

# TEACHER MAKER CAMP

10 RECIPES  
TO HELP TEACHERS (RE)DISCOVER  
THEIR INNER-INVENTOR

GET SKILLED IN  
MAKER EDUCATION



## **TEACHER MAKER CAMP**

*10 recipes to help teachers (re)discover their inner-inventor and get skilled in maker education.*

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*waag.org*

**A BIG THANK YOU TO**

*All our participants!*

AND

*Sylvia Libow Martinez and Gary Stager, Kristina Andersen,  
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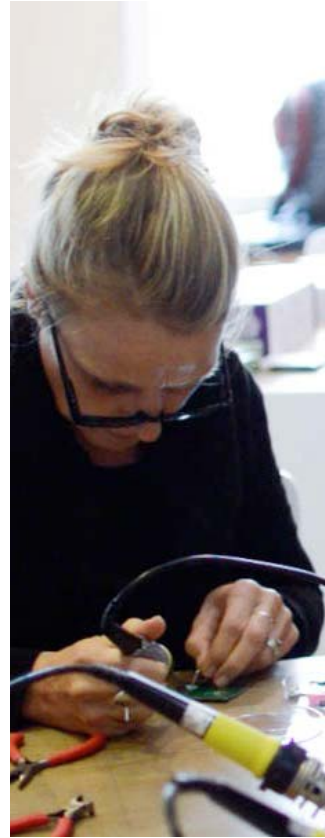
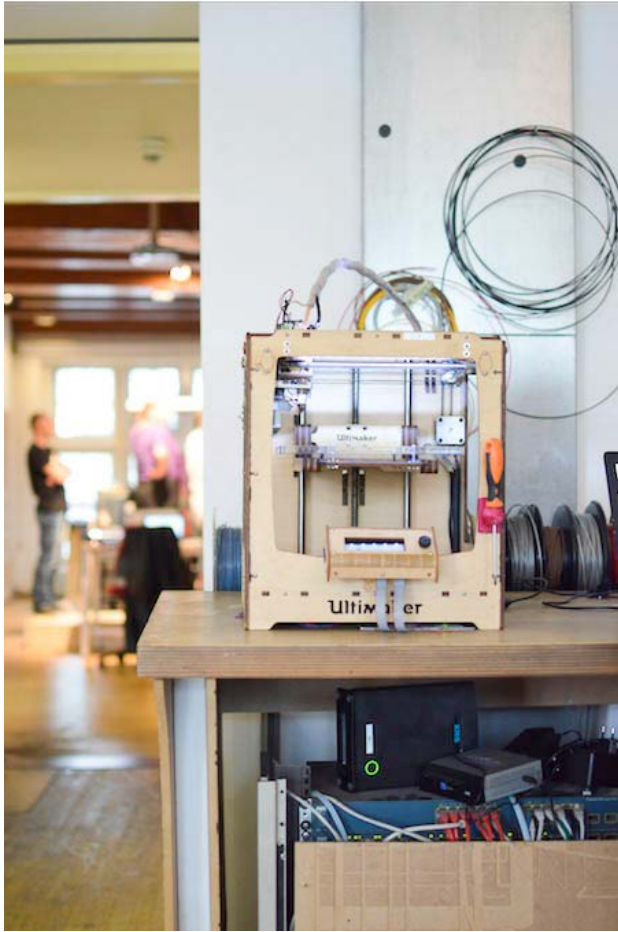
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***Can you remember  
the last time  
you challenged  
yourself to make  
something?***

***Do you remember  
what it was and  
what you learned  
from it?***

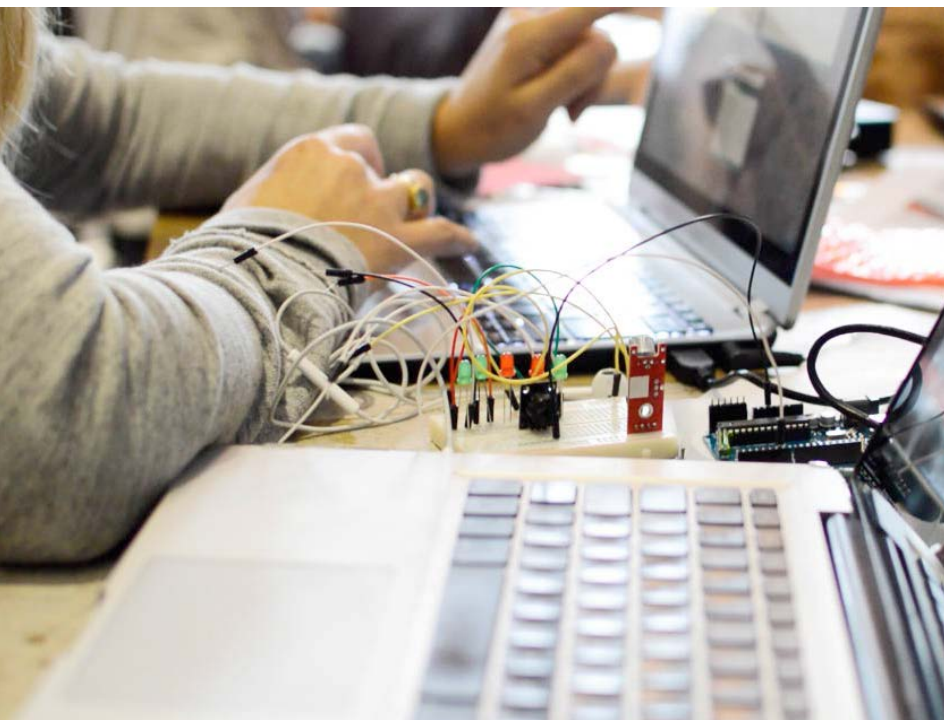
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PART.

1

**What you  
should  
know first**

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# Why we've made this book

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*By Karien Vermeulen*

*Head of Programme Creative Learning Lab, Waag Society.*

Creating makes our hearts beat. And, so does learning. At Waag Society, our mission is democratising technology and empowering people to use technology to shape and give meaning to their own living environment. Over the last few years, we have been running a variety of projects dedicated to enabling people to 'programme' technological developments themselves by focusing on design and creativity. In our FabLab (and through our digital literacy projects like FabSchool), we've gained a lot of experience in what makes making, the maker movement, and maker education so powerful and special.

We strongly believe that every child deserves the chance to become an inventor. Inevitably, this implies that teachers should enable that.

As Seymour Papert said: 'The role of the teacher is to create conditions for invention rather than to provide ready made knowledge'.

But if that is the case, is it not also true that every teacher deserves the same chance? Because if teachers don't experience making themselves, how can we possibly expect

them to guide their children in this process? And besides, just like many of us, teachers sometimes need some support to overcome their fears of both technology and of 'letting go' in the classroom.

Together with our partners, we asked ourselves the questions: can we turn teachers into makers? Can we transfer our passion for and experience with maker education to teachers? And, are we able to help teachers develop a maker mindset while they also hone their technical and creative skills?

We had the privilege of inviting Sylvia Libow Martinez, co-author of *Invent to Learn*, to come to the Netherlands so we could pick her brain about her and Gary Stager's experience with *Constructing Modern Knowledge*. They have been organizing a summer school on maker education for years now, which started with a group of about twenty teachers, and has evolved into a huge spectacle of over 250 participants.

Sylvia was kind enough to share the basic elements of their programme with us. She taught us that the main challenge is to help

teachers take of their ‘teacher-hat’ and to put on their ‘learner-hat’; to have them experience once again what it’s like to learn themselves.

As Sylvia puts it: ‘It is impossible to teach 21<sup>st</sup> century learners if you have not learned in this century’. She assured us that it all comes down to a great space, lots of materials and machines, inspiring speakers, and skilled and experienced faculty. And, perhaps most importantly, an ‘unprogramme’, which means providing enough time for participants to work on their own projects.

We quickly realised that we wanted to work with what we call ‘change makers’, passionate people who are not afraid to be pioneers. We also realised that intrinsic motivation flourishes when we let people work on their own ideas and projects, and that it was time to stop dreaming and start organizing our own maker camp here in the Netherlands. The initial building blocks of our Teacher Maker Camp were comprised of Sylvia’s tips, which we started to refer to as our ‘ingredients’. And, it was from this turn of phrase that the idea of documenting the lessons we learned using the analogy of a cookbook emerged.

THE MAKER MOVEMENT  
IS CHARACTERISED BY

DIY  
mentality

Hacking  
& inventing

MULTIDISCIPLINARY  
APPROACH

Reusing  
+ Recycling

open  
and  
SHARING

THINKING  
AND  
iterative design

MAKER EDUCATION ADDS  
TO THAT..

FOCUS ON PROCESS  
INSTEAD OF RESULT

LEARNING  
BY DOING

Discovery instead of lecturing

knowledge  
Constructive  
in stead of  
knowledge Transfer



## SO, WHAT ARE WE COOKING?

In this cookbook, we've collected our best recipes and secret ingredients for the organization of a Teacher Maker Camp. A Teacher Maker Camp is a sort of four-day pressure cooker for schooling teachers on maker education. Over these four days, we introduce a variety of teachers to the world of making and help them develop their 21<sup>st</sup> century skills. Regardless of their background or level of education (whether they're experienced or inexperienced), what these teachers have in common is that they are open to going on an adventure with us, are eager to learn, and want to make a change.

They use scrap and craft materials, 3D printers, digital fabrication, electronics, and programming tools from our FabLab both to bring their ideas to life and to rediscover their inner-inventor. But most of all, these teachers experience what it is like to step out of their comfort zone; to experiment and do things they have never done before; and to become a learner again. Back in the classroom, they are then able to share their newfound maker mindset with their students and enable them to learn by doing.



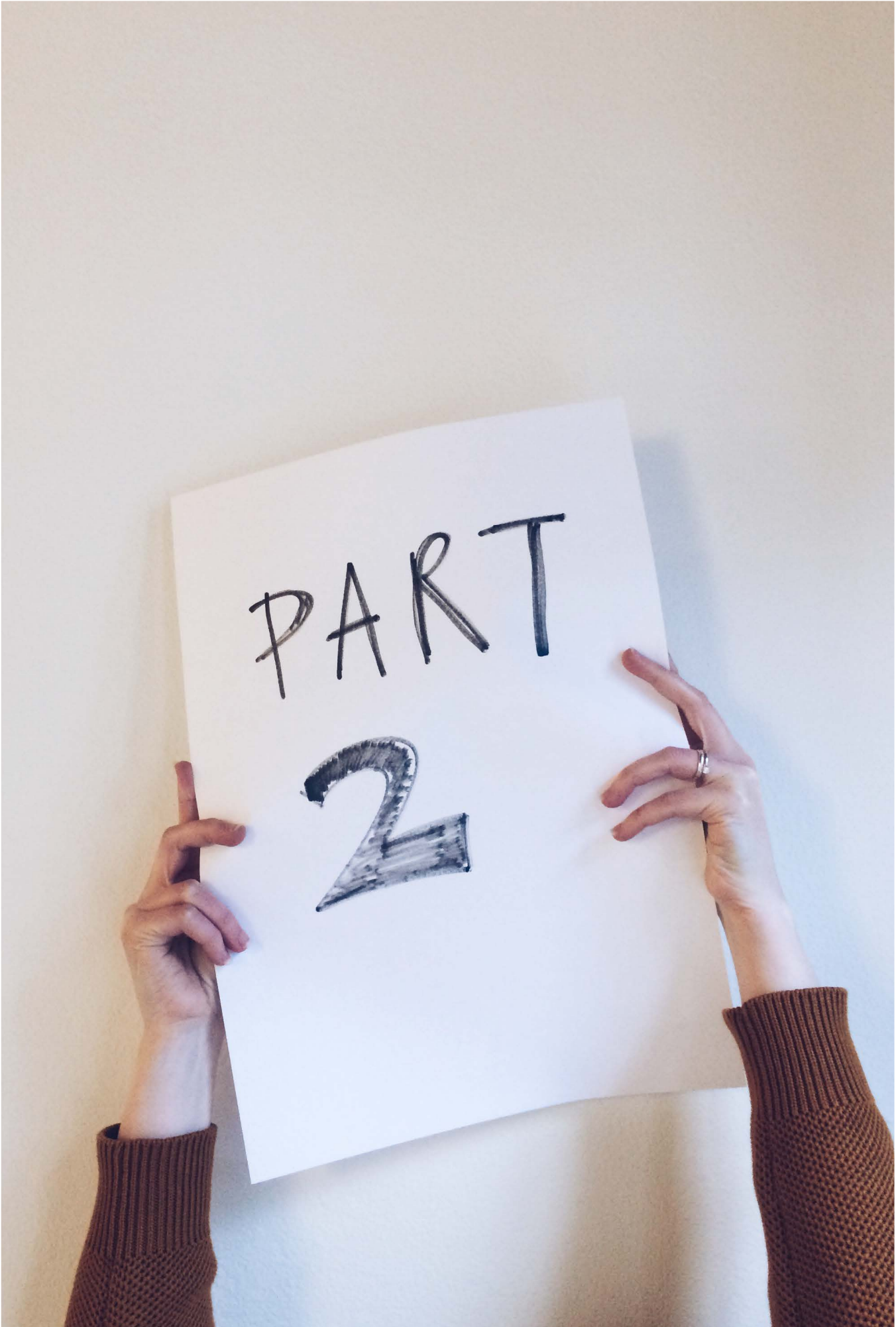
## WHY A COOKBOOK?

