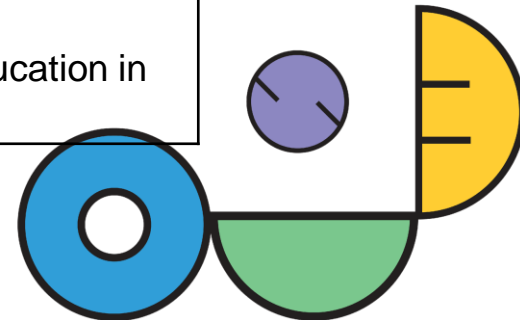
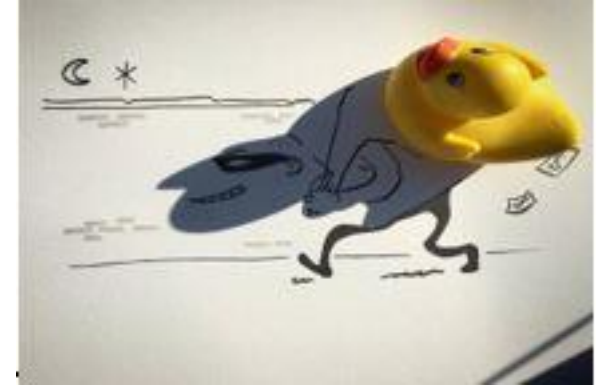


# STEAM activity: Shadow art

Description of the activity:	Hands on activity on Shadow art, as an example on how the process of inquiry and the design process are integrated.
Target group(s):	Primary teachers
Keywords:	Underlying principles, models, template STEAM activity
Duration of activity:	90'
Description of activity environment and materials needed:	Reading through this powerpoint provides tools to carry out a real STEAM activity with your pupils in primary school. It also shows you the underlying principles and models on integrated STEAM education in order to reflect upon the activity.



# Shadow Art



## Materials needed:

Pictures of artwork

Per group:

- 1 torch
- 5 tin cans
- cardboard
- 1 white sheet of paper (A3) / white wall
- 1 pencil
- 1 ruler

An example of a STEAM activity for primary education

Students discover how shadows are formed. They create an artwork with shadows and recyclable materials. They draw a floor plan of their artwork.

## Problems to be tackled:

- How can we create a shadow?  
What do we need to obtain a clear shadow?
- How can we make the shadow smaller/bigger?  
Which variables should we change to obtain a bigger/smaller shadow?
- How can we create an artwork (skyline) that matches all criteria?
- How can we draw a three-dimensional setup in two dimensions (floor plan)?



# Engage

- What do you see on the pictures?
- Which materials did the artist use to create the artwork?
- How are the artworks created?





# Investigate

## Challenge 1

- a) Create the same shadows by using the given materials:  
torch, 3 tin cans, white piece of paper/wall/...
- b) Sketch the setting of materials you have set up to form the shadows.
  - Sketch the setup from above (floor plan).
  - Sketch the setup from aside (profile).

For different setups, see:  
[www.stem4math.eu/shadow-art](http://www.stem4math.eu/shadow-art)



