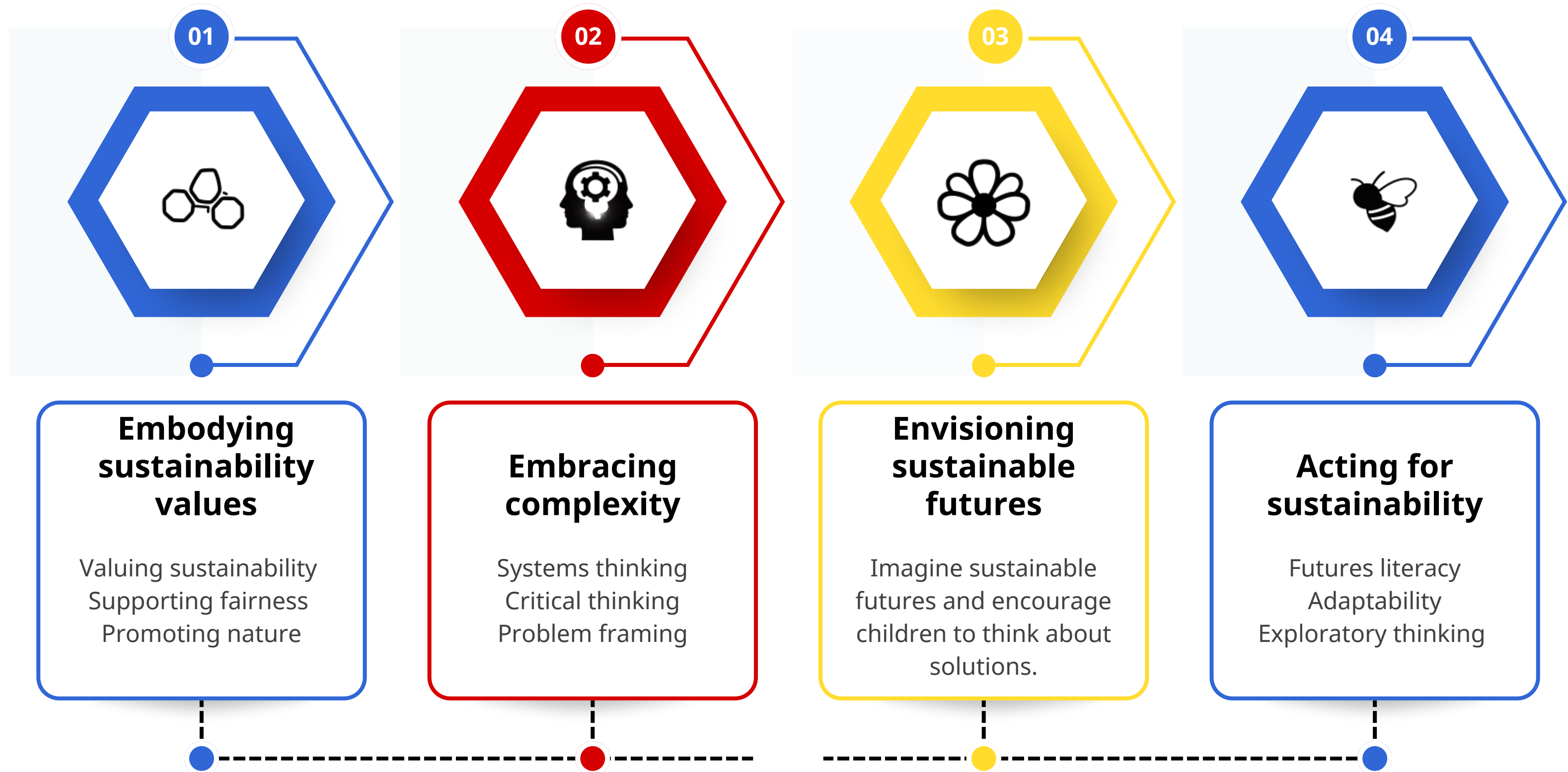
Sleeping daisy
Three little pigs' sustainable houses

Sustainable food

Diaper absorbent
(water in agriculture & food security)



EXPERIMENTS MAP TO GREENCOMP: THE EUROPEAN SUSTAINABILITY COMPETENCE FRAMEWORK



PEDAGOGICAL APPROACHES IN EXPERIMENTS



Inquiry-based learning

Children form hypotheses, test them and revise understanding based on evidence.

Problem-based learning

Each activity opens with a real-world problem: 'How can we clean the oil spill?'



Engineering design process

Design → Build → Test → Improve
Children iterate on their creations.

STEM integration

Science + Technology + Engineering +
Maths integrated into every activity.



Sustainability education

Connects science to care for the planet.
Science becomes meaningful and purposeful.

Differentiated instruction

Simpler tasks for ages 3–4; richer variables
and data recording for ages 5–6.

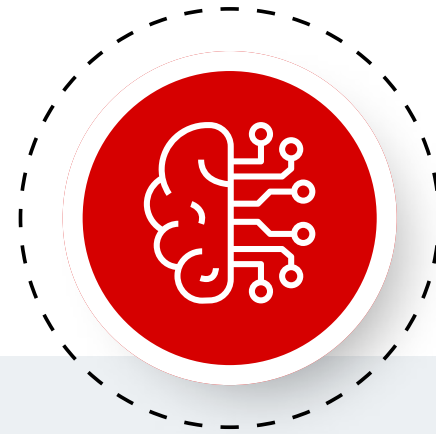


EVERY ACTIVITY FOLLOWS THIS 5-STEP STRUCTURE



Spark

Begin with a story or a real world problem. Ask open-ended questions. Introduce materials.