With the writing and distribution of this cookbook, we intend to transfer our experience with and knowledge about the organization and guidance of a Teacher Maker Camp. We aim to inspire others at FabLabs, maker spaces, and pioneer schools to start sharing and transferring their love for learning through making by creating their own, local Teacher Maker Camp.

So, we hope that reading this cookbook will whet your appetite and provide you with the ingredients to cook up some innovation.

As you read through our recipes, be sure to keep in mind that the ultimate goal is to provide every child and teacher with the possibility of becoming an inventor (again).

We invite you to share your ideas and experiences on the hashtag, #teachermakercamp, and to contact us in case you are in need of assistance. And, because it is through creation that we meet the world, we wish you 'Happy Making'!



**This is  
where  
the fun  
begins**

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## RECIPE # 1

# GETTING READY FOR LEARNING BY MAKING

## INGREDIENTS

COMMUNICATION

PARTICIPANTS

TIME

WORKSPACE

PROGRAMME VERSUS UNPROGRAMME

MAKE WHAT YOU ALWAYS WANTED TO MAKE

Before you start baking your favourite pie or putting together your grandmother's perfect lasagne, you always make sure that you are fully prepared and equipped to start cooking. You have a rough idea of what you want to cook; you make sure that you have enough time and enough space in your kitchen; and you check to ensure that you have everything you need before you start chopping, brewing, stirring, and mixing. The same applies to Teacher Maker Camp. It's safe to say that—for both cooking and maker education—the better prepared and more flexible you are, the more inspired you'll be by your guests; the more you'll be able to go with the flow; and the more you'll be able to give your dish a special twist that will satisfy everyone's tastes. This recipe is all about getting everything ready so you can start cooking together!



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## COMMUNICATION

Of course, all good chefs want to entice diners into their restaurant, dining room, or kitchen. For those cooking up a Maker Camp, this isn't always easy. Maker education can be hard to grasp at first if you're not familiar with it. So, in your communication, you need to make sure that you describe the 'why' of maker education, your approach, and provide people a taste of your planned programme without sharing exactly what you are going to do. In other words, provide your guests with a mouth-watering menu they won't be able to resist. One thing that should be clear from the beginning is that a Teacher Maker Camp is not just about learning how the machines work. Maker education is, before all else, about attitude and approach. And, last but not least, make clear that these four days are about curiosity and fun!

## PARTICIPANTS

You want to be a good dinner party host, so for this recipe, make sure you're well informed about who your participants are and what their main reason for participating is. You can ask them about their profession, expertise, motivation, and other questions and expectations via an online survey, in person, at an exploratory meeting at their school, etc. With the right information, you can decide to take a slightly different approach beforehand. And, if you discover specific needs along the way, simply adapt your programme where possible.

During our camps, there were quite a few differences amongst our participants. Our first group consisted of teachers from a vocational college where pupils are trained for professions in the woodworking, furniture, or interior design sectors in the Netherlands. The other group was more varied, and consisted of people from different kind of education: primary and secondary education, vocational education, and some of teachers from the University of Applied Sciences. You can imagine, therefore, that during the first camp there was already a lot of expertise within the group concerning technical knowledge, certain software, and some of the machinery, while in the second group, there were a lot of participants who labelled themselves as 'beginner' in our online registration form.

An important piece of advice regarding the subscriptions: ask participants to come in pairs. This is, of course, not obligatory, but working this way will help ensure that your participants share their experience with a colleague, which will make it easier for them to apply the knowledge and experiences they gain back at their own school.

## SIDE NOTE

### THE LEARNING CURVE

*We observed an interesting learning curve during the four days of our Teacher Maker Camps. Although experiences differ and the following description is not applicable to every participant, in general, you could say that the first day is inspiration day: everything is very new and inspiring, people are excited (sometimes a bit overwhelmed) by what they've gotten themselves into, and they can't wait to get started. The second day is generally characterized by frustration: participants have a lot of time to work on their own projects, but tend to bump against the limits of their knowledge and skills, and experience difficulties in realising their ideas. Breakthroughs occur the third day when people finally get things working (and start doing little victory dances). A lot of hard work and sweat goes into this day, so don't be surprised if people forget to eat, drink, and go to the toilet—these are indications that they're doing some honest, hard learning. On the fourth day, participants are usually fairly tired (perhaps somewhat resigned), but experiences and lessons learned are starting to sink in.*

## TIME

To learn by making, you need time. Providing your participants with enough time allows them to fully dedicate themselves to the 'making process,' a practise that isn't linear and that naturally comes with ups and downs. Our participants were on their school holidays and could, therefore, dive into the process for four consecutive days. Four days is a good amount of time for creating an interesting learning curve, overcoming frustration, and allowing participants to keep going (even into the evenings) once they're in the flow of making and don't want to stop.







## WORKSPACE

Sheridan et al. (in press) define “makerspaces” as “sites for creative production in art, science and engineering where people blend digital and physical technologies to explore ideas, learn technical skills and create new products.” They argue that the heart of making involves “taking an idea and constructing it into some physical or digital form.”

A workspace is, of course, equipped with the right machinery and tools. An ideal workspace is both inspiring and allows participants to make it their own for the time being. It invites everybody to grab materials and use them, to feel comfortable and safe, to work together, to experiment, to make mistakes and try again. It should be spacious: big enough to allow people to move around freely and to disengage when needed. Make sure participants can see the projects their peers are working on, too. This way, they’ll see that other people often struggle with the same problems, and they can help each other out. Because the workspace is a place to learn new things, it shouldn’t remind participants too much of their daily work or daily routines at all.

## PROGRAMME VERSUS UNPROGRAMME

A recipe, or a programme, within maker education might sound like a contradiction. In practise, there is a lot of what we call ‘unprogramme’, or time and space in which people (in teams) can build and work on their own projects. This is a deliberate choice because we strongly believe that the maker experience requires independent work.

But, in order to provide participants with a bit of structure, one should have (and provide them with) an outline of a programme. If you have a clear goal in mind and the right ingredients in place, you can create all kinds of recipes and menus, but make sure you offer enough for people to really sink their teeth into.

We provided our participants with an outline of a programme with fixed time slots for challenges, speakers, a work visit, lunches, and a social dinner. In between, we left space for a lot of unprogrammed time during which faculty was present and able to assist if needed.

## MAKE WHAT YOU ALWAYS WANTED TO MAKE

There is only one-way to start a project: find your personal inspiration, challenge, or problem and make what you always wanted to make.

Individual ideas are the starting point of great projects. When we work on something we really like, we connect to our intrinsic motivation, which means that we are more willing to continue working, to explore, and to try new things (and try again if we fail). And, if we finally succeed in making something we really wanted to make—magic happens!

There are different ways to introduce the instruction ‘make what you always wanted to make’. One option is to ask participants to think about this question beforehand and prepare a pitch for the first day. Then, have people team up based on similar, shared ideas. You can also ask the question on the spot during the first day.

In practise, however, it can sometimes be quite difficult for people to come up with their personal, big idea. And—even if they already have an idea—an idea by itself doesn’t always mean you know what to do next. This means that participants can start out a little bit clueless on how to get going. So, we came up with some recipes and programmed some elements to get people started and help them overcome some fears. That way, they could tap directly into to right mindset (recipe #2).<sup>1</sup>

<sup>1</sup> If you want to learn more about what makes a good project and prompts, it might be interesting to check the chapters in the book, *Invent to Learn*.

Results of the 'Magic Machine' workshop.



## RECIPE #2

# MINDSET

*“I don’t know, but let’s find out together”*

### INGREDIENTS

CHALLENGE: MAGIC MACHINE

MOTTO: “I DON’T KNOW, BUT LET’S FIND OUT TOGETHER”

TEACHER HAT OFF, LEARNER HAT ON

RESPONSIBILITY FOR LEARNING PROCESS

LETTING GO

OPEN AND SHARE

As Paolo Blikstein says, maker education is about curiosity and letting go of control. It is about guiding students to explore and to construct their own knowledge instead of transferring your knowledge to them. It is about experimentation, learning by doing, and focusing on and valuing the process instead of assessment. Being able to do that in the classroom (for some people) is new, and demands courage as well as a different attitude and mindset. Luckily, there are ways to help participants develop that maker mentality.

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*Paulo Blikstein of Stanford University is researching Maker Education, and asks: “How do you generate curiosity in teachers and how do they get rid of the control?” His answer: “Make them makers!”*



# MAGIC MACHINE CHALLENGE



*To trigger imagination and to get people into making and thinking with their hands right away, artist Kristina Andersen gave her 'Magic Machine' workshop as the first activity on the morning our participants arrived.<sup>2</sup>*

**WHAT**

A challenge/workshop that taps into people’s motivations and imagination, is a good equaliser, helps to overcome possible fear of making and gives your Teacher Maker Camp a great kick start.

**WHY**

This exercise allows ideas that we have not yet fully imagined, to come to the surface and to take concrete physical form. The objects created serve as a prop that help people to express their motivations and ideas; get to know each other on a deeper level; and to begin to develop an idea of what they want to start working on.

**TIME**

30 - 60 minutes (depending on group size)

**NECESSITIES**

All sorts of scrap material (important that these are white and colourless with no text on it, like plastic cups, bubble wrap, rope, straws, cardboard etc.), glue guns, tape, cards with Basic Human Desires.

**Instructions**

- 1 Introduce the assignment: create your own magic machine.
  - 2 Introduce the Basic Human Desires. Read them out loud and place them on a table. <sup>2</sup> The list of desires is as follows:  
Acceptance, the need to be appreciated; Curiosity, the need to gain knowledge; Eating, the need for food; Family, the need to take care of one’s offspring; Honour, the need to be faithful to the customary values of an individual’s ethnic group, family or clan; Idealism, the need for social justice; Independence, the need to be distinct and self-reliant; Order, the need for prepared, established, and conventional environments; Physical activity, the need to work out the body; Power, the need for control of will; Romance, the need for mating or sex; Saving, the need to accumulate something; Social contact, the need for relationship with others; Social status, the need for social significance; Tranquillity, the need to be secure and protected; Vengeance, the need to strike back against another person.
  - 3 Instruct all participants to “pick a card with a desire.”
  - 4 Instruct them to “pick a material and begin building a Magic Machine that addresses the desire on your card.”
  - 5 Give them a fixed amount of time (about 30 minutes).
  - 6 Ask each participant to present their machine to the group by answering the following questions:  
1) what is your name and which desire did you pick?  
2) give your magic machine a name  
3) what does it do?
  - 7 Reflect as a group on the machines:  
“How are they similar? What questions do they ask? How would you explore the core concept of the machine? If this was a technological object, what would it be?”
- <sup>2</sup> More info about basic desire: [reissprofile.eu/basicdesire](http://reissprofile.eu/basicdesire)  
Website of Kristina Andersen: [tinycamping.com](http://tinycamping.com)

## **“I DON’T KNOW, BUT LET’S FIND OUT TOGETHER”**

One of the most important ingredients for creating the maker mindset is living and breathing the motto, ‘I don’t know, but let’s find out together’ (both in interaction with participants, and within your faculty team as well). While practising maker education during a Teacher Maker Camp, you stimulate participants to do things they have never done before. And, boy, will they! You will find participants challenging themselves as they try to make and create things—even if they don’t quite know how to, yet. And the thing is, sometimes you, as faculty, won’t know either. Yet, that is exactly what you want, oddly enough, to create an atmosphere of curiosity and innovation. It’s okay not to have all the answers. Don’t be frightened of the skills or knowledge you don’t (yet) have. Embrace, instead, the process of learning together. Experimenting is fun, so do some crazy experiments and you might even find something valuable. There is no such thing as failing. And through leading by example, participants experience and gain trust, which is exactly the same attitude they will need to cultivate in their classrooms. They, too, can create an atmosphere of invention by responding to their pupils’ questions with, ‘I don’t know, but let’s find out together’. And, in doing so, they will help and guide them to explore, experiment, and construct their own knowledge. Help teachers to feel confident that they are still the experts in learning, and that they can coach students to organise their plans to get the answers and solutions they seek. Encourage working together, sharing knowledge, experimenting, playing, and lots of research. It is all about attitude.