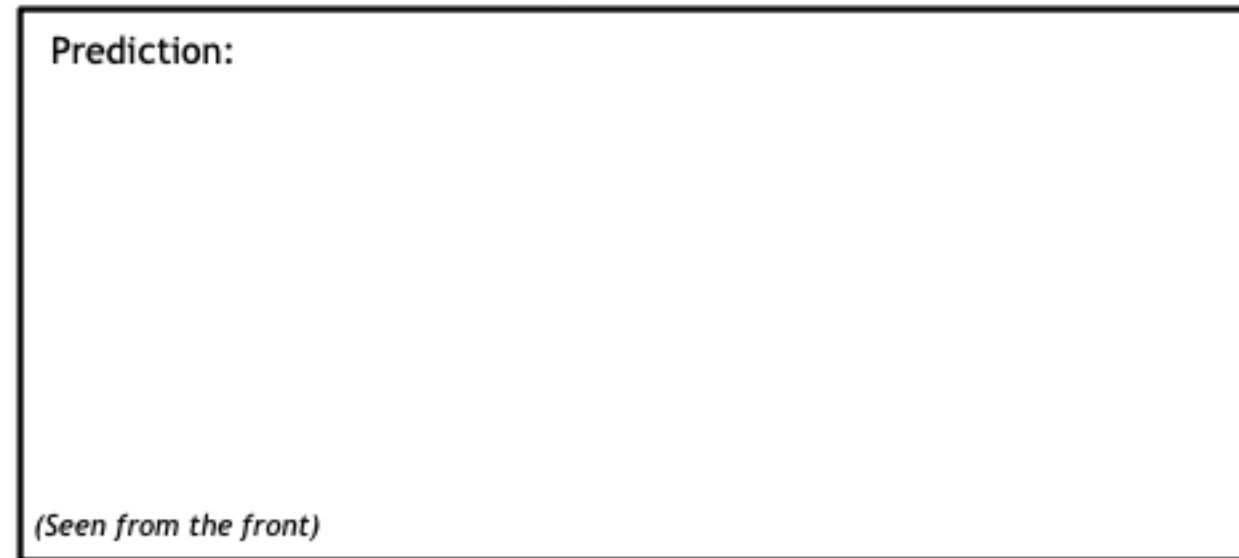
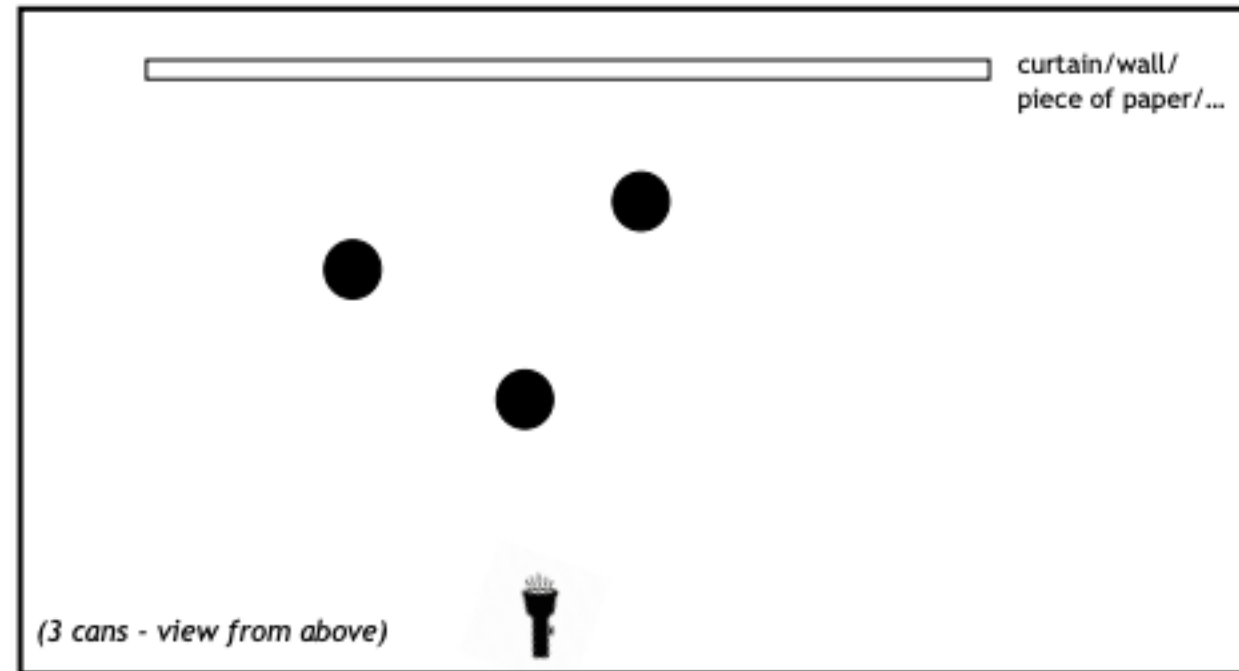


# Investigate

## Challenge 2

Look at the following setup:

- Predict how the shadow looks like when you would hold the torch.  
Sketch what you think you see as a shadow.
- Test if your prediction matches your observations.
- Does your prediction match your observations?



