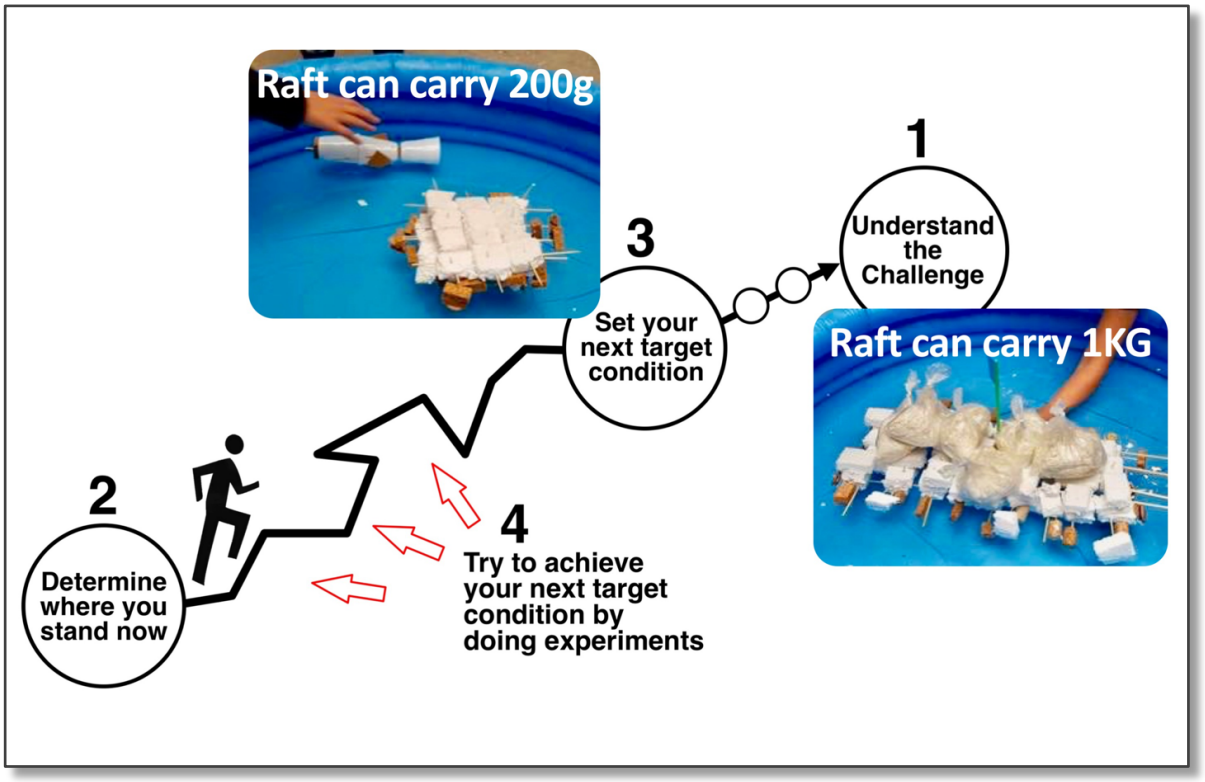
Kata for Kids: Designing rafts

A follow-on exercise after running the Kata in the Classroom puzzle exercise

By Jasmin Rengers-Gerritsen & David Bogaerts



The ability to apply a scientific thinking pattern, a pattern (or kata) in which we realise challenges, by overcoming obstacles one by one by doing experiments and reflecting and learning from them, might be one of the greatest virtues someone can possess. We see that many people of our own generation struggle with applying this pattern in their everyday live and because of that miss opportunities to take steps in realising their biggest dreams. Don't worry, we haven't given up on our own generation and we never will. However, just in case we might not entirely succeed with ourselves and our peers, we focus on the future generation too.

So we created 'Kata-for-Kids' workshops. Workshops designed to let children apply a scientific pattern.

In the workshops we follow two guiding principles:

1. We want our students to follow the basics of a scientific thinking pattern
2. It must be fun for our students since we do not want to waste their valuable time

Before we dive into this workshop and the outcome, lets first introduce the major players.

Designing rafts

Our major players are:

- **Class BD,** a group of approximately 30 kids, 9-12 years of age
- **Carolien:** their teacher
- **De Amsterdamse Montessori School**: a primary school, located in Amsterdam, The Netherlands