Hypothesis

Children predict outcomes. Formulate the research question. Record predictions on a class chart.



Experiment

Hands-on investigation. Every child touches, explores, builds. Echo science vocabulary.



Observe and discuss

Compare results with predictions. Sketch findings. Link to real-world context.



Conclude and extend

Confirm or revise hypothesis. Connect to sustainability. Propose follow-up activities.



STEP 01

STEP 02

STEP 03

STEP 04

STEP 05

Video analysis

Watch the video

[A Pirate's Fatal Mistake – Oil Spill](#) 

- 1.As you watch the video, take notes.
- 2.Compare observations in small groups.

Observation area	Notes
Inquiry moments	
Sustainability connections	
Vocabulary opportunities	
Safety considerations	
Age differentiation	

Secret drawings with invisible ink

Children draw with a baking soda solution. Turmeric's curcumin reacts with the basic baking soda, changing colour.

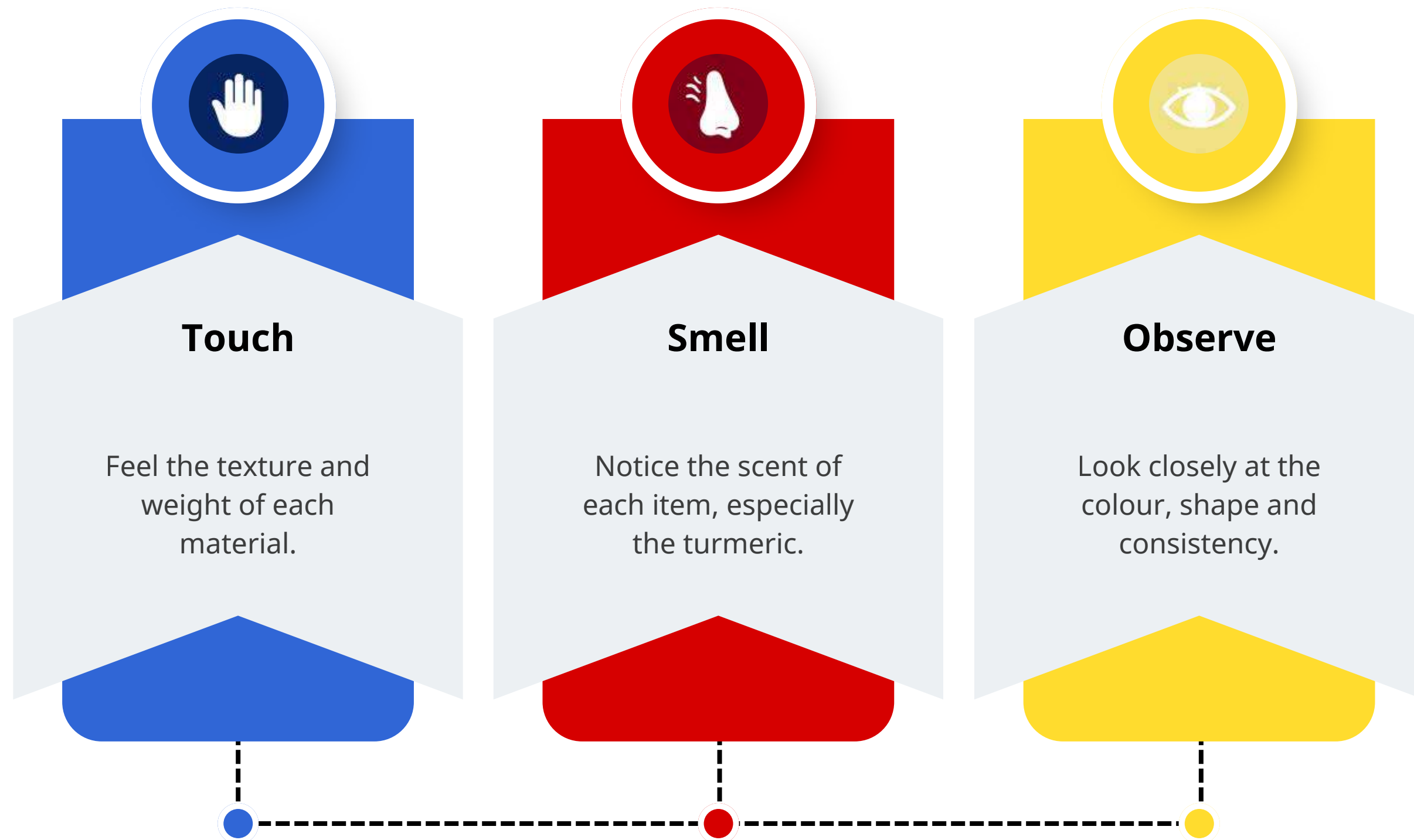
Now we will experience this experiment as a child.

Handbook page 17

[Instructional video](#) 

EXPERIMENT STATION:

BEFORE WE START, EXPLORE THE MATERIAL



Safety note: Before inviting children to touch or smell materials, make sure they are safe to handle and smell.



One morning, a little squirrel named Pip found a rolled-up piece of paper under an old oak tree. She unrolled it carefully, but the paper was completely blank.

"There is nothing here," said Pip. "Someone left a blank piece of paper!"

But her friend Benji the badger squinted at it and said: "Wait, Pip. I think there IS something on this paper.

Something we just cannot see yet. I think this is a SECRET message.

Somebody hid it here on purpose, but HOW?"

Can YOU help Pip and Benji discover the secret, and learn how to write your OWN invisible message?

What do YOU think is on the paper?

Ask these
questions
and wait
for
children's
answers:

Q1

What are the
things that we
can draw with?

Q2

What about
baking soda and
water? Can we
draw with it?