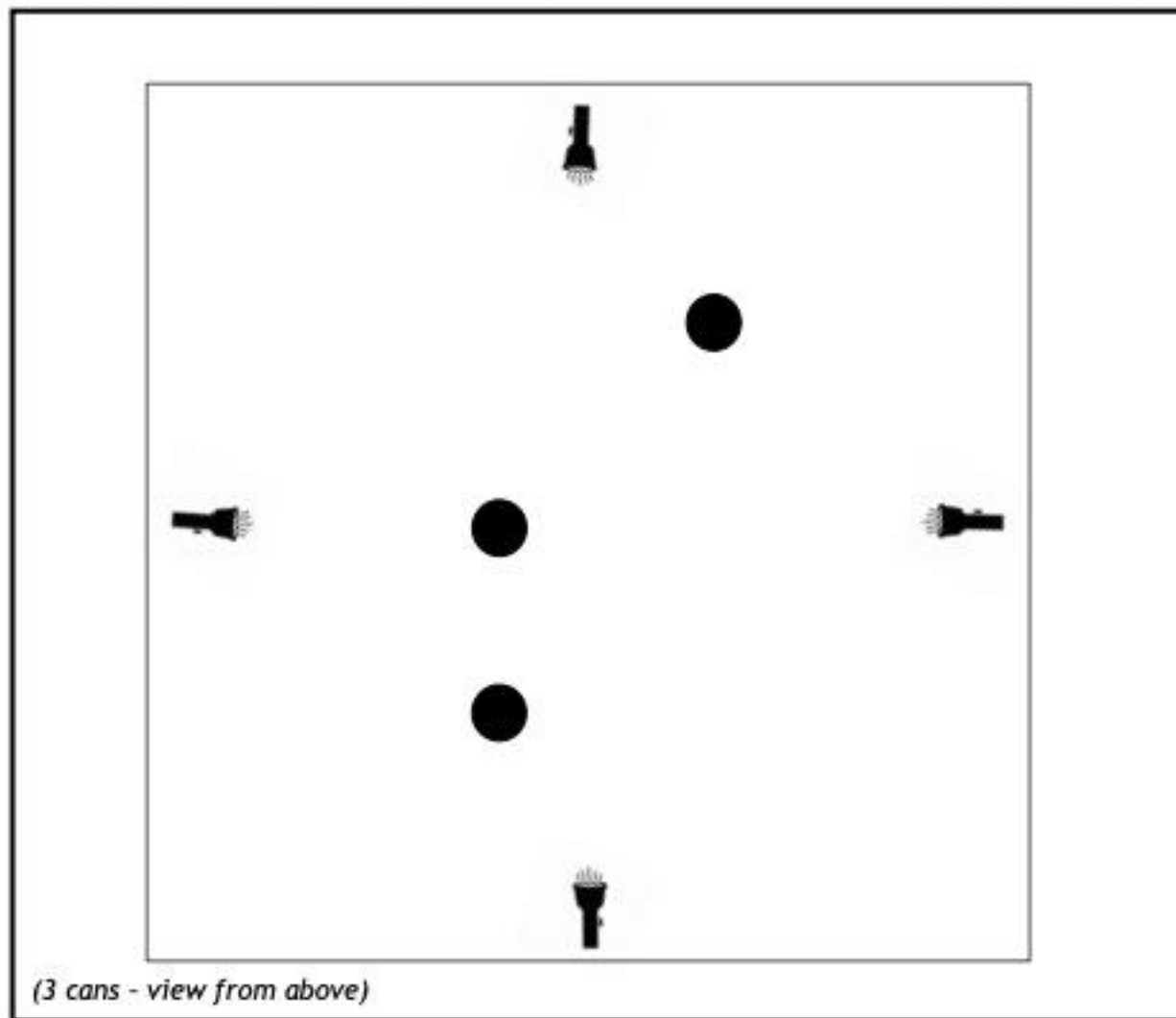


# Investigate

## Challenge 3

Look at the following setup:

- a) Draw a circle around the torch that you need to hold to see the given shadow.
- a) Test if your prediction matches your observations.
- a) Does your prediction match your observations?





# Investigate

## Challenge 4

Look at the following setup:

- a) Predict how the shadow looks like when you would hold the torch.
- a) Sketch what you think you see as a shadow.
- a) Test if your prediction matches your observations.
- a) What kind of object do you see? .....



