AirFab

Basic

Stimulate problem solving	Bronze		**Stimulate entrepreneurship**	Bronze
Stimulate creativity	Bronze		**Informal learning enviro.**	Bronze
Stimulate critical thinking	Bronze		**Technology use**	Bronze
Stimulate group work	Bronze			

Practicalities

Preparation: < 1 h

Duration: 50'

Material needs:
- Cardboard
- Paper cups
- Paper
- Wood (small)
- tooth picks
- rope
- 3D-printer or plastic cups
- Tape
- Scissors
- Paper clips
- Cotton buds
- Marbles
- Small rocks
- Elastic bands
- Glue gun
- Plastic bags
- Staples
- Stapler
- Glue sticks
- Etc.

Group size range: maximum 2
Ideal sub-group size: 1 (individual)

Workshop made for: -12/12-16 years old
Easily transferable to workshops for ages between: +16

Environment FabLab necessary: no, but you'll need an AirFab (a vertical wind tunnel, which can be made in a fablab, makerspace or science center)

Educational area:
* Engineering
* Science
* Technology
* (Visual) Arts

Precognition

The participants do not need to know anything about hot air balloons and immediately start with all the available material.

(see box 'content links' below)

Preparation

Let people work individually (ideally) or create groups of maximum 2 participants.

Set up a work station per person or install a material area where all the material is situated.

Workshop Guidelines

Phase 1: Orientation and instruction phase

Material needs:
Essential: Essential: tinkering material to build a hot air balloon: plastic or paper cups, plastic or paper bags, small sticks, rope, staples, stapler, glue, pair of scissors, glue sticks, glue gun
Optional: small tinkering material

Goals:
Skill Goals (**Blue**)
(S1) working alone or working in pairs
(S2) collecting material
(S3) assembling material (later phase)
(S4) problem solving: solve the problems that arise (construction too light or too heavy)
(S5) social skills: waiting in line, collecting goods in an orderly manner
(S6) Self-regulation
(S7) Critical thinking
(S8) Creative thinking

Content Goals (**Green**)
(C1) Spatial insight
(C2) Insight in weight distribution
(C3) Research based learning
(C4) Insight in wind capture

Background story:

This workshop is based on following instructions, like following a recipe.

The students need to build a hot air balloon that floats upwards inside the AirFab and it has to float to the top side of the AirFab, without flying out of the AirFab.

Goals	Activities	Duration
S1-S8 C1-C4	Give the problem which students have to solve: *Build a hot air balloon that floats upward inside the AirFab. The balloon can't float outside the AirFab and it has to float in the top side of the AirFab.*	10'

		Give them the amount of time they have: usually 50', but you can lengthen or shorten this, but you need to communicate in order to let them plan. Show them the infrastructure they can use: guide them through the fablab/makerspace or show them what you have in your classroom or project room.	

Phase 2: Design phase

Material needs:
Essential: Essential: tinkering material to build a hot air balloon: plastic or paper cups, plastic or paper bags, small sticks, rope, staples, stapler, glue, pair of scissors, glue sticks, glue gun
Optional: small tinkering material

Goals:
Skill Goals (**Blue**)
(S1) working alone or working in pairs
(S2) collecting material
(S3) assembling material (later phase)
(S4) problem solving: solve the problems that arise (construction too light or too heavy)
(S5) social skills: waiting in line, collecting goods in an orderly manner
(S6) Self-regulation
(S7) Critical thinking
(S8) Creative thinking

Content Goals (**Green**)
(C1) Spatial insight
(C2) Insight in weight distribution
(C3) Research based learning
(C4) Insight in wind capture

Goals	Activities	Duration
S1-S8￼C1-C4	1. Checklist:￼ - Collect the following materials: plastic or paper bag, cup, 4 strings of rope, hole puncher	15'

Phase 3: Making phase

Material needs:
Essential: Essential: tinkering material to build a hot air balloon: plastic or paper cups, plastic or paper bags, small sticks, rope, staples, stapler, glue, pair of scissors, glue sticks, glue gun
Optional: small tinkering material

Goals:
Skill Goals (**Blue**)
(S1) working alone or working in pairs
(S2) collecting material
(S3) assembling material (later phase)
(S4) problem solving: solve the problems that arise (construction too light or too heavy)
(S5) social skills: waiting in line, collecting goods in an orderly manner
(S6) Self regulation
(S7) Critical thinking
(S8) Creative thinking

Content Goals (**Green**)
(C1) Spatial insight
(C2) Insight in weight distribution
(C3) Research based learning
(C4) Insight in wind capture