## **TEACHER HAT OFF, LEARNER HAT ON**

Inspired by Sylvia Martinez, we deliberately ask participants to take their ‘teacher hat off’ and put their ‘learner hat on’. When confronted with new things, skills and information, teachers tend to ask themselves immediately: ‘How can I use and implement this in my classroom?’ Of course, this is a natural occupational hazard, but during Teacher Maker Camp, we would like teachers to experience what it is like to be student again first. This allows them to reflect on their own learning process, during which they will gain a lot of valuable insights into their students’ learning processes. For instance, they’ll remember that real learning is hard work (and exhausting), that you sometimes need a break, and that it can be very annoying to have to wait and be patient when you are in a good workflow. By first remembering what it’s like to learn, they are then able to reflect on their teaching practise in a new way.





Frysklab mobile maker space

Opportunity is missed by most people because it is dressed in overalls and looks like work.

*Thomas Edison*



***“I am totally absorbed by the maker philosophy. It’s not about the product, but about the process. Also, my final prototype broke down, but I enjoyed myself immensely.”***

---

– Frank (participant)

## **RESPONSIBILITY FOR LEARNING PROCESS**

Also, we ask participants to take responsibility for their own learning process. This means that if they are in need of specific skills or information, we encourage participants to find peers who have the same questions or have run into the same problems, and then organise something like a short workshop, for instance, with one of the faculty members.

## **LETTING GO!**

That means organisers and faculty, too. Creating the right mindset and attitude starts with yourself. The curriculum for Teacher Maker Camp is not determined in advance. Of course, you aim for certain skills, knowledge, and learning to occur; but Teacher Maker Camp has an emergent curriculum that comes from both the contextual and individual interests of the participants, and the needs and opportunities that arise during collaboration. Because each individual participant has different motivations and needs (and the process is open and self-directed), it is neither advisable nor desirable to define fixed learning objectives and outcomes.

## **OPEN & SHARE**

Makers like to help each other because they know that many hands make light work. And in Dutch we like to say: ‘one plus one equals three’. That’s why they’re all about staying open and sharing their processes, prototypes, and designs with each other (both on the Internet and in Fablabs). So, create a short session in which you talk about moments when people share their ideas, accomplishments, and struggles with each other. Then provide each other with input and feedback.

And, take some time to help your participants find their way online on platforms where people share their ideas and designs like, for instance, Instructables, Etsy, and Github. In doing so, you not only open up a whole new world for them, but you also prevent them from reinventing the wheel. And, importantly, you show them that they can build upon the experiences and results of others. Also, be sure to stimulate your participants to document their ideas, learning process, and design(s) and to share them for others to learn from or build upon.

## RECIPE #3

# THE POWER OF WORKING TOGETHER

### INGREDIENTS

PITCH & TEAM UP

NETWORK

ICEBREAKERS

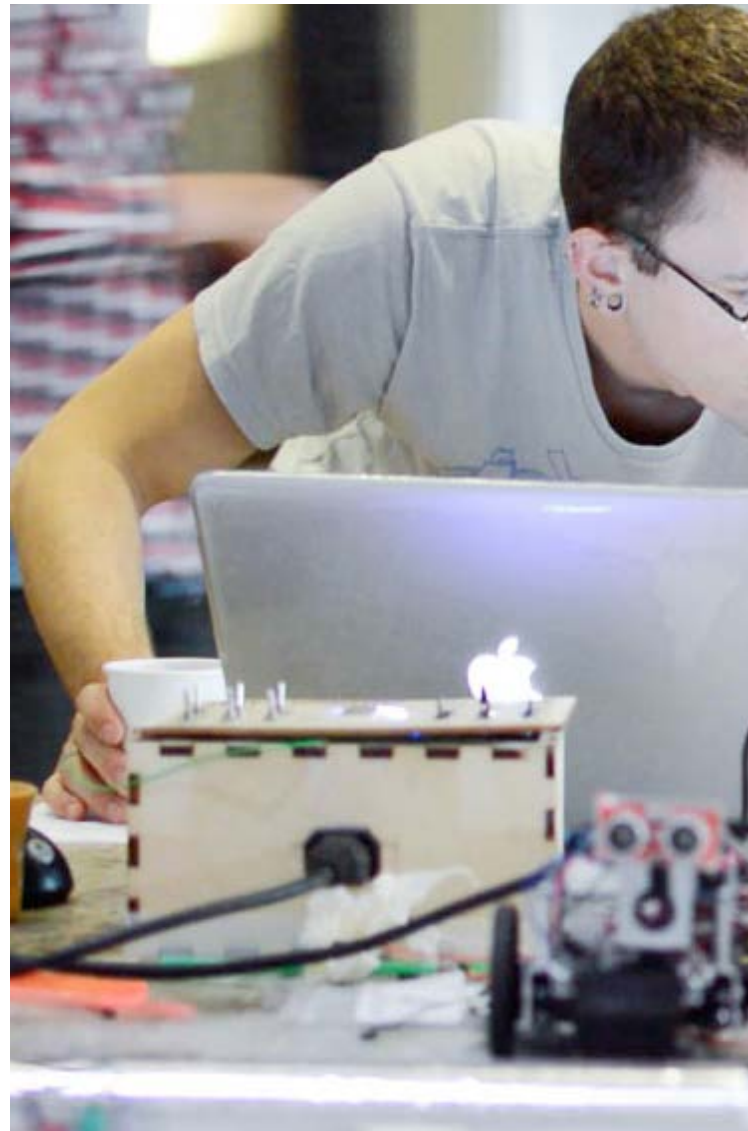
LEGO CHALLENGE

Not only is cooking together more fun, it also provides the opportunity to swap knowledge, expertise, and experience to create the best dishes and flavours. The same goes for maker education, a movement focusing on learning in the 21st century. As we said before, in the maker world, many hands make light work. Technological changes move rapidly, and the challenges we face today are simply too complex to solve by ourselves. So, the only way forward is to collaborate and learn together. We demand it from our children in the classroom all the time, so we might as well challenge ourselves to do the same during Teacher Maker Camp. Although people could work on individual projects, we encouraged participants to work in teams, share knowledge, and help each other. This way, participants not only work with their own strengths to move the project forward, but they could also each discover different machinery and techniques and then share their experiences with team members.



## PITCH AND TEAM UP

just like to work on each other's project. As previously mentioned in Recipe #2, you can ask people to think of something they want to make ahead of time, or let them think of something on the first day. After your kick-off session, you should ask people to pitch their ideas. These ideas can be abstract like, for example, a problem they want to solve, a technique they want to explore, or a piece of art they want to make. The pitch can be simple, and is meant to invite or convince others to work on the same idea. People who have ideas in common or are enthusiastic about each other's idea can form teams. Although this might be a bit uncomfortable sometimes, the groups eventually form themselves; you don't need to do anything. It is part of the process. The size of the group doesn't really matter. However, having four group members tends to work well. It's just enough people to work on different aspects of the project, but not so many that it could slow down the process. Remember: cooking together is fun, but too many cooks spoil the soup!



## NETWORK

Collaboration shouldn't stop at the end of Teacher Maker Camp. Give people the opportunity to stay in touch with each other after camp is over. This way, they can keep working on their projects, work on developing education, etc. During our camps, we started a Meetup group, but you can discuss how best to stay in contact with the group you have in front of you.



## ICEBREAKERS

In a group where people don't really know each other, ice breakers can help to get them comfortable with each other in a short amount of time. Just keep a few exercises on the side in case you need them. For example, have people draw each others' portraits using a single line (without taking their pencils off the paper) and without looking at their paper. The results are always rather strange, messy, and funny. You can't do right or wrong. And if you ask people to choose their favourite portrait of themselves (and have them explain why), you not only get some hilarious situations, but also a quick, easy, and approachable way of getting to know each other

# LEGO CHALLENGE

*source: kaospilot.dk*



*Are you ready for some playful reflection on collaboration?*



**WHAT**

Accomplishing an individual and group task without verbal communication.

**WHY**

Collaboration is essential in maker education. This challenge shows how groups work together, what skills are important while collaborating and working on a complex task.

**TIME**

45 - 60 minutes

**NECESSITIES**

one kit per group: LEGO blocks, LEGO board, printed assignments. Optional: flip-over charts, pencils.

## Instructions

- 1 Put a kit on each table and form groups of 8 to 14. No more, no less.
- 2 There must be absolute silence from the time that you explain the overall group task and give out the individual assignments. No talking from that moment on. Before assignments are given, explain what a layer is and what a brick is. When each person receives their assignment, they must read it only to themselves in silence. If they do not understand the task, they may ask the instructor for clarification. It is crucial that each person understands their assignment because, if they don't and proceed anyway, they may cause the entire team to fail.
- 3 "You are now, as a group, going to build a structure with the LEGOs in front of you. In a moment, you will each be given a note with an assignment on it. This is your personal assignment during the exercise. The message on the note is to be kept secret from the other members of the group."
- 4 Give the notes to the candidates.
- 5 "You will now have 15 minutes to build your structure. The work will take place in complete silence. I will let you know when there are 3 min left." . Allow an additional 5 minutes if needed to the groups.
- 6 When a group is finished: Ask them to place their hands behind their back and on the count of 3, ask them to show on a show of fingers/hands from 0 - 10 (with 10 representing that their task is 100% complete). If they are not all finished, then request that they support each other to complete as many tasks to a 10 finger level as possible in 5 minutes.
- 7 To be read out after 5 min: "You will now, individually, read out your assignments to the group, and explain whether or not you completed your assignment. Then explain how you view your group's ability to work together."
- 8 Optional: reflect on the collaboration by discussing the positive attributes the team needs to perform and the negative attributes that need to be left behind.

*\*All the lego tasks can be found in the appendix of this publication.*

## RECIPE #4

# INSPIRATION

*Take a look in someone else's kitchen*

### INGREDIENTS

SPEAKERS

FACULTY

INSPIRATION CORNER

CHALLENGES

WORKVISIT

You want to cook a meal that is rich in flavour, bright in colour, and that smells and looks like heaven. And you want to be surprised. To be inspired by the unconventional—even if that means finding peppers in your chocolate or olives in your carrot cake sometimes.

To accomplish this, don't be afraid to be generous with adding various elements of inspiration to your recipe.





Sylvia Libow Martinez speaking at Teacher Maker Camp

**SIDE NOTE****Who did we invite to share their story?****SPEAKERS**

A variety of great and interesting speakers, who preferably tackle different aspects related to your Teacher Maker Camp, is indispensable. Try to engage passionate makers that speak from their personal experience. They don't necessarily have to be educators, but can work as artist, stylists, designers, stylists, and even hackers. As long as they are people who are able to create a spark.

Also, be sure to ask your speakers to make time and to be available for questions. Invite them for dinner, or even ask them to stay the whole day to work with participants on their projects. This way, you create an intimate, personal, and approachable atmosphere that allows for informal interaction and learning to take place.

**FACULTY**

At Teacher Maker Camp, your faculty will be responsible for a lot of casual learning and inspiration. Lots of implicit skills, knowledge, information, and inspiration will be transferred via the people who lead by example over four days (and nights). Their personal projects, experience, and authenticity will be very inspiring for participants. We've described this ingredient in more detail in the recipe Faculty.

*We decided to address and programme a specific topic each night, and then asked our speakers to elaborate on their experiences with that subject. For 'Maker Education', for instance, we were lucky enough to have Sylvia Libow Martinez and Gary Stager to come to the Netherlands again to share their experiences with Invent to Learn and Constructing Modern Knowledge. For the theme, 'Hacking and Inventing', we invited TV B-Gone inventor, Mitch Altman, via Skype, and had Eibert Draisma demonstrate his wonderful and poetic projects and innovative teaching methods. And for 'Playing and Learning', designer Astrid Poot shared a very intimate story about the importance of love and attention for the people and processes involved, and Loes Bogers (of the HvA MediaLab) talked about her experiences with teaching students to tinker with technology. When working with teachers from the Wood and Furniture College, we asked DUS Architects (who are building the 3D Print Canal House) to discuss innovative ways of conducting material research and business modelling.*

## INSPIRATION CORNER

When you're not sure what you want to cook, glancing through the glossy photos in a cookbook can sometimes whet your appetite and spark your imagination. Visualisation is a powerful motivator. With this idea in mind, create an inspiration corner somewhere in your workspace. With books (a lot of books) on crafts, materials, design, DIY, the maker movement, maker education, programming, education, psychology, architecture, fairytales—you name it! Just make sure that your collection of great books comes with lots of images that visually stimulate the imagination. They just may trigger an idea or bring certain aesthetic quality to a project—consciously or unconsciously.

And, you might also consider putting a laptop or tablet in your inspiration corner filled with links and websites concerning interesting hardware, software, projects and possibly interesting films or documentaries on the topic. We had *Maker The Movie* and *Design Thinking* available, which could have turned into a spontaneous movie night.