Prediction:

*(Seen from the front)*

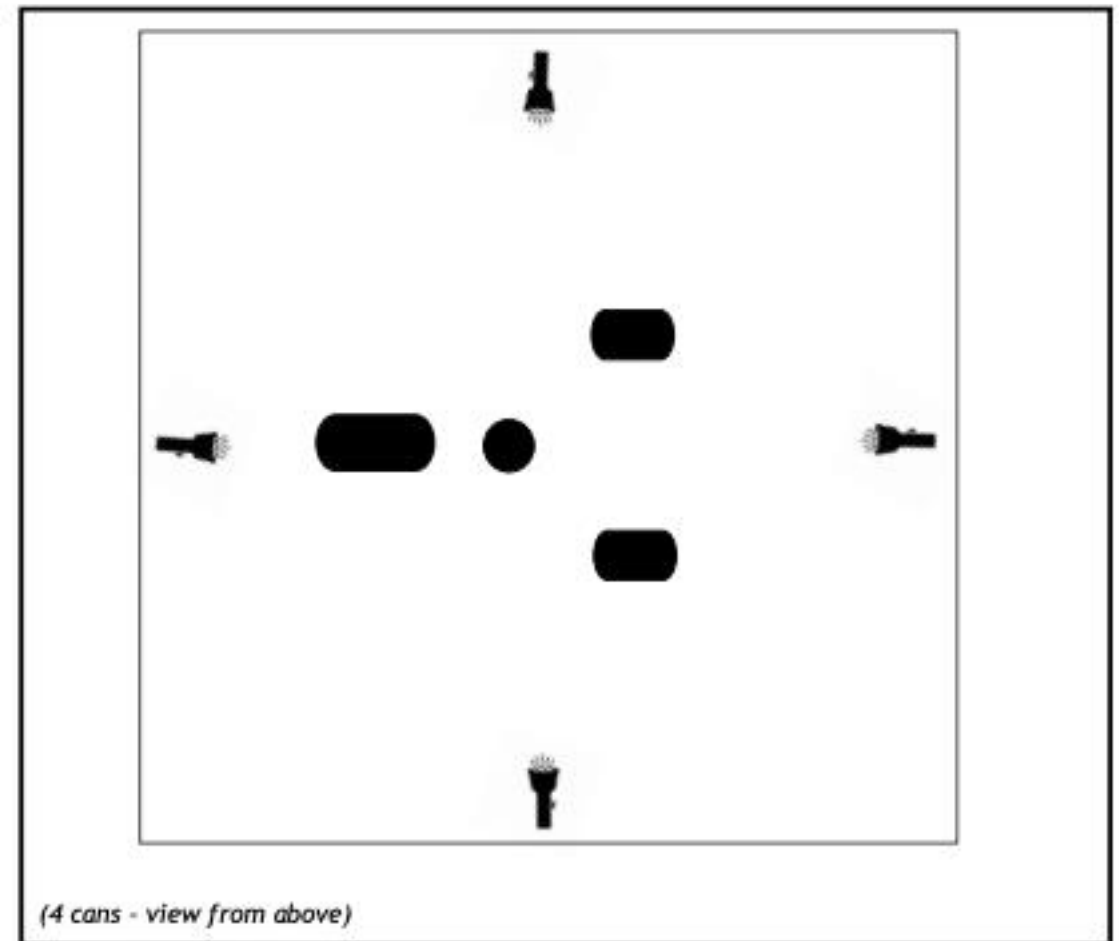


# Investigate

## Challenge 5

Look at the following setup:

- Draw a circle around the torch that you need to hold to see a given shadow.
- Test if your prediction matches your observations.







## Conclude

How did you create the shadows during the investigation?

Where did you pay attention to concerning:

- The torch:
  
- The tin cans:

How does the distance from object to torch affect the size of the shadow?

How does the position of the torch affect the shape of the shadow?



## Create

Do you now know how to create a shadow? How to make it smaller? Bigger?

Then it is now time to create your own piece of art!

Take a close look at the following artwork

### **Create your own skyline**

by using only 5 tin cans and some materials you can find around you.

