

Nerdy Debry

Intermediate

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

Practicalities



Preparation: 1 h



Duration: 50'-100'



Material needs:

- Cardboard
- Thin wood to lasercut
- Lasercutter
- Paper
- Stickers
- Isomo or insulation foam
- Foamcutter
- 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
Easily transferable to workshops for ages between: +16



Environment FabLab necessary: no, if you have pre-lasercut boxes and a racetrack (parcours) available. You'll need a way to cut foam (foamcutters can be bought or made with wire and 9V batteries)



Educational area:

- * Engineering
- * Science
- * Technology
- * (Visual) Arts

Precognition

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

For an advanced approach, it helps if they know about gravity, mass, acceleration, friction and negative acceleration (slowing down).

(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 tinker 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 car: cardboard or wood, small sticks, rope, staples, stapler, glue, pair of scissors, glue sticks, glue gun, screws, screwdrivers
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 gravity, mass, acceleration and friction*



Background story:

This workshop is based on tinkering: problem solving while testing your device: adjust your design (trial and error) to gain success.

The students need to build a car that can reach the end of a pre-built race track. The car can't fall off the track and has to reach the end.

Goals	Activities	Duration
	<p>Give the problem which students have to solve: <i>Build a race arc that reaches the end of the race track</i></p> <p>Give them the amount of time they have: usually 50' (short) or 100' (intermediate), but you can lengthen or shorten this, but you need to communicate in order to let them plan.</p> <p>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.</p>	<p>10' (short) 20' (intermediate)</p>

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	You start tinkering with all the available material: collect and assemble material until you get a construction that resembles a race car.	15'-20' (short) 30'-40'

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	15’-20’ (short) 30’-40’ (intermediate)
	A car with weight in front will be easier to keep close to the track	

Phase 4: Operational 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	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? When the car doesn't get far enough or if it goes out of the track, adjust your design (= trial & error). This way of working is very associative and doesn't require any planning. This is the reason this method is very much liked by youngsters.	5' (short) 10' (intermediate)

Phase 5: Evaluation 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	Evaluation will take place every testing phase. If it doesn't work, it is adjusted. If it works, it's used. Completion: with tinkering you can still make your design unique, but most of the time you will have a piece unique. Your design can always be decorated.	
	Teacher and others are called when they want to show and tell → the contraption will be put to the test on the race track	5' (short) 10' (intermediate)



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 all the constructions. Avoid working on the ground – make workstations (tables for group work).

Visit a fablab or makerspace that has a Nerdy Derby. It's easier than building one yourself.



How to transfer to non-Fablab environment

Build a Nerdy Derby yourself: online inspiration:

<https://nerdyderby.com/resources-1#resources>

<http://www.frisdenker.nl/frisdenken/follow-up-on-the-nerdy-derby-story/>

<https://github.com/pkropf/nerdyderby>

<http://rasterweb.net/raster/2012/08/23/nerdy-derby/>

<https://peterkropf.com/archives/tag/nerdy-derby>

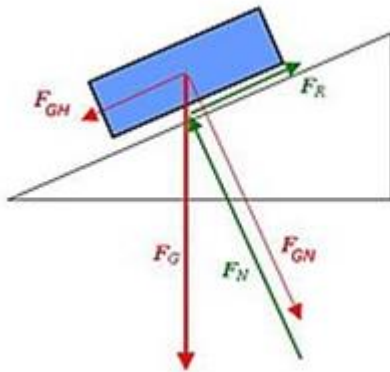
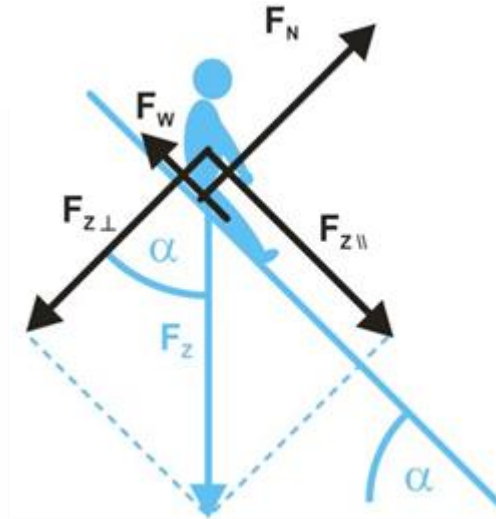
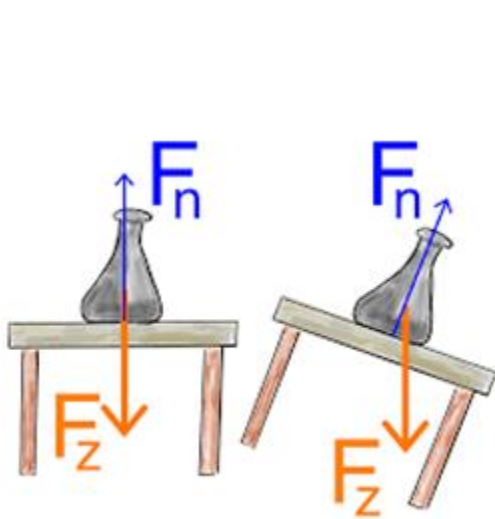