## CHALLENGES

Great cooking is also a matter of practise. So, we started each day with a half-hour challenge to get people directly into making. These challenges are great because they function not only as icebreakers and as a way to get people to cooperate, experiment, and work with their hands—but also as useful classroom activities! We had teachers not only repeating these challenges in their classrooms the week just after Teacher Maker Camp, but also during their family weekends. The challenges are described in more detail in the different recipes throughout this cookbook.



***“This has already brought me a lot.  
The conversations with my colleagues to start with.  
And the challenges I would do immediately with the teachers I work  
with. Simple, good assignments to set the proper mood and tone.”***

---

**– Lenny (participant)**

## WORKVISIT

In English, you say “take a look behind the scenes.” In Dutch, we say, “take a look in someone else’s kitchen.” So, during your camp, try to build in a work visit to an interesting creative space or company. If you are not a FabLab yourself, it might be worthwhile to take your participants to a local FabLab to have a look around and learn about their ideas around opening up and sharing designs, their methodologies, machinery, and international knowledge network. Otherwise, there are plenty of other professionals or hobbyists out there willing to share some of their special tools and ingredients with you.





## SIDE NOTE

### Who did we visited?

With our Teacher Maker Camp, we visited the Joris Laarman Lab. Joris Laarman Lab is an experimental playground set up to study and shape the future. It allows craftsmen, scientists, and engineers to tinker with the many new possibilities of upcoming technology and its consequential aesthetics. The work is very diverse: from sculptural, experimental furniture and innovative production processes to museum installations, film, digital media, and workshops at universities around the world.

On another occasion, we had a tour through the fantastic Cinekid Medialab. The Cinekid MediaLab is the largest interactive digital playground in the world. Imagine 1200 square metres filled with the latest games, virtual reality systems, 3D worlds, puzzles, and information about programming where you can fiddle with the latest apps, or take the best workshops to get started. Being able to see what is possible with the newest technologies in the field of education, play, and gaming for children was a great experience for our participants.



## RECIPE #5

# FACULTY

### INGREDIENTS

EXPERIENCE

SKILLS

DIVERSITY

Every dinner party has its centrepiece, and every chef has a go-to recipe. One of our go-to recipes for hosting a successful Teacher Maker Camp is a solid faculty. This recipe is all about balancing the right team and the right flavours. The key ingredients are experience, skills, and diversity.

In practise, in both maker education and during Teacher Maker Camp, you often don't know exactly what your participants are 'cooking'. They probably have an idea; a clear mental image of what it should look like and how it should function. But, to be honest, projects often develop in strange directions. There are no fixed solutions, and it is often a matter of trial and error for everyone involved. So, to help and motivate people to actually finish their projects and overcome difficulties, you need to be able to improvise. This is when the motto, 'I don't know but let's find out together', definitely comes in handy.

To be able to live and breathe that motto, maintain that attitude, and help your participants cook their own 'meals' at home, you need good faculty. Ideally, you need a fresh (yet mature and skilled) team that trusts each other and has the attention and love for the people and processes involved.





## EXPERIENCE

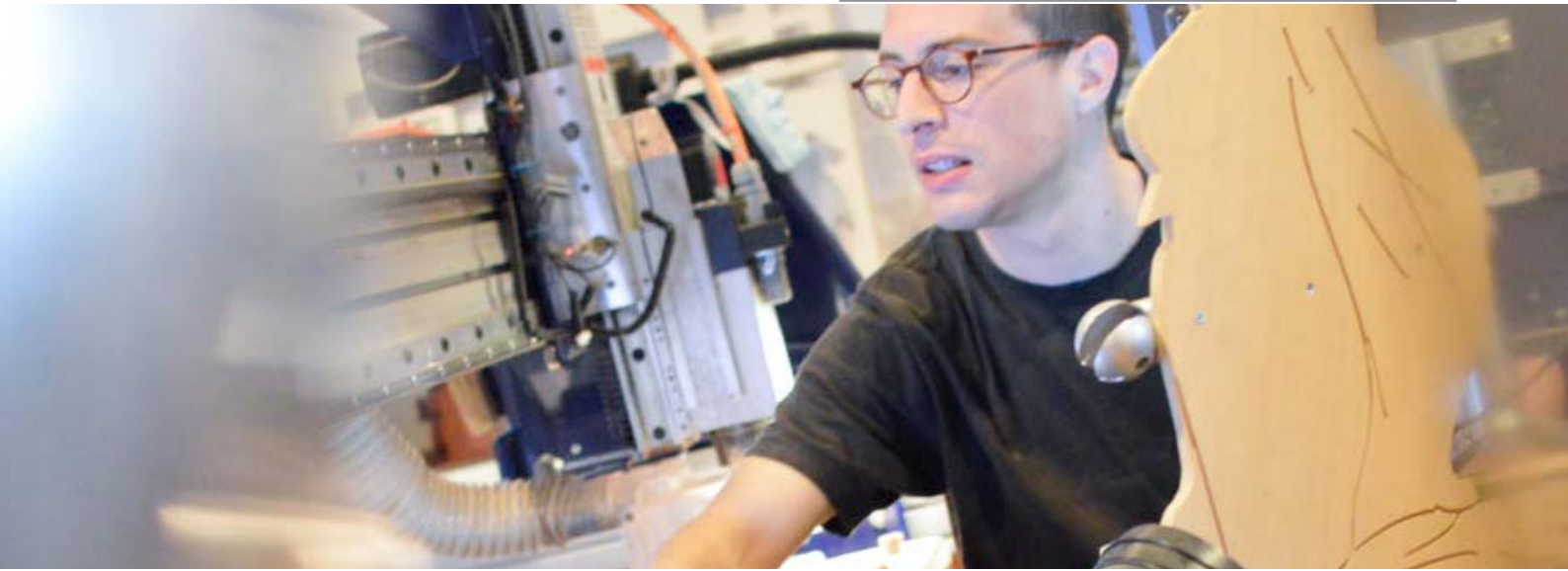
You need faculty that has experience with maker education; with the machines, the tools, and the materials; and in guiding people and processes. You need faculty that can stimulate teachers to do things they have never done before. They must know how to mix the right flavours into the group they're working with, providing the right amount of information at the right time and coaching them to overcome problems. And, you especially need faculty who don't fall into the trap of 'taking over people's projects'. In short, you need faculty who encourage participants to learn how to follow a recipe by themselves. That means teaching them to make and fix things by themselves instead of doing it for them.

## SKILLS

Also, for a richer flavour, it is important to have a diverse team in terms of background and skills. When composing our team, we tried to make sure we engaged people who both knew how to handle the equipment and who were skilled in digital fabrication (laser cutting, 3D printing, CNC phrasing, etc.), electronics (Arduino, sensor technology etc.), and DIY kits (Arduino tinkerkit, Bare Conductive etc.). Our colleagues at Waag Society, who run our FabLab's open days, know all about the available machines, tools and, software. They were, therefore, able to transfer a lot of their knowledge and skills to our participants. We also involved a hacker who (naturally) questioned things and helped to open up both hardware and software. This aided participants in developing their investigative mindset.

We wanted to have faculty who know how to start and implement maker education at school; who feel comfortable in guiding kids to work on their own projects (without acting like the 'master of content'); and who can share experiences with other teachers.

We were fortunate to work with the great pioneers from FabKlas, who have practised maker education at their school, De Populier, in The Hague for years now.



## DIVERSITY (THAT EXTRA BIT OF FLAVOUR)

Lastly, make sure you engage an artist in your team. Artists and their creative practices have a lot to offer makers and the field of education. They're the ones who really know how to spice things up. Their methods are very much comparable to tinkering. They question the questions, challenge themselves (and other people) to look at things from a different perspective, and they know how to conceptualise and visualise ideas. Artists are disruptive by nature. They're also storytellers who naturally bring ethics and aesthetics into their projects. And lastly, their love for materials and hacking of materials contributes to new innovative solutions for existing problems. Engaging artists who know how to inspire (and possibly infect participants with their way of working), certainly results in more interesting outcomes and projects.

In our case, we were lucky enough to work with the wonderful Kristina Andersen. Kristina not only gave the Teacher Maker Camp a great kick-start with the Magic Machine workshop (during which participants immediately were forced to quickly tinker with scrap materials to visualise their ideas),



## RECIPE #6

# TINKERING

*Thinking with your hands and learning through doing*

## INGREDIENTS

TINKERING

EXPERIMENT & PROTOTYPE

MARSHMELLOW CHALLENGE

TOOTHBRUSH CHALLENGE

Would this soup taste better if I substituted sweet potatoes for carrots? Do bananas belong in a sandwich? Could adding basil liven up this cake batter? Being a maker and an inventor is about doing things you have never done before. It is about trying, fixing problems, finding solutions, and trying again.

But, when the ‘what’ and the ‘why’ are maker-driven, how do you prepare a framework for making? A process and methodology that is often called tinkering.

So, what is tinkering exactly? The Exploratorium writes in *The Art of Tinkering*<sup>3</sup>: The word was first used in the 1300s to describe tinsmiths who would travel around mending various household gadgets. But in our minds, it’s more of a perspective than a vocation. It’s fooling around directly with phenomena, tools, and materials. It’s thinking with your hands and learning through doing. It’s slowing down and getting curious about the mechanics and mysteries of the everyday stuff around you. It’s whimsical, enjoyable, fraught with dead ends, frustrating, and ultimately about inquiry.

<sup>3</sup>

*More info about tinkering: [tinkering.exploratorium.edu](http://tinkering.exploratorium.edu)*



## **TINKERING**

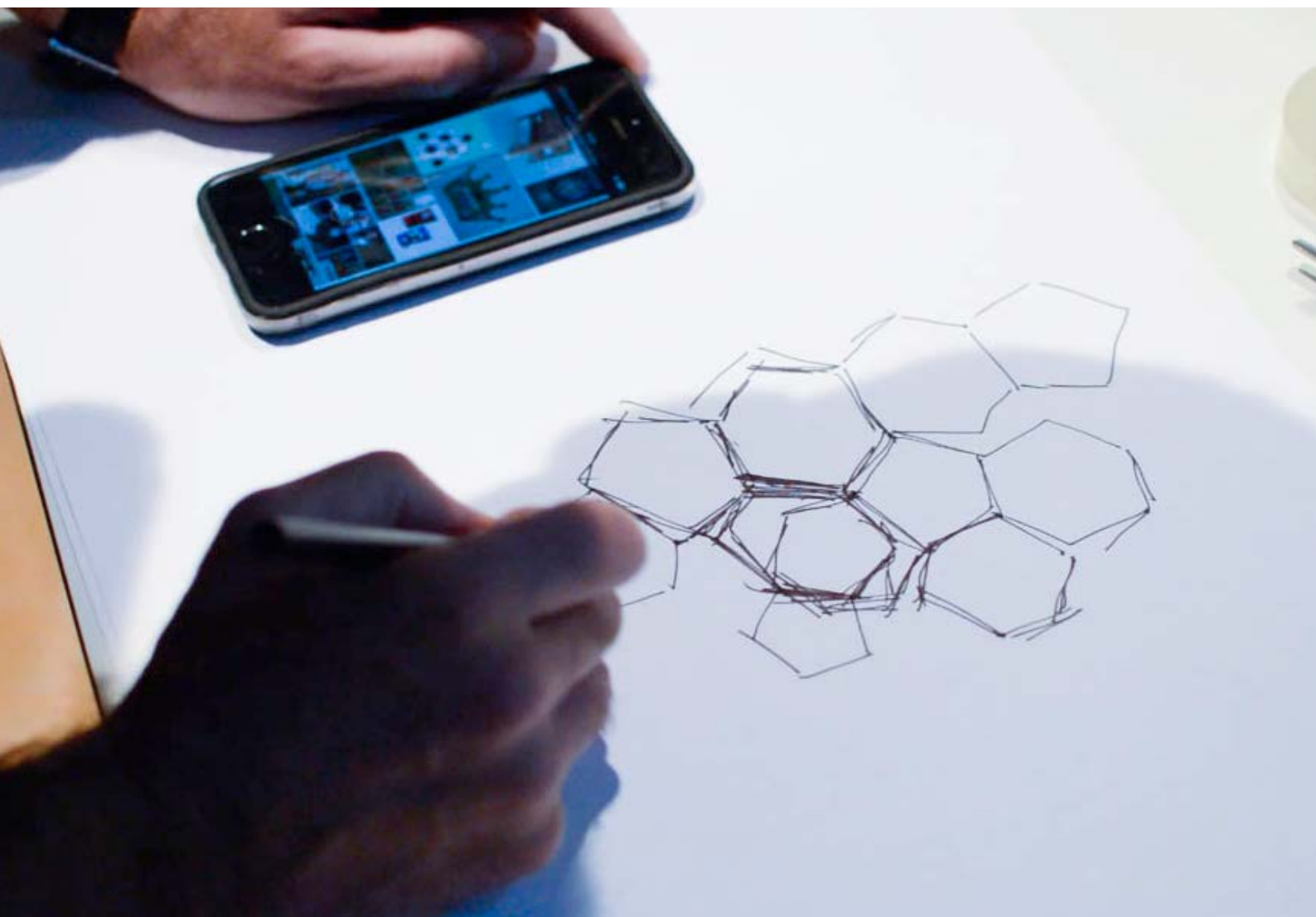
We use tinkering as a making method. Sylvia Martinez describes tinkering as a “mindset” involving a playful approach to solving problems through “direct experience, experimentation, and discovery.” In our experience, the “mindset” of organizers and participants, and the way they work together is at least as important as what they do or which machines they use. We complete a design and making process together, during which different outcomes are possible, and the end result is neither good nor bad. Together, we research, make, fail, and try again in the name of learning. Join the quest and make room for spontaneous discoveries on the way.