The skyline should meet the following criteria:

- At least 5 buildings
- At least 1 sloping roof
- At least 1 building with one or more windows
- At least 1 antenna or chimney
- One building must be 2 times as high as another building
- One building must have a height of  $\frac{3}{4}$  the height of another building





## Plan

Sketch the floor plan of the skyline you will create:

curtain/wall/  
piece of paper/...

A large, empty rectangular box with a black border, intended for sketching a floor plan. A horizontal line is drawn near the top left corner of the box, extending across most of its width. The text 'curtain/wall/piece of paper/...' is positioned to the right of this line.



## Investigate

Check if your skyline matches the criteria!  
Are you happy with the result? Why or why not?  
Explain to each other!



## Plan

Think together about how you can improve the skyline!  
Are there elements you can add to your skyline (e.g. Bridge, church, mosque,...)?



## Create

Finalize your skyline so you have created a real piece of art!  
Can you think of a name for your city?  
Why did you choose this name?



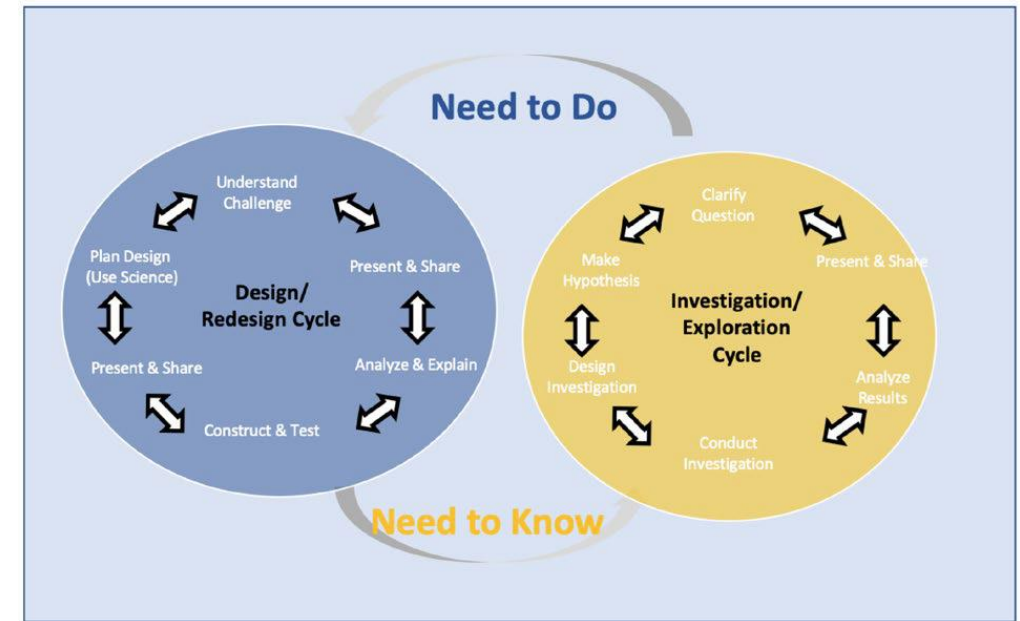
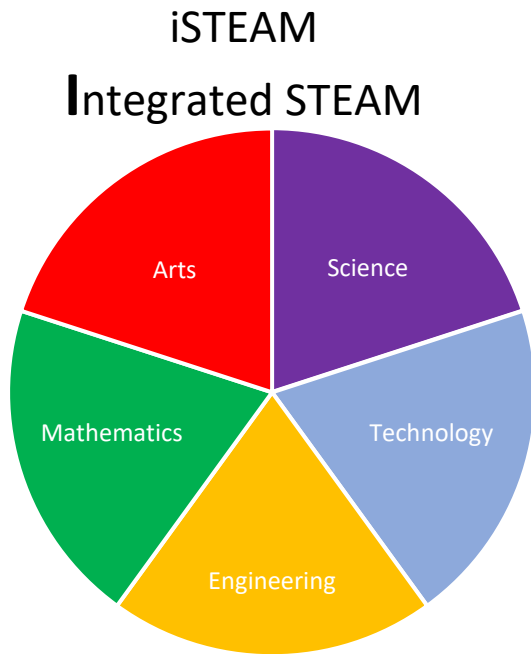
## Report

Draw a floor plan so that your skyline  
can be rebuilt at another place,  
at another time, ...  
Be very precise. You will have to measure!