Q3

Do you know if
invisible ink
exists? Can we
draw with it and
then, later, make
the image
visible?

Research question

Can we write a message with baking soda mixed with water and then SEE it?
Hypothesis vote: Ask every child to predict.

☒ YES — We CAN see the message!

☐ NO — We CANNOT see the message

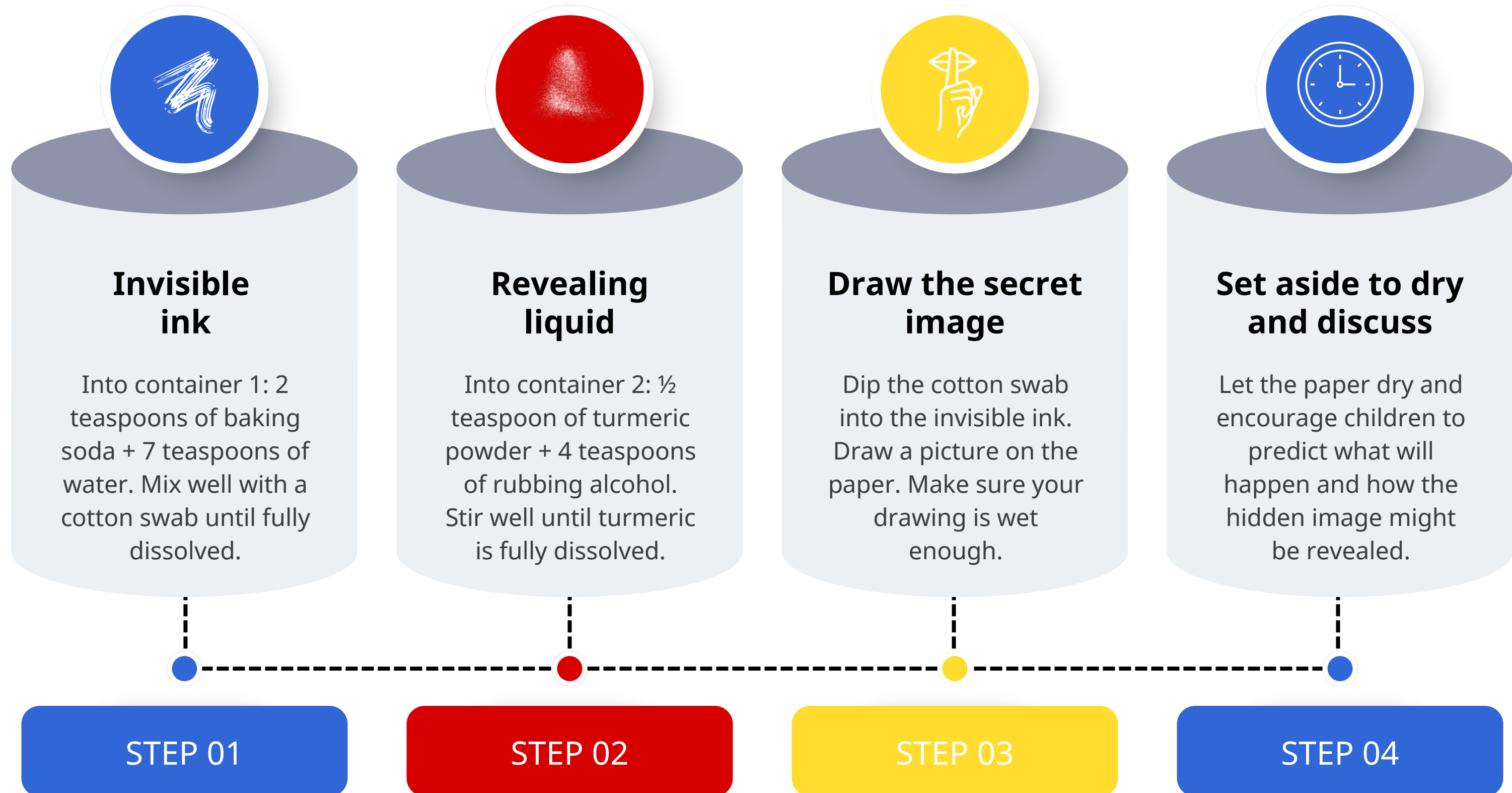
Your Canva profile name won't be shared

How to record predictions?