Tinkering, as a making method, consists of what we call a ‘question - make - test’ process, which means learning (playfully) what a design will look like through making lots of short iterations. Always start with a question or problem, which you then begin working through in your first design. Then, create a prototype to further investigate your question or problem. Afterwards, test and put your prototype into practise to see if this is the answer to your question or the right solution to your problem. Often, the results provide new questions that are the beginning of the next cycle of iterations. Take time to consciously reflect upon what you have learned and what you want to learn more about.

## **EXPERIMENT & PROTOTYPE**

If you want to get people tinkering, you’ll need to get their hands moving with some materials. You want to encourage them to play, experiment, and prototype. A good exercise to get people going (while also illustrating the importance of experimenting and prototyping) is the Marshmallow Challenge.





# MARSHMALLOW CHALLENGE

\* source: [marshmallowchallenge.com](http://marshmallowchallenge.com)



*Prototyping with marshmallows!*

**WHAT**

Accomplishing an individual and group task without verbal communication.

**WHY**

In maker education, there are no fixed answers. Teachers and students are discovering and learning together. Prototyping is key to seeing what works and what doesn't. It both reveals hidden assumptions at an early stage and is a way of discovering new ideas through making.

**TIME**

60 minutes

**NECESSITIES**

tape-measure; (online) stopwatch; and for each group: a table, a kit with 20 sticks of uncooked spaghetti, tape, marshmallow, string, and scissors

Optional: computer & projector to show an online video (TED talk on Marshmallow Challenge), presentation, flip chart, pencil, music

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## Instructions

---

- 1 Put a kit on each table and form groups of four.
- 2 Deliver clear instructions: "Build the tallest freestanding structure. The winning team is the one that has the tallest structure from the table-top surface to the top of the marshmallow. The entire marshmallow needs to be on top. Cutting or eating parts of it disqualifies the team! Use as much or as little of the sticks, tape, or yarn as you like. Spaghetti sticks can be broken."
- 3 Show the time on a screen that is visible to everyone. The challenge lasts 18 minutes. Put on some music and walk around the room during the challenge. Remind the teams of the remaining time, and raise the energy by calling out the teams that have a standing structure in the meantime.
- 4 When time runs out (count down!), everyone should take their hands off their structures. Check which teams are disqualified (i.e. not standing, no marshmallow on top, use of other material that was not in the kit, structure taped onto the table and, therefore, not freestanding) and identify the winning team by measuring the structures.
- 5 Discuss the importance of prototyping and the marshmallow as a hidden assumption in a project. "Kids typically do better than business school students in this challenge. Kindergarteners create taller and more interesting structures because they spend more time playing and prototyping. They naturally start with the marshmallow and stick in the sticks. The business school students spend the vast majority of their time planning the structure before they eventually build it, leaving almost no time to fix the design once they put the marshmallow on top."
- 6 "The marshmallow is a metaphor for the hidden assumptions of a (make) project: We think marshmallows are light and fluffy and easily supported by the spaghetti sticks, but when you actually try to build the structure, the marshmallows don't seem so light. The lesson in the marshmallow challenge is that we need to identify the assumptions in our project: "the material or machine will do what I want", "this is too difficult to do", etc.

# TOOTHBRUSH CHALLENGE

*Inspired by a workshop from  
Andreas Ostrowski of Fablab Nurnberg*



*Prototyping with toothbrushes!*

**WHAT**

A group assignment that shows the importance of rapid prototyping and testing by building a the fastest vehicle possible in groups of three to four in 20 minutes

**WHY**

In maker education, there are no fixed answers; teachers and students are discovering and learning together. Making prototypes and testing them is key to seeing what works and what doesn't. It both reveals hidden assumptions at an early stage and is a great way of discovering new ideas through making.

**TIME**

30 minutes (construction time: 20 minutes)

**NECESSITIES**

(online) stopwatch, and for each group: a table, a kit / closed bag with 3 ice cream sticks, 3 toothbrushes, 1 9v battery, 1 pair 9v battery clips, 1 dc motor. Required tools: glue gun, a wire cutter, and/or strong scissors. Optional: computer & projector to show an online presentation, flip chart, pencil, music, electrical wire stripper, soldering iron.

---

## Instructions

---

- 1 Put a kit on each table and form groups of three to four
- 2 Deliver clear instructions: "Build the fastest vehicle possible with the given materials. Construction tips: Keep discussion time to a minimum. Keep making and testing over and over again to learn as much as possible and improve your design. Keep it simple; there's not much time!"
- 3 Show the time on a screen that is visible to everyone. The challenge lasts 20 minutes. Put on some music and walk around the room during the challenge. Remind the teams of the remaining time, and raise the energy by calling out the teams that have a moving vehicle in the meantime.
- 4 When time runs out (count down!), everyone should take their hands off their vehicle. Put all the vehicles in position behind the START and then make them race each other. Or: give each group their moment in the sun by showing off their vehicles one by one and clocking the race time.
- 5 Discuss the importance of rapid prototyping and testing.

## RECIPE #7

# MATERIALS & MACHINERY

*Make sure you are equipped with the right tools for the job*

### INGREDIENTS

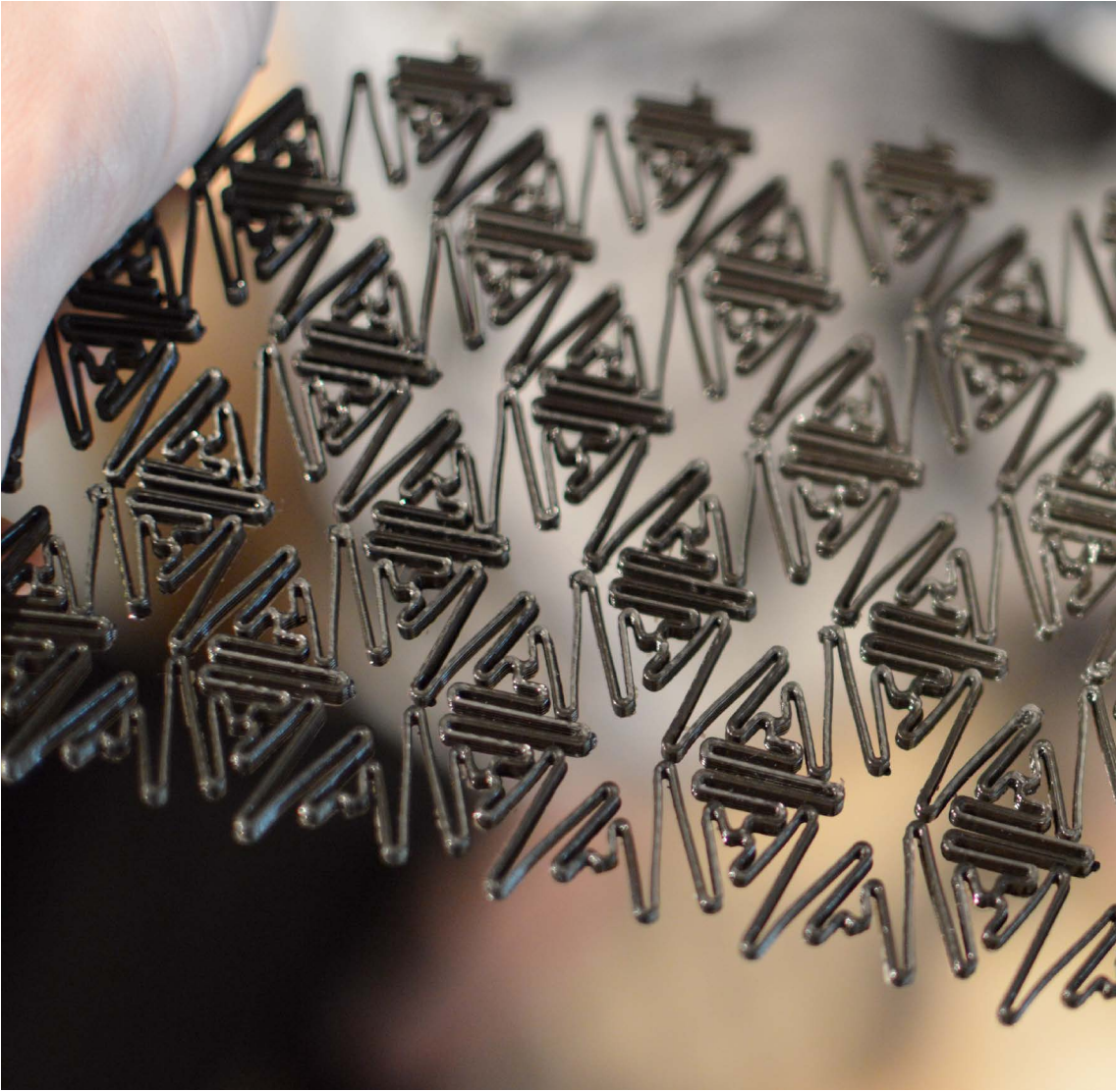
EVERYTHING FROM SCRAP TO HIGH-TECH

KITS

MACHINES

Your ideal kitchen would likely be equipped with sharp knives, lots of bowls and other common cooking tools, a food processor, and a fridge. Likewise, your ideal workspace should be equipped with craft and scrap materials, fabrics, tools and toolkits, electronics, and machinery. In this recipe, we describe an ideal workspace situation. But really, even if you don't have a 3D printer or a laser cutter, you can start making and creating with tools as simple as cardboard and a glue gun.