Goals	Activities	Duration
S1-S8 C1-C4	Assemble your contraption a. Adjust following materials: use the hole puncher to create 4 holes in the bag (at the edges, 4 wind directions) and in the cup (near the edge, 4 wind directions [e.g. 12h, 3h, 6h, 9h]). b. Cut the pieces of rope so they are even length c. Use the pieces of rope to connect the cup to the bag d. Your balloon is ready to be tested!	15'

Phase 4: Operational Phase

Material needs:
Essential: Essential: tinkering material to build a hot air balloon: plastic or paper cups, plastic or paper b
gun
Optional: small tinkering material

Goals:
Skill Goals (**Blue**)
(S1) working alone or working in pairs
(S2) collecting material
(S3) assembling material (later phase)
(S4) problem solving: solve the problems that arise (construction too light or too heavy)
(S5) social skills: waiting in line, collecting goods in an orderly manner
(S6) Self-regulation
(S7) Critical thinking
(S8) Creative thinking

Content Goals (**Green**)
(C1) Spatial insight
(C2) Insight in weight distribution
(C3) Research based learning
(C4) Insight in wind capture

Goals	Activities	Duration
S1-S8 C1-C4	Operational phases will take place in production and testing (feedback on designs): Does it work? What needs to be altered? How can we improve? What doesn't work? User check: Does the balloon fly up? When this is not the case, the space between the cup and the bag could be too small. Making this bigger could help. Does the balloon fly to high? You could make it heavier. Doesn't your balloon fly high enough? You could make it lighter or make the opening of the bag bigger.	5'

Phase 5: Evaluation phase

Goals:
Skill Goals (**Blue**)
(S1) working alone or working in pairs
(S2) collecting material
(S3) assembling material (later phase)
(S4) problem solving: solve the problems that arise (construction too light or too heavy)
(S5) social skills: waiting in line, collecting goods in an orderly manner
(S6) Self-regulation
(S7) Critical thinking
(S8) Creative thinking

Content Goals (**Green**)
(C1) *Spatial insight*
(C2) *Insight in weight distribution*
(C3) *Research based learning*
(C4) *Insight in wind capture*

Goals	Activities	Duration
S1-S8 C1-C4	Evaluation will take place every testing phase. If it doesn't work, it is adjusted. If it works, it's used. Completion: When your balloon flies you can personalise it: a. Customize your balloon so it isn't the same as everybody else (who followed this checklist). Examples: pimp your balloon with stickers, pimp your cup with fabric, tin foil, markers, etc.	5'
	Teacher and others are called when they want to show and tell → the contraption will be put in the AirFab	

	Pedagogical tips

Strive to make teams of 1: only allow pairs when someone drops out due to specific reasons.

Use a large room with an open path in between tables to put al the constructions. Avoid working on the ground – make workstations (tables for group work).

Visit a fablab or makerspace that has an AirFab or windtunnel. It's easier than building one yourself.

	How to transfer to non-Fablab environment

Build an AirFab yourself: you can use ventilator or inflator of the engine of a bouncy castle

	Evaluation of achievements

Every test-moment is an evaluation, but the final feedback round is the moment to gather the entire group and ask what they learned from each other during the research, the making and the testing + WHAT they altered and WHY.

Tips/background on material:

Picture of AirFab:

Video online of AirFab:

YouTube:
Instruction video: https://youtu.be/zbUhtCAbvic
https://youtu.be/LTDtj5UmbBM

Twitter:
https://twitter.com/janzondervrees/status/934864472203780097
https://twitter.com/janzondervrees/status/920734852978282498
https://twitter.com/janzondervrees/status/934864880951332866

Resources

Different versions (4 versions) of this workshop are available at: www.teachSTEM.eu/workshops

Student checklist:

Name: _____   **date:** _____

1. Build a hot air balloon that floats upward inside the AirFab.
   Problem The balloon can't float outside the AirFab and it has to float in the top side of the AirFab.

2. Amount of **time** you have (planning): _____

3. **Checklist:**
   Collect the following materials: plastic or paper bag, cup, 4 strings of rope, hole puncher

4. **Assemble**:
   a. Adjust following materials: use the hole puncher to create 4 holes in the bag (at the edges, 4 wind directions) and in the cup (near the edge, 4 wind directions [e.g. 12h, 3h, 6h, 9h]).

   b. Cut the pieces of rope so they are even length

   c. Use the pieces of rope to connect the cup to the bag

   d. Your balloon is ready to be tested!

5. **User check:**
   Does the balloon fly up? When this is not the case, the space between the cup and the bag could be too small. Making this bigger could help.
   Does the balloon fly too high? You could make it heavier.
   Doesn't your balloon fly high enough? You could make it lighter or make the opening of the bag bigger.

6. **Completion/creativity:**
   When your balloon flies you can personalise it: Customize your balloon so it isn't the same as everybody else (who followed this checklist). Examples: pimp your balloon with stickers, pimp your cup with fabric, tin foil, markers, etc.