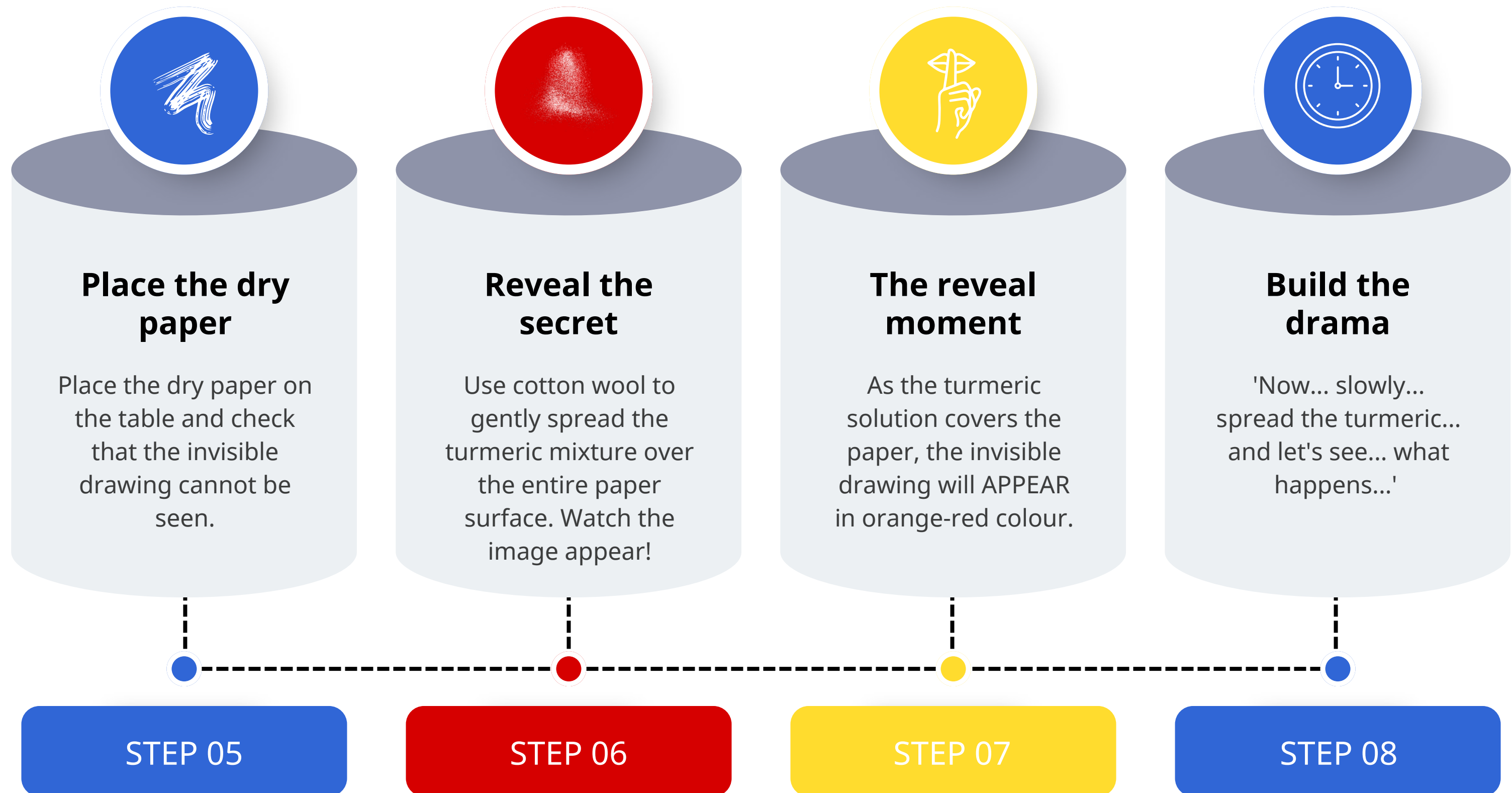
- Write or draw YES / NO votes on a large class chart where everyone can see.
- For ages 5–6: each child writes their own prediction on a sticky note.
- For ages 3–4: use a show of hands and tally on the board, simple and fast.
- Leave the chart visible throughout, you will return to it in observation and discussion.

EXPERIMENT

Distribute all materials to each child first. Allow 1 minute for children to touch, smell and observe each item before starting.



EXPERIMENT: THE REVEAL MOMENT



Quiz

Why does the hidden drawing appear when turmeric solution is applied?

A

The heat from the liquid dries the paper.

B

Turmeric's curcumin reacts with the basic baking soda, changing colour.

C

Baking soda becomes visible when it gets wet.

D

Alcohol dissolves the baking soda powder completely.

Observation and discussion

Now we know there's nothing magical about invisible ink. It's all about using the right chemical reaction to reveal the message.

Q1

What happens to your drawing when we apply the turmeric solution?

Q2

Why does the invisible ink appear?

Q3

If we used yellow paint instead of turmeric, would it work the same way?

Q4

When the paper dries again, would the drawing still be visible?

The science background for teachers

What is actually happening?



Baking soda is a BASE

When it dries on paper, it leaves an invisible residue white on white, which is impossible to see.



Turmeric contains CURCUMIN

Curcumin is a natural pH indicator. It changes from yellow to red-orange when it meets a base.



The REACTION

Curcumin reacts to the basic pH of dried baking soda turning orange-red and revealing the drawing. Alcohol carries the turmeric pigment evenly across the paper for a smoother colour change than water alone.

All drawing materials come from two sources: natural (charcoal, graphite, chalk, plant dyes) or man-made (crayons from paraffin wax, marker ink from synthetic pigments).

Natural materials are eco-friendly and biodegradable. Choosing them reduces our environmental impact.

Relevance to real life: What to tell children?



Now you know how to share your secret messages with your friends,
while learning something new about different natural products.

EXTENSIONS



Try other invisible inks

Lemon juice, milk, apple juice or sweet water. Reveal with heat from an iron.

pH indicator activity

Introduce natural pH indicators using red cabbage juice. Test acids vs bases.