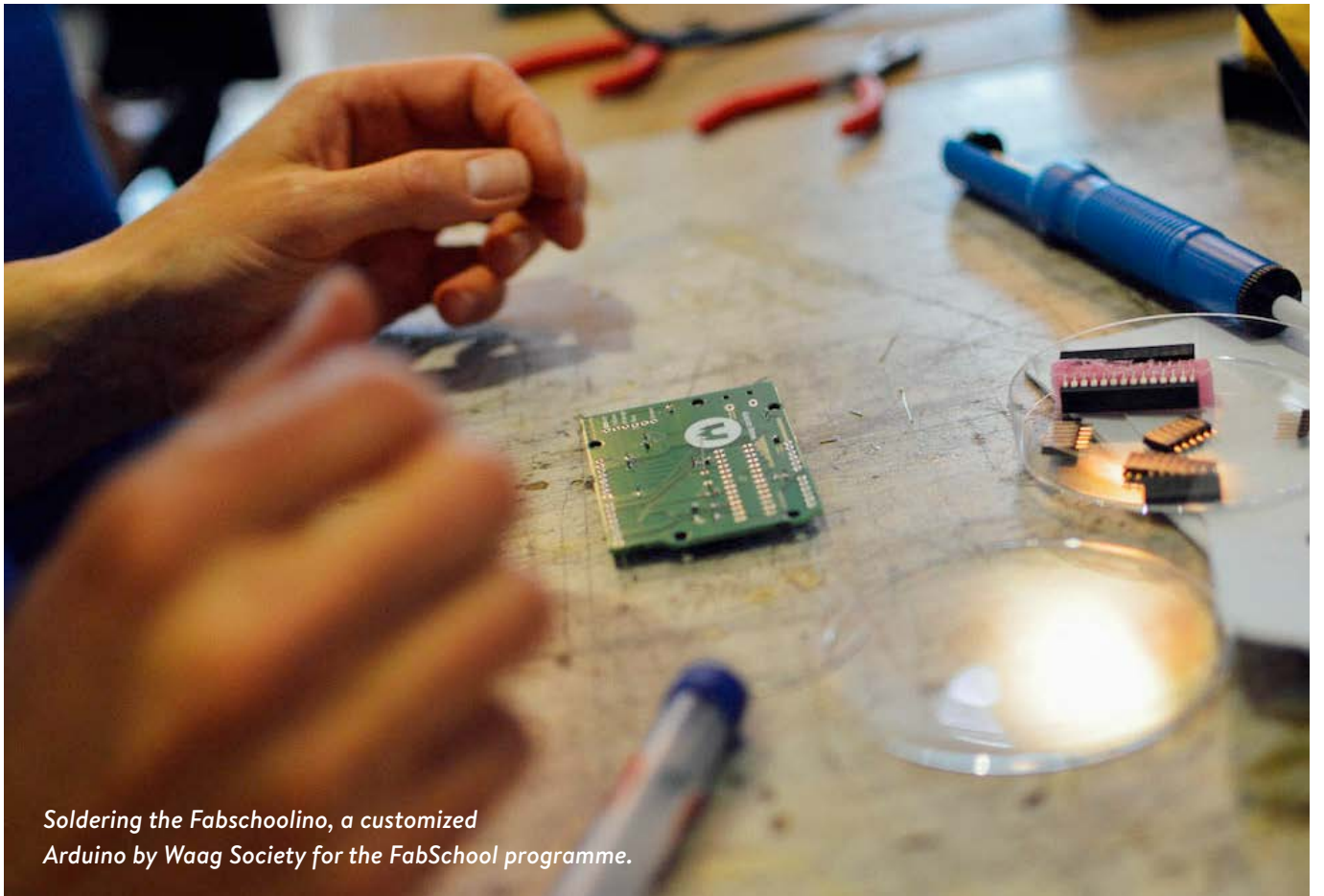




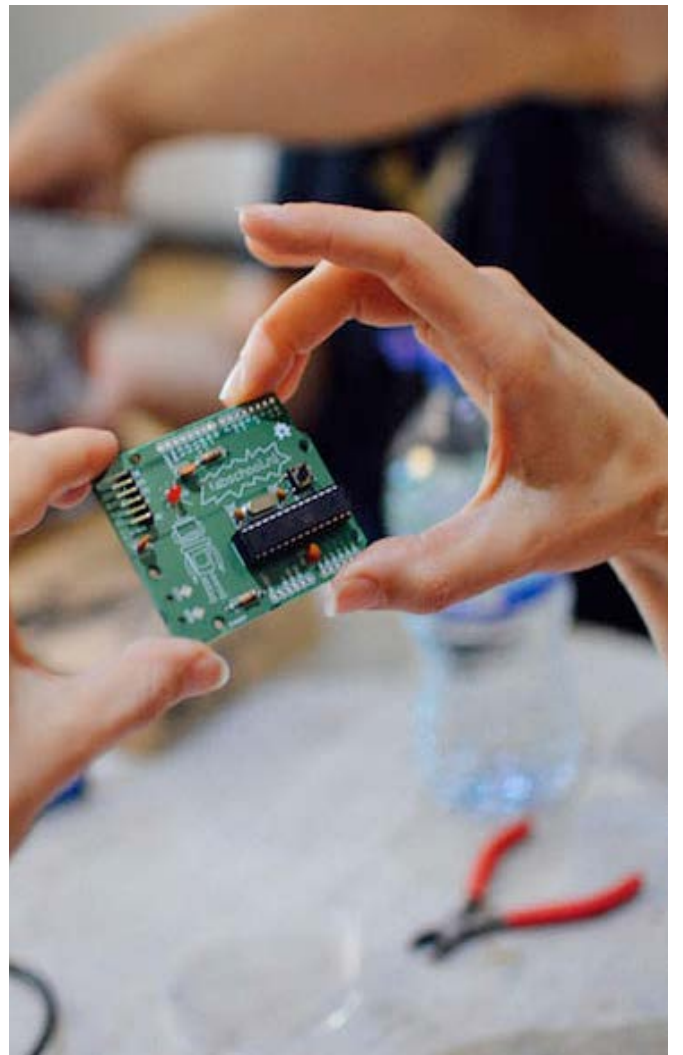


## RECYCLED MATERIALS

From scrap to high tech, materials are essential to getting this party started. Please note that your list of materials will never be complete, nor final. Make sure you have lots of different materials (and plenty of it!) on hand: from common plywood, MDF, crafting materials, fabrics, and (biodegradable) plastics to more exotic things like conductive ink and thread. Provide waste materials for re-use as well. It will make the process a lot more forgiving if you can actually make a mistake without ‘ruining’ something. However, if there is a shortage of a certain material, you can either ask the participants to bring it themselves, or to find a different way to make their project. Encourage participants to be inventive in their material use.



*Soldering the Fabschoolino, a customized Arduino by Waag Society for the FabSchool programme.*



## (INVENTOR) KITS

To explore the wonderful world of interactive object making (and testing), start with some of these inventor kits that will help you start work on electric circuits, conductivity, electronics, robotics and/or programming:

### *MakeyMakey*

[makeymakey.com](http://makeymakey.com)

Make electric circuits out of anything conductive! You can change everyday objects into 'touchpads' that can be used to control your computer. For some inspiration and to get started: [pinterest.com](https://www.pinterest.com) > search: MakeyMakey

### *Bare Conductive*

[bareconductive.com](http://bareconductive.com)

Use the touch-triggered 'Touch Board', Electric Paint, and the Starter Kit to make interactive projects. It doesn't need to be connected to a computer or a circuit. For some inspiration and to get started: [bareconductive.com/make](http://bareconductive.com/make)

### *Hummingbird Robotics Kit*

[hummingbirdkit.com](http://hummingbirdkit.com)

Make anything into a light-up, moving, sensing robot. The kit consist of the Hummingbird Duo Controller, power, USB, a tool for attaching electronics, motors, sensors and LEDs. For some inspiration and to get started: [hummingbirdkit.com/learning/tutorials](http://hummingbirdkit.com/learning/tutorials)

### *mBot*

[kickstarter.com/imbot](https://www.kickstarter.com/imbot):

An educational robot consisting of 38 assembly parts to get hands-on experience with robotics, programming, and electronics.

### *Arduino*

[mouser.com](http://mouser.com)

A kind of microcontroller that can be programmed. It has input and output ports to which you can connect a variety of sensors and actuators. For some inspiration and to get started: [fabschool.nl](http://fabschool.nl) > search: Arduino.

### *Arduino tinker kit*

[mouser.com](http://mouser.com)

Design interactive environments and electronic prototypes without using a breadboard or breaking out the soldering iron. The kit consists of a Sensor Shield, cables, and various sensors and actuators. For some inspiration and to get started: [arduino.cc/en](http://arduino.cc/en) or search for tutorials on YouTube.

### *LittleBits*

[littlebits.cc](http://littlebits.cc)

Use the colour-coded magnetic building blocks, 'Bit modules', to create electronic circuits in seconds; and combine them with craft materials to make projects. For some inspiration and to get started: [littlebits.cc/projects](http://littlebits.cc/projects)

### *SparkFun Inventors Kits (SIK)*

[Sparkfun.com](http://Sparkfun.com)

Start programming and working with hardware using the Arduino programming language. The SIK contains everything you need to make 15 circuits that will teach you how to control sensors and motors, display information on an LCD screen, and more. For some inspiration and to get started: a full-colour instruction booklet comes with the kit.

## MACHINES

FabLabs are equipped with digital fabrication machinery that can be used to fabricate and manufacture objects, installations, and actually, almost anything. Our FabLab, for instance, is equipped with 3D-printers, a vinyl-cutter, a laser-cutter, a CNC-milling machine, electronics, sewing and knitting machines, workbenches for soldering and using woodworking tools, microscopes, scanners, etc. If you don't have machines at your school or in your workspace, you can contact a local FabLab. There is a widespread, well-connected, and relatively dense FabLab network<sup>4</sup> around the world from which you can find contacts to see if there are possibilities for cooperation near you.

And, if you're interested in getting started with purchasing machinery for your locality or school, you can check out Bart Bakkers' Mini FabLab website. The miniFabLab explores affordable, desktop fab machines. The focus is on their potential uses at home, by artists, smaller schools, makerspaces, libraries, and mobile workspaces. Mini FabLab<sup>5</sup> researches, documents, and shares their possibilities, limitations, and ease of use.

<sup>4</sup> More info: [fabfoundation.org](http://fabfoundation.org)

<sup>5</sup> More info: [minifablab.nl](http://minifablab.nl)

**“I just turned 60,  
but this is definitely  
my highlight:  
I've made a computer myself!”**

— Aad (participant)





*3D-Printers in the Frysklab bus,  
the Fablab on wheels.*

## RECIPE #8

# REFLECTION

*Are you really learning?*

### INGREDIENTS

NOTEBOOKS

QUESTIONS

DAILY WRAP UP

YO-YO CHALLENGE

UNDER THE RADAR

When you cook something for the first time, you look at the recipe regularly. You taste while stirring to see if it needs more herbs or spices. You check the recipe (again) when you forget the next steps. When the cooking is done, you reflect on your recipe so that you understand what you've made, what you need to adjust, and how you might do it better next time. In other words, reflection is how you learn from the process.

Within the Teacher Maker Camp, there should be a good balance between the process of making and learning, and reflecting on the process of making and learning. It is your role to facilitate this reflection as part of this experiential education.

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*John Dewey: 'We do not learn from experience, we learn from reflecting on experience.'*



## NOTEBOOKS

There are different ways to make reflection part of your Teacher Maker Camp. Here are some examples of the things that we initiated.

We handed out booklets on the first day. These booklets can be made any way you want, but make sure it looks special and inviting so that people will want to sketch and write in it. Participants can use these booklets not only to document their process and write down interesting websites, but also to reflect on their learning.

## QUESTIONS

We asked participants the question: what did you learn today as a teacher, student, and maker? In maker education, the roles of teacher, student, and maker often alternate; so it is important to make a distinction between the three identities in order to rethink and (re)design one's own educational practise. We reminded people to answer the questions for themselves at a set time each day.

## DAILY WRAP-UP

Another way to facilitate reflection is to ask groups to present their works each day during a daily wrap up. But, to ensure people don't start elaborating on every step they took, ask them a straightforward question they have to answer (either individually or as a group). Some examples include: what did you learn today; how did you collaborate; come up with three words that describe the day or your project; and so forth. Have a few questions ready at the beginning of your Teacher Maker Camp and decide each day, depending on the moods and stated of minds, which questions you decide to tackle during the wrap up.

You can also decide to present a moment for reflection in the form of a challenge. The Yo-yo Challenge, for instance, helps people reflect on the way they prefer to learn.





A woman with blonde hair tied back, wearing a purple long-sleeved shirt and a patterned scarf, is looking down at a table. The background is slightly blurred, showing what appears to be a workshop or classroom setting with a guitar on a stand.

## SIDE NOTE

### UNDER THE RADAR

But, all that being said, you don't have to over-arrange and formalise reflection for it to actually happen. In the same way that you might not notice as bread or cakes slowly rise in the oven, a lot of reflection happens under the radar. Perhaps it happens during casual talks while participants are fidgeting with materials or just hanging around, are making lunch together, or decide to take a short break in the sun. Regardless of location, you can rest assured that that reflective thoughts are percolating, melding, and fermenting in the minds of your Teacher Maker Camp participants.

# YO-YO CHALLENGE

\* source: [kaospilot.dk](http://kaospilot.dk)



**WHAT**

A challenge to experience (again) how it feels to learn and what is important while teaching or facilitating others in their learning process.

**WHY**

In maker education, you are always teacher and student at the same time. But, as teachers, we tend to forget how we learn. This challenge allows you to reflect on the teaching and learning process and it shows the importance of 1) active learning; 2) autonomy in the learning process; and 3) room for failure. Three important aspects of maker education.

**TIME**

30 minutes

**NECESSITIES**

Yo-yos (one for each participant), and space.

Optional: flip chart, pencil, music

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## Instructions

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- 1 Put all the yo-yos in a central place in the room.
- 2 Deliver clear instructions: “Everyone take the yo-yo that calls to you and play with it for 10 minutes.” (or: everyone takes the yo-yo that calls to her or him and plays.. etc.)
- 3 Now choose something (a trick) you want to learn with the yo-yo, and try it for 10 minutes.
- 4 Choose a partner and talk about what you learned for 5 minutes.” Questions you might address as a facilitator: What is it like to play with a yo-yo again? Is it hard or easy? What happens when you try to learn something new and practise?
- 5 Now, stand in a line from those who feel ‘pretty good’ with the yo-yo to those who are not so confident.” Now divide into pairs, placing those who are ‘pretty good’ with the yo-yo with someone who is not so good. Then, start teaching them how to do the trick they want to learn.
- 6 Give the trick a name and present it to the rest of the group.” Put on some music and applaud each endeavour. There’s no failure here!
- 7 Discuss the following topics in the same pairs. Student: what was the difference between trying it yourself (that is, learning by doing and by making mistakes) and being shown/taught the technique?
- 8 Optional: discuss as a group and write down points on a flip chart. We are always learning. But, how do you learn? What insights did you get about how you learn? And how do you teach? How important is it to have a relationship with the student? How important is timing of input/intervention in teaching? What is

## RECIPE #9

# DOCUMENTATION

*Share your recipes*

### INGREDIENTS

#### DOCUMENT

INSTRUCTABLES, ETSY, GITHUB  
VIMEO CHANNEL, FLICKR PAGE

Remember that special dessert your favourite aunt always makes? Surely, it would be the icing on the cake for your next dinner party. Good thing she was kind enough to write down the recipe and share it with you, so you can make it for your guests!