Evaluation of achievements

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:



De zwaartekracht (F_z) op een voorwerp is recht evenredig met de massa en de zwaartekrachtversnelling

$$F_z = m \cdot g$$

Zwaartekracht [N]

Massa



Wrijvingskrachten

De wrijvingskracht leidt zoals elke kracht tot een "versnelling".

Omdat de wrijvingskracht altijd in tegengestelde richting werkt als de beweging, leidt wrijving altijd tot

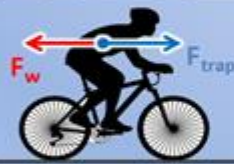
"negatieve versnelling" ofwel: vertraging.

Nettokracht



aandrijfkraft groter dan wrijvingskracht

De snelheid wordt groter.



aandrijfkraft gelijk aan wrijvingskracht

De snelheid blijft gelijk.

Dit kan bij elke snelheid, ook bij stilstaan!



aandrijfkraft kleiner dan wrijvingskracht

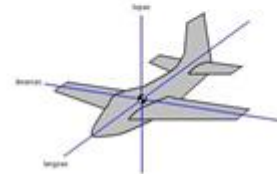
De snelheid neemt af.

© 2007 Puchner



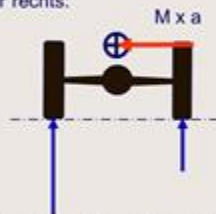
Zwaartepunt

Het zwaartepunt van een voorwerp is het punt waar de zwaartekracht aangrijpt. Dus waar je alle massa samengeklonterd mag denken.

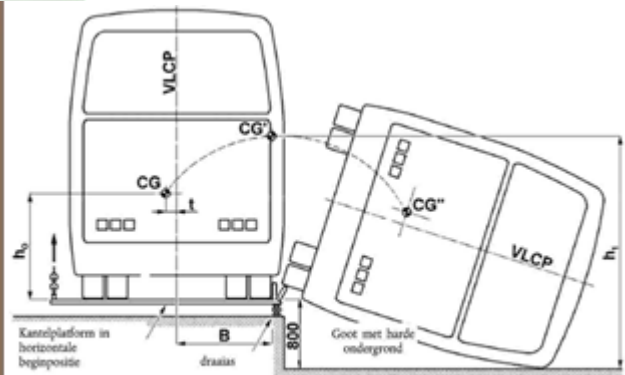


Invloed van het zwaartepunt

Bocht naar rechts:



Het buitenste wiel wordt zwaarder belast; het binnenste minder zwaar.



Schooling vs. Making

Traditional Schooling (as per current "reform" strategies)	Making
Teacher-centric	Student-centered
Instructionism	Constructionism
Overvalues learning with one's head	Learning with head, heart & hands equally valued
Race to the Top	Flow
My time	Our time
Standardized	Unique
Backward design	Serendipity
Teach to control, monitor & deliver content	Teach to liberate and amplify
Reproduce	Create
Differentiated instruction	Intimate learning
Raise achievement	Empower

inventtolearn.com

© 2014 Gary S. Stager

Friday, February 28, 14

Resources

STEM-education with design thinking:

https://youtu.be/YB_QhFFpLs

Different version (easier version) of this workshop also available on <http://www.teachstem.eu/workshops>