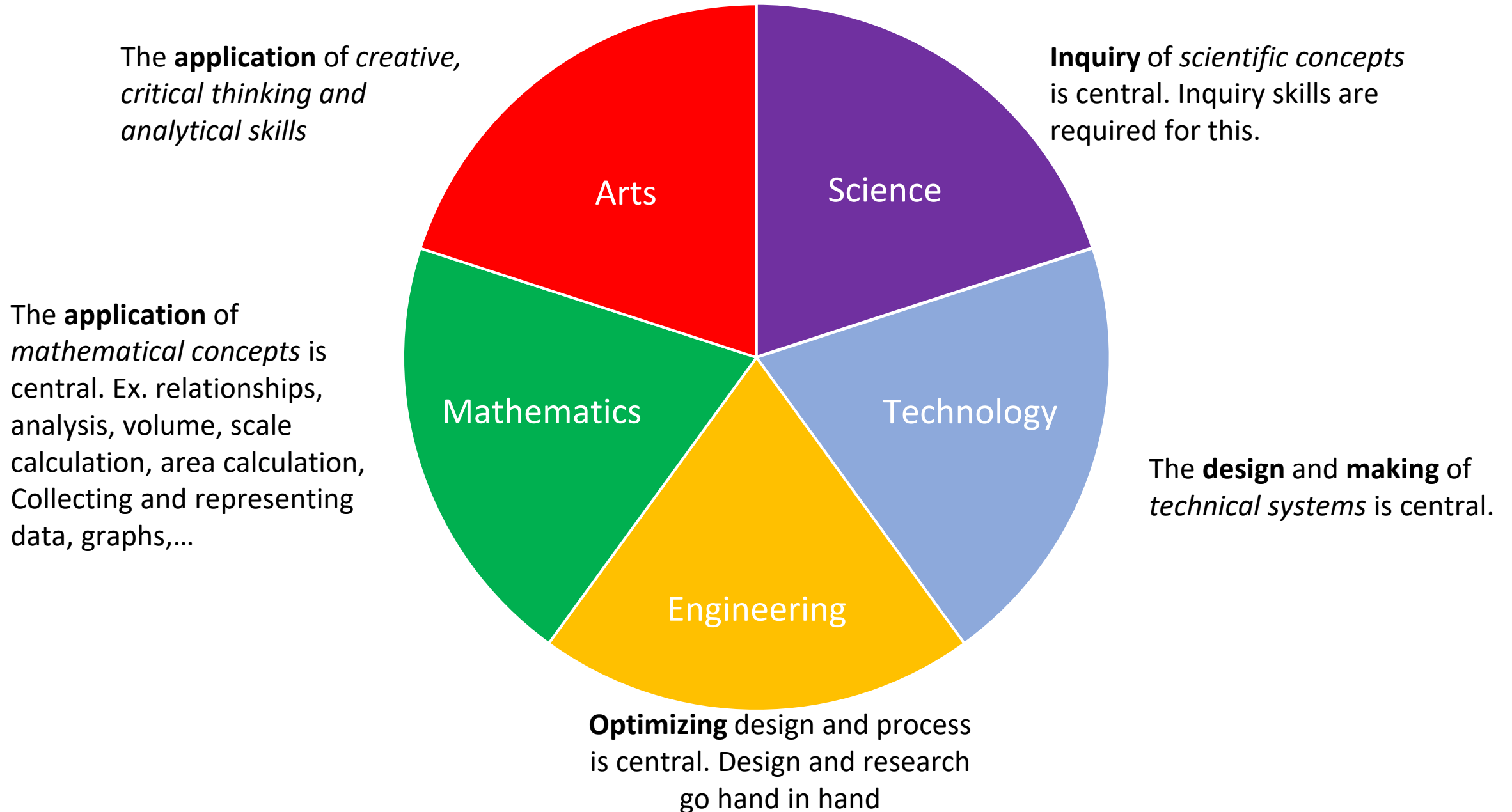
Write the scale you use to make your plan

curtain/wall/  
piece of paper/...