The Maker Movement, like your kind aunt, is also known for documenting and sharing ideas, designs, and inventions. And, it's because of this cooperative attitude and practise of sharing that no one works in isolation. We believe that real (social) innovation arises from the bottom up (not the top down).







WE ALSO MADE  
A VIDEO OF OUR  
TEACHER MAKER CAMP

*\*Search for Teacher Maker Camp on Vimeo.com*

### DOCUMENT

Make sure to motivate your participants to document the things they have made and learned, so they can share their results with others. This way, they can learn from each other; and not just within their local maker environment, but all over the world. Additionally, they'll end up with a chronicle of memories relating to the ups and downs of their greatest failures and biggest successes.

### SHARE

Documentation is easily shared on the Internet. There are a lot of websites (like Instructables, Etsy or Github) that can help you share your projects and provide you with a great platform to make your designs visible in the world. Take a lot of pictures, draw quick sketches, create files, shoot videos, and make screenshots throughout the process. Then, combine these records of your progress in a document, making sure that you format it using a clear organizational structure. For example, start with a quick, two-line introduction to the project—what is it?

### VIMEO + FLICKR

Then, provide a list of all materials used and resources accessed. If you have any files a future reader may need, this is also a good place to put them. After that, make a numbered list with all the necessary steps for a successful project. Finish with comments about your experiments, failures, and decision making throughout the process. Finally, publish your documentation on, for instance, a Vimeo channel or Flickr page.

# Bouw je eigen modderbatterij



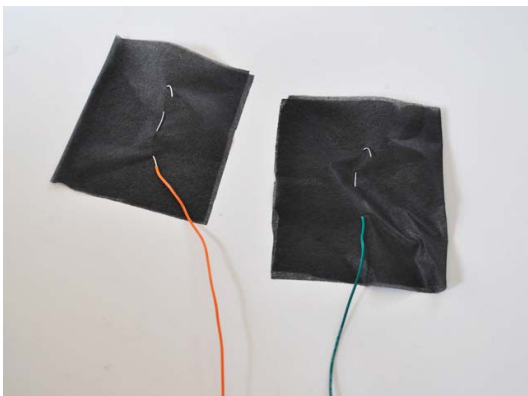
Je hebt nodig: schaar, modder, een schaal, elektriciteitsdraden, water, carbondoek, handschoenen, kabelstriptang, multimeter voor Volt & Ampère en een veiligheidsbril.



Maak het carbondoek nat. Knip 2 stukken van dezelfde afmetingen uit het carbondoek. Zorg dat het doek groter is dan je schaal, zodat je het 2x dubbel kunt vouwen.



Pak de elektrische draad erbij. Knip hier twee stukken van af, lang als je schaal is.



Je hebt nu 2 zelfgemaakte elektroden. Eén plus en één min elektrode. Deze ga je straks gebruiken in je schaal met modder.



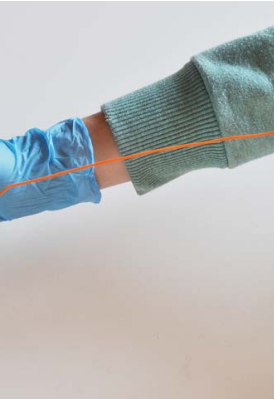
Haal een emmertje modder uit je tuin. Vul vervolgens het schaal met een laagje van 1 cm modder. Maak je vingertoppen een beetje nat zodat je de modder goed kunt aandrukken.



Leg nu het ene carbon doek op de laag modder. Druk het doek aan zodat het goed maakt met de schaal verder. Zorg dat er zo luchtbelletjes



# erij



elektrociteitsdraden  
van twee gelijke  
dikte, ongeveer zo  
lang als je arm.



Het eerste velletje  
van de eerste  
batterij. Dit is de min  
ste dikte. Druk dit goed aan  
om goede contact  
te maken met de  
modder. Vul de  
batterij met modder.  
De batterij moet  
zo min mogelijk  
open te zien zijn.

## SIDE NOTE

### INSTRUCTABLE EXAMPLE



Je gaat nu de 2  
elektrociteitsdraden  
strippen! Dit doe je met de  
kabelstriptang. Verwijder  
aan de ene kant 1 cm van het  
gekleurde plastic en aan de  
andere kant 5 cm.



Het tweede velletje  
carbondoek leg je bovenop  
de laag modder. Dit is de  
plus elektrode. Je batterij  
is af! Na een paar dagen  
begint deze te werken.  
Met de multimeter kun je  
dit in de gaten houden.

Want to document like a pro?

Good documentation includes:

- An overview of materials used
- An explanation of decisions about design and construction
- A lot of visuals
- A step-by-step explanation of process (using either pictures or video)
- Links to resources (like websites and books) used during the process
- Advice for potential improvements

The instructable on the left is an example of how we do it.

Want to get inspired by lots of different Instructables from the minds of Waag Society?

We've made a special website where we collect DIY projects for in the classroom.

**[fabschool.nl](http://fabschool.nl)**

## RECIPE #10

# FUN

*Don't forget to season your meal*

### INGREDIENTS

### DECORATION

### SOCIAL DINNER

### WORDS & TERMINOLOGY

### ROCKET CHALLENGE

Placing a plate of bland Brussels sprouts with no salt or pepper in front of your guests is usually a recipe for disaster. But, if you season the meal generously with spices, they might be more likely to enjoy it. Cooking and making should be fun! And so should your Teacher Maker Camp.

Make sure you allow your participants (and yourself) the freedom and time to play and to fool around. And don't be bland! Throw in some spicy ingredients and build in some elements that set the right tone.



Creativity is  
allowing yourself  
to make mistakes.  
Art is knowing  
which ones to  
keep.

Scott Adams



## DECORATION

The ideal kitchen is both clean and charming, but not so perfect that you recoil at the thought of getting it dirty. Your kitchen should invite you to cook (and cooking is messy business). In much the same way, an orderly and attractive (yet never pristine) maker workspace should invite your participants to work. So, here are some ingredients to help you decorate and create a space that radiates love for creation and makes you want to start without any hesitation.

We have the advantage of being housed in a beautiful old building that looks a bit like a castle (complete with spiral staircases, hidden tower rooms, and a domed theatre). But beautiful architecture isn't enough on its own, and we wanted to draw participants into a playful mood as soon as they arrived. To liven up our medieval atmosphere, we decided to build a Makey Makey piano in the stairwell at the entrance to our building. Each stair had a different tone, so participants could play a tune as they touched different steps. We did this, primarily, to add an element of surprise and to send the message that, in our space, play and fun are allowed.

Make sure you put your materials, tools, and machines out in the open and not behind closed doors or cabinets. You want to invite people to take materials in their hands, to touch them and fidget with them, smell them, and start tinkering—even if there's no idea behind any of it. Also, it's a good idea to have some of your own (or your team's) prototypes lying around. They act as conversation starters, triggering questions, ideas, and your participants' imaginations.

Put up a lot of posters with inspiring quotes and statements from your heroes, makers, inventors, hackers, artists, educational professionals—you name it. Make sure you choose some funny and controversial quips. Not only will it look nice, it will show where you get your inspiration from, pays tribute to the founders, and gets the conversation going. After our Teacher Maker Camp, we had many teachers asking for our quotes, so they could decorate their classroom or school with them.

It's also helpful to create hideaways: places to relax and get away from the buzz of the workspace. Participating in a Teacher Maker Camp can be very intense. And because creativity demands moments of wandering and stillness, you will need to create comfortable and sheltered corners to encourage states of calm and imagination.

An idea we have toyed with (but have not been able to execute just yet) is filling each room with a huge pile of a single (residual) material, such as cloth, sponge, wood, or styrofoam. The idea would be to softly push participants to work with just one ingredient, which would necessarily introduce constraints. These constraints would then force them to be more creative and treat the material in an innovative way.

This is quite a common practise in art education, and we believe it could be enormously interesting and beneficial to adopt this strategy during a Teacher Maker Camp. If you decide to do so, please let us know how it worked out!



## SOCIAL DINNER

One valuable lesson Sylvia taught us is that it people sometimes need time to withdraw into themselves (either alone or in small groups) to rethink things, to let things settle, to reflect on their learning process, or just to, well, have a moment to do ‘nothing’. With that idea in mind, and because we have many nice bars and restaurants in our vicinity, we decided not to over-organise dinner and lunch. Participants were given set times when programme sections started, but in between, they were free to organise themselves in terms of going out for or bringing in lunch and diner. This worked very well.

We do, however, advise you to organise at least one social dinner with your participants—preferably on the first or second night. Providing a relaxed, social atmosphere with good food and drink will help everyone involved to get to know each other and discuss their ideas for the camp. And if your space allows it (ours unfortunately doesn’t), why not have participants cook together? At our Teacher Maker Camps, we laser-cut the sandwiches with inspiring sayings and created a musical dessert buffet using the Makey

Makey. After dinner, we found participants in a pudding jam session. We count that as a success.

Another thing we have not yet tried, but would love to organise in one of our next Teacher Makers Camps is a night of playing with fire. Not only is playing with fire very instructive, but it’s also fun—and a little bit dangerous. Danger means risk, and learning to take risks is an important part of innovation. If you are interested in doing ‘dangerous’ things with children, check out Gever Tulley’s 50 Dangerous Things (You Should Let Your Children Do).

## WORDS & TERMINOLOGY

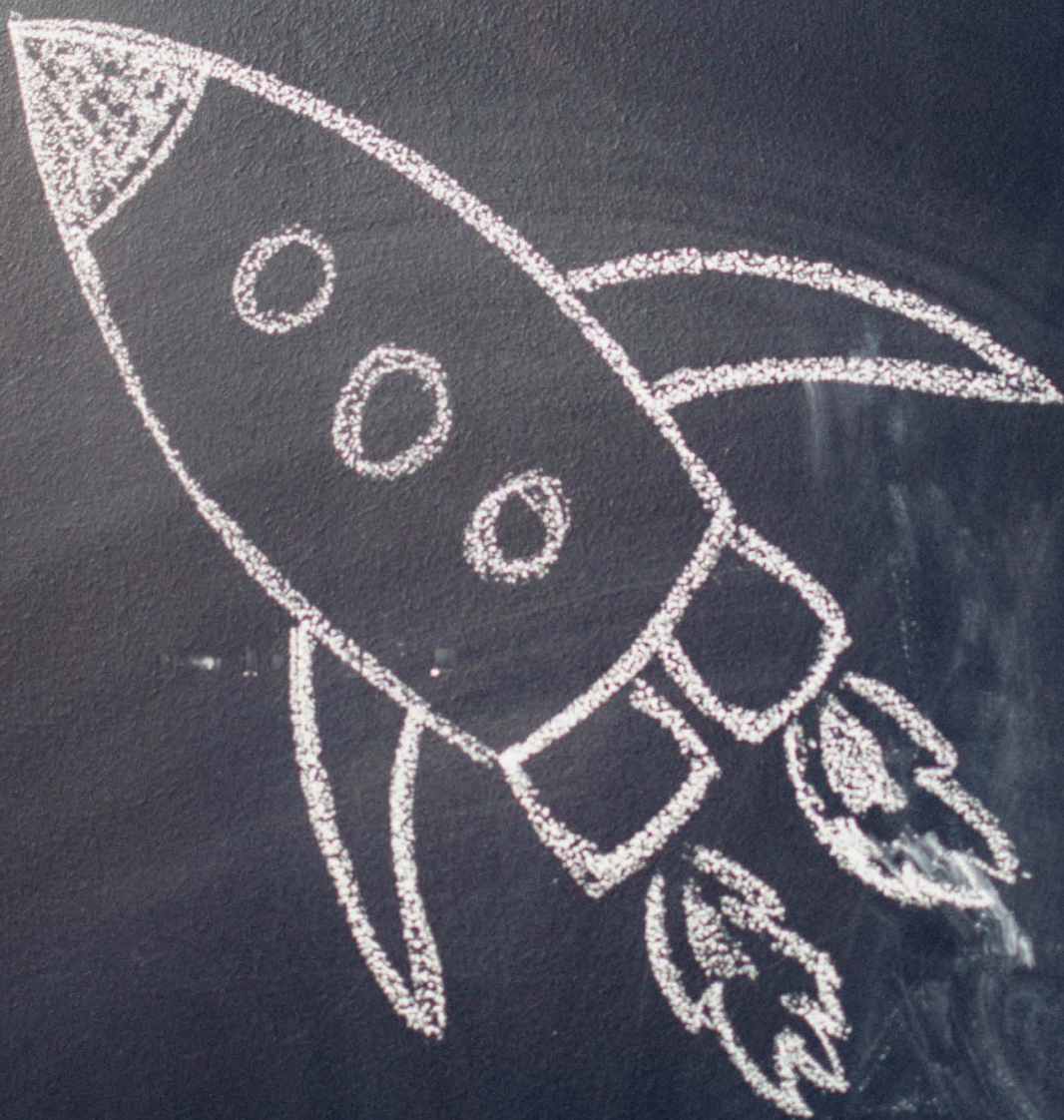
Lastly, we found that it worked well to play with fun words and terminology that might not have meant that much in the beginning, but over the course of a weekend become commonly used expressions. In our programme, for instance, we called our final demonstration of projects, ‘Fabuleuze Fabricaten en Meesterlijke Mislukkingen’, which translates to ‘Fabulous Fabrications and Masterly Mishaps’, and to which we like to add: \*Bonus points for explosions.