Natural dye exploration

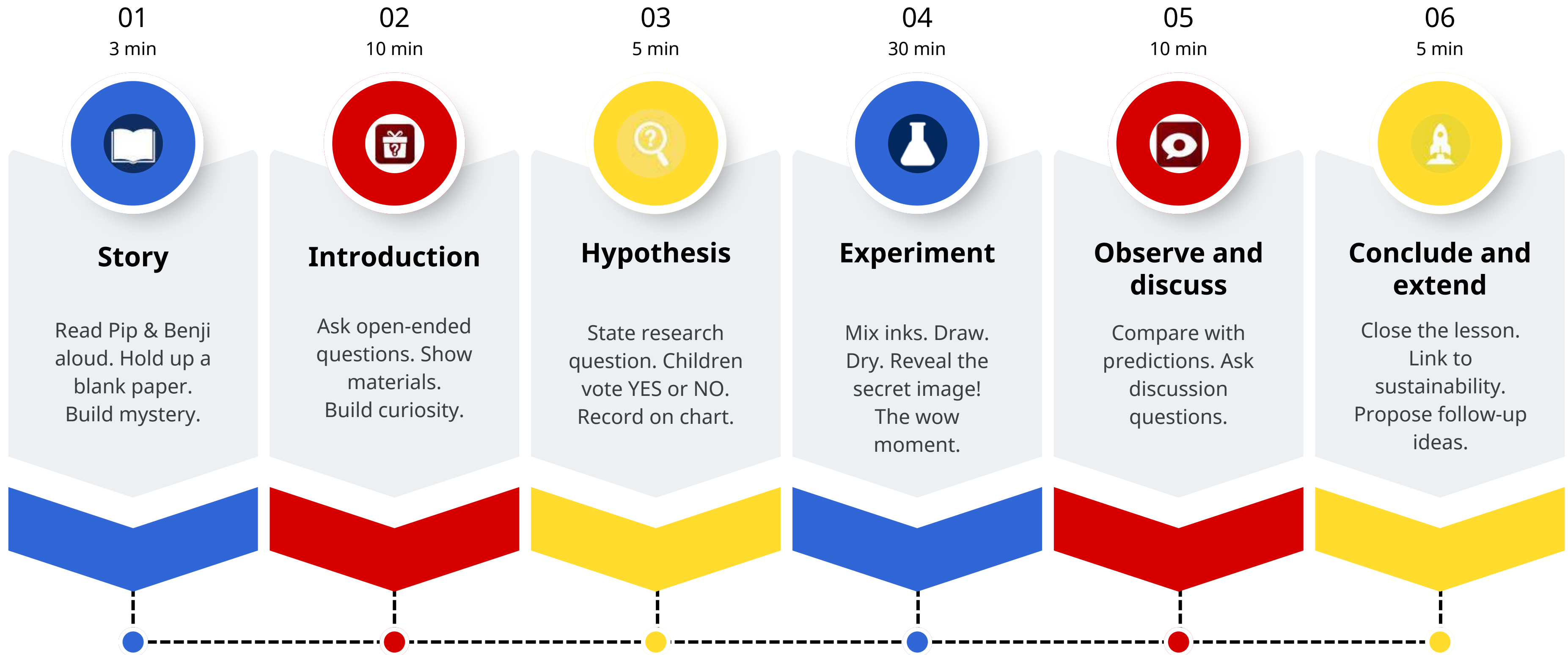
Make natural red colour by mixing baking soda, alcohol and turmeric.

Art connection

Create a class secret-message gallery — children reveal each other's drawings



EXPERIMENT SUMMARY





You are ready to teach!

Remember: Questions guide the learning, not answers.



I have watched the video tutorial.



I have tried the experiment myself before teaching it.



I have prepared materials for children.



I have planned my open-ended questions for each phase.



I have considered safety issues.



Create a short story introduction for an experiment.

A scientist who lost a secret message ...

Quiz

A child's hypothesis turns out to be WRONG after the experiment. What should the educator do?

A

Tell the child the right answer immediately so they learn quickly.

B

Skip this child's result to avoid confusion for the group.

C

Celebrate it! A wrong prediction is useful scientific data and a learning opportunity.

D

Redo the experiment until the child gets the right answer.

Work in triads

With your colleagues.

01

A child says:

"My rocket didn't fly. I did it wrong."

Discuss:

- What would you say?
- Which response encourages scientific thinking?

02

A child asks:

"Why can't we just pour soap into the ocean to clean oil spills?"

Discuss:

- How would you guide children's thinking without giving the answer immediately?

Discover experiment

Diaper absorbent

Children discover what it is in the diaper that makes it absorb liquid so well and explore where the absorbents can be used towards sustainable goals in food production and agriculture.

Handbook, page 67



Work in triads with your colleague

Diaper absorbent

How would you adapt this experiment for:

- 3 year olds?
- 5 to 6 year olds?
- children with limited language skills?
- mixed age groups?

Handbook, page 67



Work in triads

What would you do?

01

The experiment doesn't work.

02

Children get different results.

03

A child gives a scientifically incorrect explanation.

04

Children lose interest halfway through.

SQAT PLAN

Complete these
sentences:

S

START

One thing I will start
doing is...



QUESTION

Q

One question I will
ask more often is...



T

TRY

The first Superhero
lab experiment I will
try is...



One habit I want to
change in my practice
is...

ADAPT

A

My first Superhero lab experiment

Reflection

Wish

What experiment would you like to try with your children in the next two weeks?

- Why did you choose this experiment?
- What do you hope your children will experience?

Outcomes

Imagine your experiment goes really well.

- What will children be doing?
- What will you be doing differently as a facilitator?
- How will you know the lesson was successful?
- What will you feel at the end of the activity?

Obstacles

- What might prevent you from carrying out this experiment?
- Which obstacle is most likely?

Plan

- If that obstacle happens, what will you do?

The Superhero Lab: Engaging Children as Scientists to Explore Sustainability

DAY 2

Accompanied by a pedagogical handbook and instructional videos.



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Agenda

Day 2



Discovering more Superhero lab experiments



Developing inquiry skills



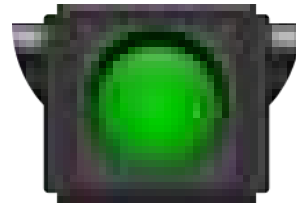
Creating engaging age appropriate science experiences



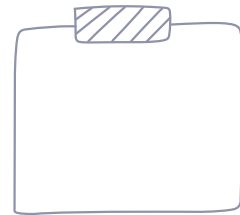
Designing your own Superhero lab experiment

Welcome

Icebreaker



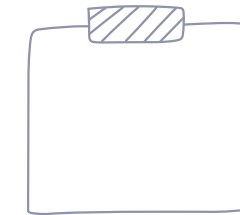
I feel confident
about...