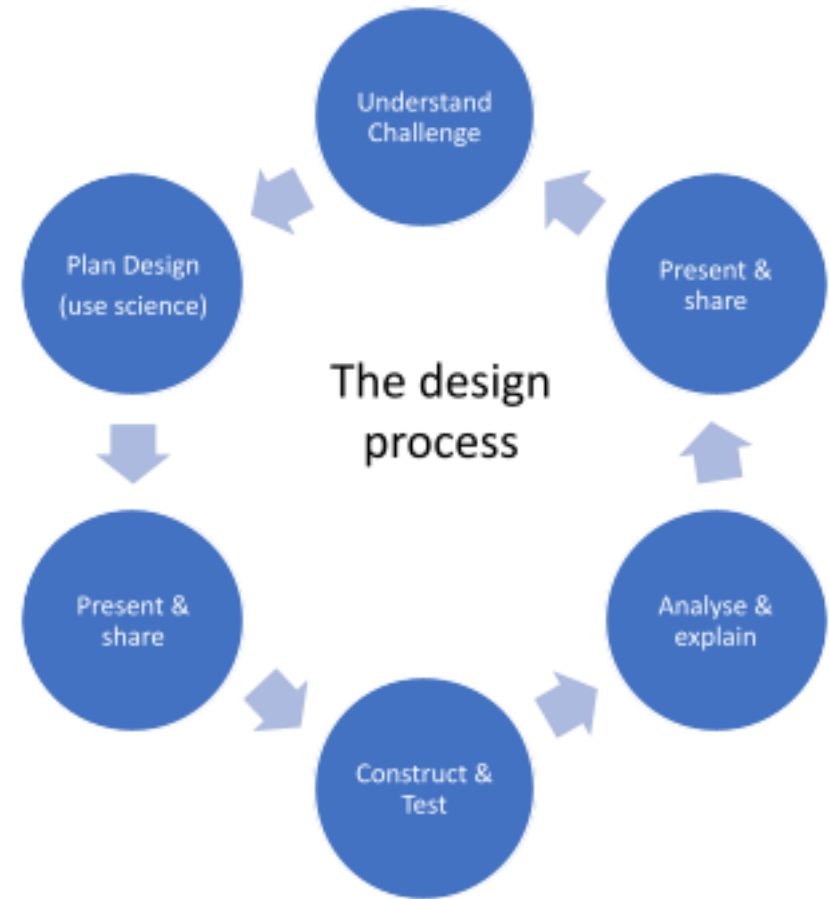
# Underlying principles, models



# Underlying principles, models: *ISTEAM*



# Underlying principles, models: *ISTEAM*





# Underlying principles, models: *ISTEAM*



Kolodner et al. (2003); Vossen (2019)

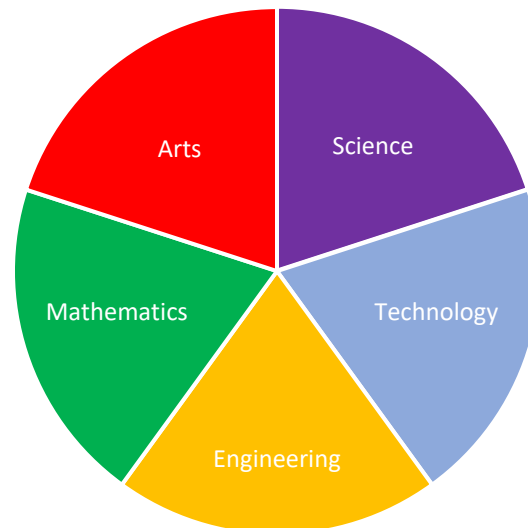
# Reflection

First, discuss the following questions:

1. What have you learnt during the activity?
2. Did you use mathematics? When? Examples?
3. What did you do very well? Why?
4. What went wrong? Why?
5. What will you do differently next time?

# Reflection

- Did you recognize elements of the different STEAM disciplines? Where did you use elements of 'science', 'technology', 'engineering', 'mathematics', 'arts'?
  - Use the *iSTEAM model* to formulate your answer and use terms such as 'inquiry', 'design', 'make', 'optimize', 'apply', 'create' ...



# Reflection

- Did you apply elements of the inquiry cycle and design cycle? Use the model below to explain