*Makey Makey desert buffet*

# ROCKET CHALLENGE

\* source: [wikihow.com/Build-a-Bottle-Rocket](http://www.wikihow.com/Build-a-Bottle-Rocket)





**WHAT**

Group challenge on building and launching your own rocket. The highest rockets wins, or give an originality prize for the most beautiful one.

**WHY**

For fun! Why not?! The nice thing about this challenge, like all other challenges, is that this is something teachers can immediately implement in their teaching when they go back to their schools.

**TIME**

30 – 45 minutes

**NECESSITIES**

Plastic bottle, cork, bicycle valve, bicycle pump, craft supplies.

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## Instructions

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- 1 Make a small hole in the cork (using a hand drill). Put in the valve as tightly as possible.
- 2 Design and decorate your bottle.
- 3 Fill the bottle with water (about  $\frac{1}{4}$  to  $\frac{1}{3}$  full). Close your bottle with the cork
- 4 Place the bottle in an upright position on a launch platform ( you could use a crate, for instance, or build one yourself). Now, attach the bicycle pump to the valve.
- 5 Empty and close off your launch area.
- 6 Ready for take off... pump... 5, 4, 3, 2, 1, go!

# *Epilogue*

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*So what does it  
tastes like?*

## **FABULOUS FABRICATIONS THAT TAKE THE CAKE**

It is truly incredible to see what participants are able to accomplish and learn in just four days. On the last day, spirits are high and work ethic is strong. It is fantastic to see how many pots and pans people are able to balance on the proverbial stove. As participants run around trying to get their prototypes working, you'll hear excited yells from all corners in the building, and watch as people get so caught up in their projects that they forget to eat or go to the toilet.

At our final, festive show and tell, DIY interactive wearables were shown; boxes for multi-sensory learning were presented; spinning lights casting poetic shadows were demonstrated; and interactive mobiles, birds, marble tracks, and small flower fields à la Daan Roosegaarde took the stage. One of our groups, a team of four primary school teachers, managed to get their 'dBeter' working. The 'dBeter' was a decibel meter meant to encourage their students to calm down and be silent in a playful manner. Their project made use of sensor technology; was programmed on a self-soldered Diavolino; and featured 3D-printed smiley faces housed in a custom wooden box made with a laser cutter. The group really surprised and impressed us.

Afterwards, we, as organizers, naturally want to know what our guests thought of the meal we presented to them. What did it taste like? And are they leaving the table hungry for more? To gather this information, we ask our participants to provide us with feedback on their (learning) experiences. Since responses differ enormously, it can be hard to get one, clear answer, so we use the responses to highlight interesting outcomes and sketch a general idea of how the camp went.

### **A HEAVY MEAL?**

On average, our reviews are good; Teacher Maker Camp is evaluated very highly. We haven't received our Michelin star (yet), and there is definitely room for improvement, but we can proudly say that most people like what we've put on their plates. And we think it's interesting to see that what people report learning from their experience is very diverse. For instance, the most important skills developed, according to participants we surveyed, include everything from '3D printing', 'laser cutting', and 'scaling projects' to 'dealing with uncertainty' and 'trust'.

And, participants report that the most important insights gained are: 'making is trial and error'; 'learning to let go is difficult, but when you manage to do it, it is very rewarding'; 'it is possible to create a playground in the classroom'; and 'as a teacher, it is possible to create conditions for experimentation'. We



do have to admit that our meal is a bit on the heavy side. We need to work on balancing our programme because, at the moment, it is very intensive. Also, we have to improve ourselves in terms of supporting people with hardly any computer skills. And, we have to find ways of compromising with people who experience difficulties in cooperating in with others in projects.

But, the fact that everyone involved gets something different out of Teacher Maker Camp is both intentional and rewarding. To us, it is important to be able to meet the needs of different skill levels and interests, and to tap into different motivations.

We hope to have many more Teacher Maker Camps not only here in Amsterdam and throughout the Netherlands, but also all over the world. We're preparing the menu, and we think it's mouth-watering. We expect full restaurants!



# *Appendix*

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*Some last  
handy stuff*

# #TEACHERMAKERCAMP

*Enthusiastic about this digital booklet? Spread the makerspirit and share it!*

MAKEREDUCATION.NL



*A Dutch maker education platform  
for and by schools, makers and makerspaces.*

# Annex I: inspiration

FEEL FREE  
TO SHARE  
THIS LIST.

STUFF THAT INSPIRED  
US DURING  
TEACHER MAKER CAMP

Here is an (incomplete) selection of books, videos and websites that inspire us.

## + Inspiring books

Invent to Learn: vision and practical guide on maker education: <http://www.inventtolearn.com>  
The Art of Tinkering: <http://tinkering.exploratorium.edu/art-tinkering>  
Dangerous things for kids: <http://www.fiftydangerousthings.com/>  
Computer science without a computer for kids: <http://csunplugged.org/>

## ● Inspiring websites

Tinkering school: <http://www.tinkering.school.com/>  
Instructables: <http://www.instructables.com>  
Etsy: <https://www.etsy.com>  
Github: <https://github.com>  
Make (magazine): <http://makezine.com>  
Wired (magazine): <http://www.wired.co.uk/news/archive/2013-03/13/digital-fabrication>  
Exhibition Power of Making V&A London/product design: <http://www.vam.ac.uk/content/articles/p/powerofmaking/>  
NYC Makers, MAD Biennial New York: <http://madmuseum.org/exhibition/nyc-makers>  
Textiel Museum, Textiel Lab: <http://www.textielmuseum.nl/en/>

## - Inspiring videos

FabLab founder and visionary: <https://www.youtube.com/watch?v=aPbJmYCSCgA>  
Maker the movie: <http://designthinkingmovie.com>

## + Makers, ideas and instructions

Exploratorium tinkering studio: <http://tinkering.exploratorium.edu/>  
Tech for kids: <https://diy.org/>  
Coding for kids: <http://www.helloruby.com>  
FabLab projects: <http://fablab.waag.org/projects>  
Smart textiles: <http://www.kobakant.at/DIY/>  
Smart textiles: <http://etextilelounge.com/>  
Tech & design: <http://www.instructables.com/>  
Furniture designs: <http://makingsociety.com/2013/02/20-open-source-furniture-designs/>

## ✂ Background information

Makers Movement: [https://en.wikipedia.org/wiki/Maker\\_culture](https://en.wikipedia.org/wiki/Maker_culture)  
Maker Education: LINK

HANDY! :)



USEFULL TO CHECK OUT BEFORE  
YOU START USING A MACHINE.

#### \* Art, Media & Design

Anouk Wipprecht: <http://www.anoukwipprecht.nl>  
Lucy Mcree & Bart Hess: <http://lucyandbart.blogspot.nl>  
Dirk van der Kooij: <http://www.dirkvanderkooij.com>  
Maria Blaisse: <http://www.mariablaisse.com/maria/home.html>  
Régine Debatty: <http://we-make-money-not-art.com/>  
Royal College of Art: <http://www.rca.ac.uk/>  
Theo Jansen: <http://www.strandbeest.com>

#### Pressfit constructions

<http://fablab.waag.org/archive/press-fit-boxes>  
<http://techcrunch.com/2014/09/01/press-fit-standing-desk-review-an-affordable-option-with-u-s-manufacturing-and-materials/>  
<https://www.pinterest.com/taniagsaez/press-fit/>  
<http://makezine.com/2015/03/09/fab-academy-adventures-7-press-fit-construction-kits/>

#### 3D printing

<http://reprap.org/>  
DIY: <http://lifehacker.com/how-to-get-started-with-3d-printing-without-spending-a-1340345210>  
Building a 3D printer: <http://3dprintingfromscratch.com/common/how-to-build-a-3d-printer-from-scratch/>

#### Laser printing ideas

<https://www.pinterest.com/cartridgeshop/laser-printing-ideas/>  
<https://www.ponoko.com/>  
<https://www.laserbeest.nl/laserbeest-in-english/>

#### Open source software

3D modelling for beginners: <https://www.tinkercad.com/>  
Furniture design: <http://sketchchair.cc>

#### \* Websites in Dutch

Arjan van der Meij, teacher maker blog: <http://makered.nl/>  
Astrid Poot, creative learning: <http://www.astridpoot.nl/>  
Leo van der Veen, interactive objects: <http://nr37.nl>  
Tutorials and maker projects for kids: <http://fabschool.nl/>  
Coding for kids: <http://www.codekinderen.nl/>

COOL  
YOU  
IN  
PROJECTS  
CAN USE  
THE CLASSROOM.

# Annex II: programme example

## ~~Annex I~~ Example programme

### Day one

- 10:00 **Introduction**  
10:15 **Challenge** Magic Machine – Imagining with your hands  
11:15 **Tour** Introduction to the machines and materials  
13:30 **Make** Team Building and idea-generation  
17:30 **Reflect** Crazy Breakthroughs, Masterly Mishaps and Fabulous Fabrications  
18:30 **Social Diner** Collective dinner at Waag Society  
20:00 **Talk** Maker Education: Sylvia Libow Martinez and Gary Stager (Invent to Learn)

### Day two

- 10:00 **Challenge** Marshmallow Challenge  
11:00 **Make** Work on own projects  
17:00 **Challenge** Toothbrush Challenge  
17:30 **Reflect** Crazy Breakthroughs, Masterly Mishaps and Fabulous Fabrications  
18:30 **DIY Diner**  
20:00 **Talk** Hacking and Inventing: Eibert Draisma and Mitch Altman (hacker / inventor)

### Day three

- 10:30 **Inspiration** Visit Cinekid Medialab / Joris Laarman Lab  
12:00 **Make** Work on own projects  
17:00 **Challenge** Rocket challenge  
17:30 **Reflect** Crazy Breakthroughs, Masterly Mishaps and Fabulous Fabrications  
18:30 **DIY Diner**  
20:00 **Talk** Playing and Learning: Astrid Poot and Loes Bogers (HvA)

### Day four

- 10:00 **Challenge** LEGO / Yo-yo Challenge  
11:00 **Make** Work on own projects  
12:30 **Talk** Neil Gerschenfeld (MIT / Skype)  
13:30 **Make** Work on own projects  
17:00 **Show and Tell** Festive presentation of Fabulous Fabrications  
19:00 **Drinks**

— TIME TO SHINE —

# Annex III: tasks for Lego challenge

ARE YOU  
READY FOR THIS?

## TASKS FOR LEGO CHALLENGE

1. You are the only person allowed to build (put together pieces) in the first 3 layers of the structure.
2. You are to ensure that the 3rd and 4th layers in the structure consist only of yellow pieces.
3. You are to ensure that the 2nd and 6th layers of the structure are made up of exactly 8 pieces.
4. You are the only one allowed to build (put pieces together) on layers 5 and 6 of the structure.
5. You are to ensure that a maximum of 8 pieces are used in layers 3 and 5 of the structure.
6. You are to ensure that any pieces next to each other in the 1st, 6th, and 8th layers are not the same colour.
7. You are to ensure that you, and 2 others must build in layers 4 and 8.
8. You are to ensure that layers 2 and 5 of the structure consist only of red pieces.
9. You are the leader of the group. You are to ensure that the construction is completed as fast as possible whilst ensuring that all participants have succeeded 100% in their tasks.
10. You are to ensure that max. 3 people build (put together pieces) in layers 4 and 7.
11. You are to ensure that layer 7 consists of max 10 pieces.
12. You are to ensure that the construction consists of max 10 layers!
13. You are the project manager and need to support in completion of the problem as fast as possible.
14. You have the opportunity to define your own emergent role/task as the exercise unfolds.

STAY CURIOUS -