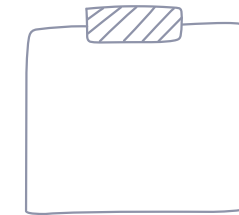
Each participant writes their ideas on sticky notes and places them on the board.



I need more
practice with...



I still need
support with...



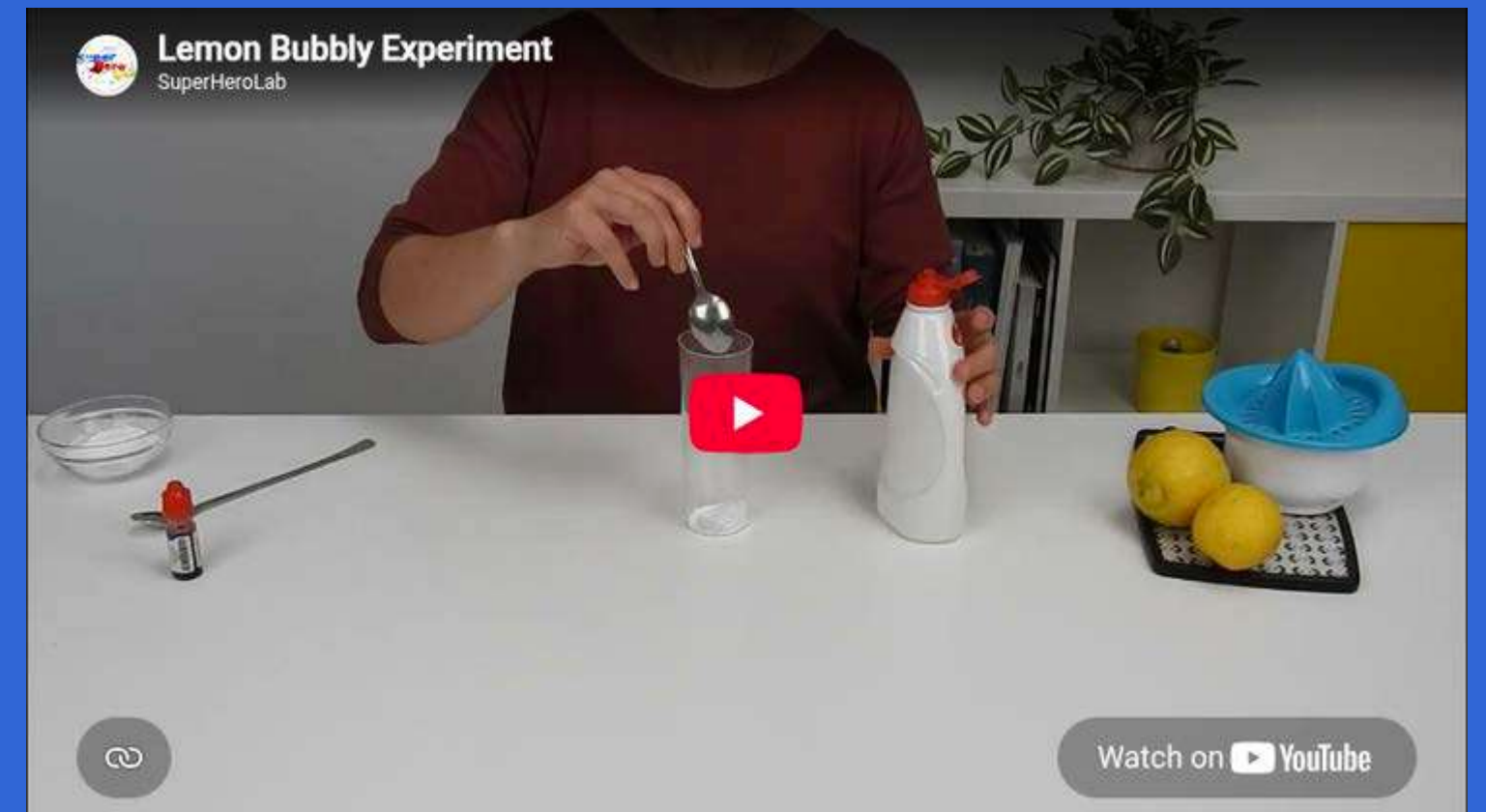
Discover experiment

Lemon bubbly experiment

In this experiment, children mix lemon juice with baking soda to create a fizzy, bubbling reaction.

They explore how mixing substances can cause a chemical reaction and produce new substances, while discovering different ways to use everyday materials.

Handbook, page 58



Reflection

1. Individual
2. Share with colleagues

01

How could this experiment support children's development in MY learning environment?

02

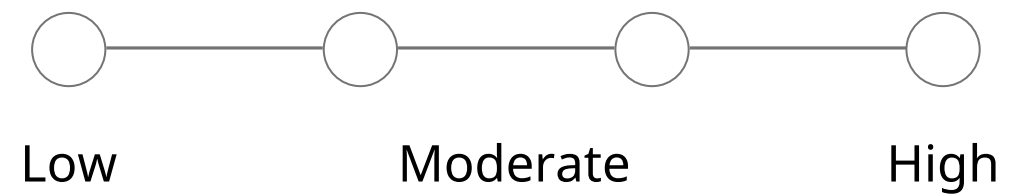
When could I use this experiment with the children?

03

Adaptations needed:

04

My confidence in using this experiment is:



Discover experiment

Paper rocket

In this experiment, children build and launch their own paper rockets, learning how air can push objects to move. By blowing through a straw, they create a simple force that propels the rocket into the air.

Children observe how design elements, like fins, affect flight.

Handbook, page 34



Reflection

1. Individual
2. Share with colleagues

01

How could this experiment support children's development in MY learning environment?

02

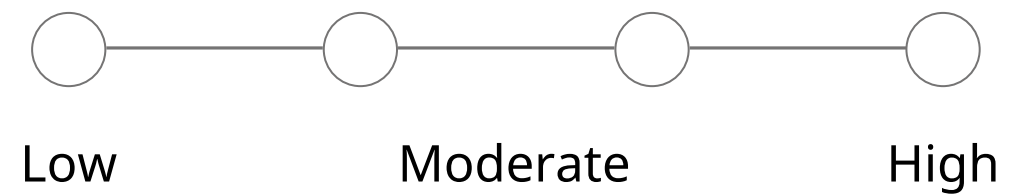
When could I use this experiment with the children?

03

Adaptations needed:

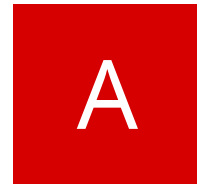
04

My confidence in using this experiment is:

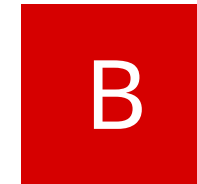


Quiz

Which question encourages inquiry?



What do you notice about its colour?



What colour is it?

Quiz

Which question encourages inquiry?

A

Why do you think it floated?

B

Did it float?

Quiz

Which question
encourages inquiry?

A

Is it clean?

B

How could we
find out if it is
clean?

Quiz

Which question encourages inquiry?

A

Will the paper change colour?

B

What do you think will happen when we add the turmeric solution?

Quiz

Rewrite each closed question as an inquiry question that encourages children to observe, predict, explain, investigate, or reflect.

A

Did the rocket fly?

B

Is the daisy open?

C

Is that possible?

D

Will the flower close?

E

Is baking soda a solid?

Inquiry questions

Mark the purpose of each inquiry question

Question					
What happened when we mixed the ingredients?	Observe	Predict	Explain	Test an idea	Reflect
Which material do you think will absorb the most water? Why?	Observe	Predict	Explain	Test an idea	Reflect
How did today's result compare with your prediction?	Observe	Predict	Explain	Test an idea	Reflect
Why do you think this material absorbed more water?	Observe	Predict	Explain	Test an idea	Reflect
What do you notice about the water?	Observe	Predict	Explain	Test an idea	Reflect
How could we find out if it is clean?	Observe	Predict	Explain	Test an idea	Reflect
What do you notice about the oil in the water?	Observe	Predict	Explain	Test an idea	Reflect

In triads,
write a story
introduction
for one
experiment.

Fabric detectives
Sow bugs
Solar pizza oven

1

A character

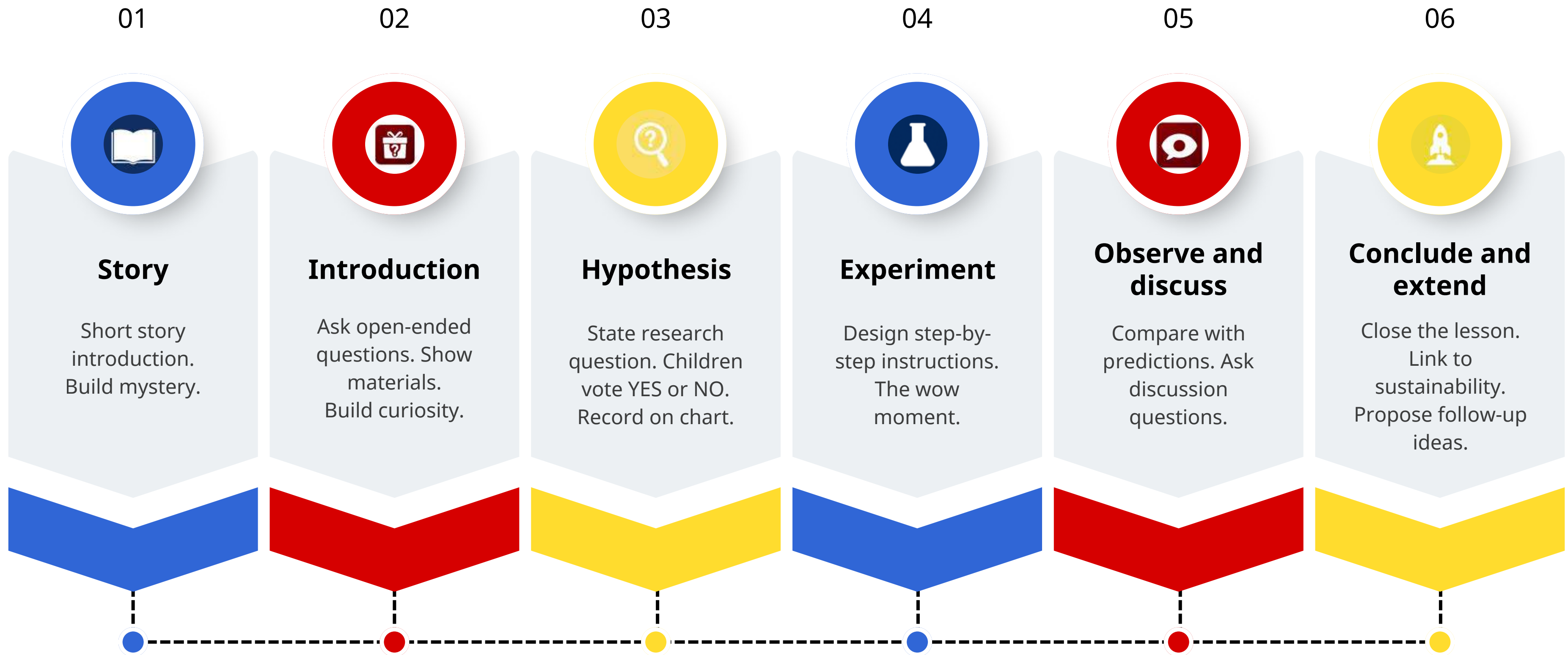
2

A problem

3

A question that
ends with: Can
you help?

DESIGN YOUR OWN SUPERHERO LAB EXPERIMENT



Resources

Working in groups of 3 to 4, design a new Superhero lab experiment using everyday materials.

- 1. Use the websites provided for inspiration, but make the experiment your own.
- 2. Use the Superhero lab methodology.

Source	Link	QR code
Home science tools	https://learning-center.homesciencetools.com/science-projects	
We are teachers	https://www.weareteachers.com/easy-science-experiments	
Experiment archive	https://experimentarchive.com	
Teach engineering	https://www.teachengineering.org	
Science buddies	https://www.sciencebuddies.org	

Superhero lab plan

Topics:

Age range:

Duration:

Class
organization:

Overview



Summary and learning objectives

Materials needed



Simple, safe, affordable, and easily accessible materials that educators can find at home, in the kindergarten, or in nature

Curriculum



Curriculum alignment and GreenComp connection

Introduction



Story and inquiry questions

Research question and hypothesis



Research questions encourage investigation, while hypotheses invite children to predict what they think will happen

Real-life connection



Connect the experiment to children's everyday experiences and sustainability

Step-by-step instructions



Describe each step of the investigation, ensuring every child has an opportunity to explore, observe, and participate

Observation and discussion



Encourage children to observe carefully, compare results, and share their ideas using evidence

Science background



Explain the scientific concept in simple, age appropriate language after the investigation



Checklist

Before presenting, ask yourselves:



Is every child actively involved?



Does the experiment begin with curiosity?



Will children make predictions?



Are children discovering rather than following instructions?



Does the activity help children understand a sustainability concept?

After this training, my Superhero lab superpower is...





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www.superherolab.eu



Suggested training agenda

Notes for the trainers

This is a **blended learning course**, combining face to face training with a pedagogical handbook and instructional videos available on the [Superhero lab YouTube](#) channel.

The agenda and timings provided in are suggestions only.

Trainers are encouraged to adapt the structure, sequence of activities, timing, and content to best suit their training context, participants' prior knowledge and experience, available time, and learning needs.

The aim is to provide a flexible framework that supports active learning while allowing trainers to select, modify, or extend activities to create the most meaningful learning experience for their participants.



Suggested training agenda

DAY 1
8 pedagogical hours

Activity	Time
Welcome, introduction, learning objectives, agenda, Superhero lab resources	20 min
Icebreakers (Bingo + From telling to facilitating)	30 min
Superhero lab methodology, curriculum, GreenComp, pedagogical approaches, 5 step inquiry model	40 min
Video analysis (Oil spill)	25 min
Invisible Ink experiment (story, inquiry, hypothesis, hands on experiment, reveal)	90 min
Quiz, observation, science background, sustainability, extensions	35 min
Experiment summary and teacher preparation	15 min
Story hook workshop	20 min
Quiz: Children's hypotheses	10 min
Classroom scenarios (triads)	20 min
Diaper absorbent experiment and differentiation activity	25 min
"What would you do?" case studies	15 min
SQAT reflection	10 min
WOOP action plan	15 min



Suggested training agenda

DAY 2

8 pedagogical hours

Activity	Time
Welcome back, reflection, confidence check	25 min
Lemon bubbly experiment and reflection	40 min
Paper rocket experiment and reflection	40 min
Inquiry questions activity (quizzes and identifying question purpose)	50 min
Story hook design activity	30 min
Design a research question and hypothesis	20 min
Design step by step instructions	20 min
Design the remaining lesson plan (science, sustainability, differentiation, safety)	30 min
Design your own Superhero lab experiment (group work using websites)	75 min
Group presentations, feedback and course evaluation	30 min



About the Superhero lab

Erasmus+ partnership

Ref. number:

2023-1-DE03-KA220-SCH-000151314



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Engaging children as scientists to explore sustainability

The Superhero Lab Project is an Erasmus+ partnership that brings together dedicated organizations from Lithuania, Sweden, Germany, Austria, Slovenia, and Greece. United by a commitment to sustainability education, these partners believe that children learn best about sustainability through hands-on activities, which allow for meaningful exploration and personal engagement with the topic.

However, fostering sustainability isn't just about children; it also requires that we support teachers with resources and opportunities to explore sustainability education. Under the Superhero lab framework, we've created a range of materials and learning experiences to empower teachers alongside their young students.

Partners:

- Die Brücke, kindergarten teacher training organization from Germany;
- Primera - Zentrum für pädagogische Fortbildung Wien, teacher training association from Austria;
- GoINNO, developer of STEM activities for educators from Slovenia;
- K&R Education, teacher training organization from Sweden;
- E-School, accredited VET provider from Greece;
- Šiauliai, local government from Lithuania;
- Žiedelis, kindergarten from Lithuania.

Associated kindergartens: Zwergenland (Germany), Schmetterling (Austria), Solkan (Slovenia), The 21st Kindergarten of Larissa (Greece), Kindergarten of Stefanovouno (Greece), Rockaden Landskrona (Sweden).