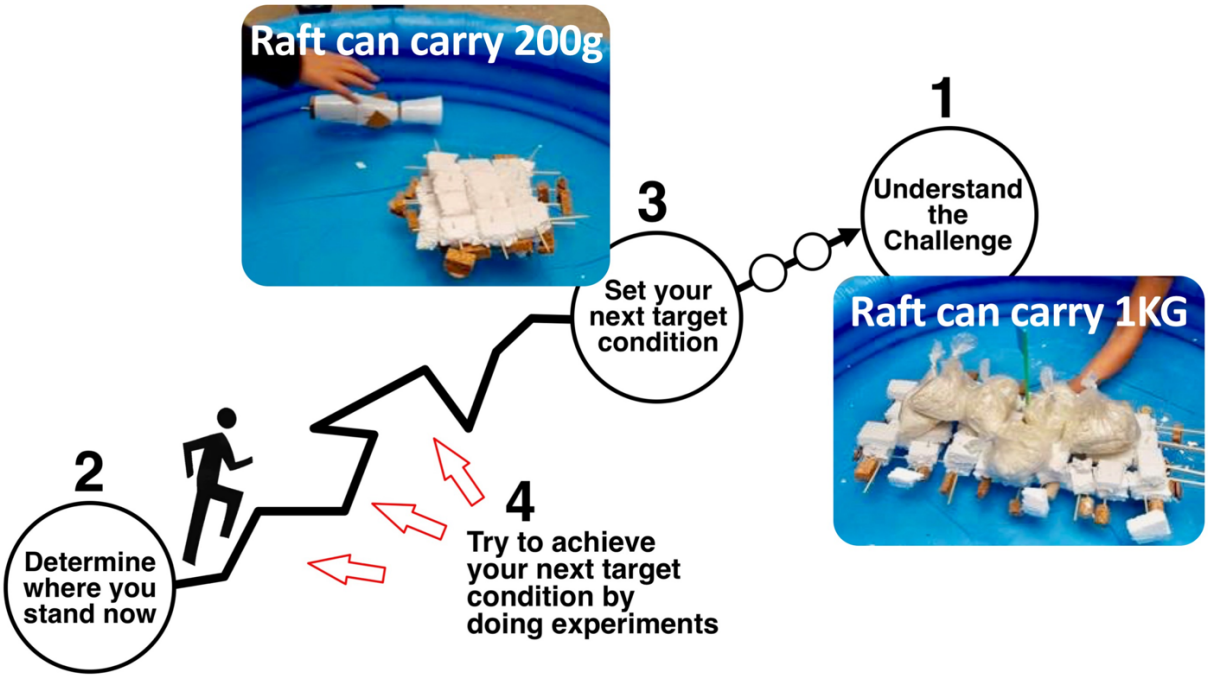
Setting the stage
First we created an environment in which the students 'start to wonder'. Something like this:

'Today we are going to do something which you might not do very often at school. We are going to build rafts. But not just that. We are going to build rafts in the way real scientists would do so: by doing as many experiments as possible.
Does anybody know what an experiment is? Yes, indeed a test! And what can happen with a test? Indeed, it can succeed or it can fail. And it doesn't matter whether it succeeds or fails since in both cases we learn about the next step we could take.
The challenge you will work on this afternoon and tomorrow afternoon is to build a raft which can carry 1 kg of weight and still keeps on floating. The raft must be constructed of separate pieces of 32 cm³ (= approximately 2 cubic inch) *or smaller.'*

The extra criteria on the size of the pieces was wisely added by Carolien to make the challenge a bit more difficult to achieve.

Introducing the 4 steps improvement pattern
After setting the scene we introduced Mike Rother's four steps improvement pattern (see drawing below). We explained that this will be the way of working during this workshop. We repeated the challenge and gave the first target condition: a raft which can carry 200 grams.

Drawing: the challenge and first target condition



Carolien divided the class in teams of 4 – 5 students. We explained one last ground rule before our young scientists could start:
'When you are ready to do an experiment, come to us'

Then we gave the signal to start: '*Assess your current condition by assessing the material available* (mainly Styrofoam, cork, cocktail sticks, skewers and glue), *and design your first experiment: your first raft'*.

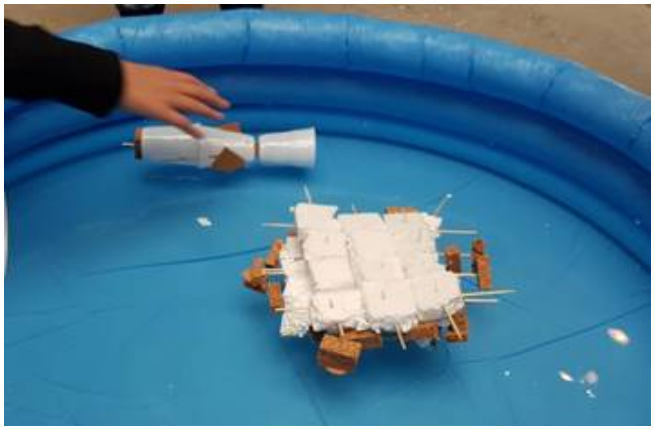
The workshop

Immediately after the call for action our scientists started to work: the teams assessed the material they had at hand and began to make a first version of their raft.

Soon the first team came to us with the request to perform a test. Our test lab was a blue inflatable swimming pool, filled with water. The weight we used for the tests were small bags containing 200 grams of flower.
Before executing the test the team had to explain again the current condition and the target condition. We asked them to write this down on the reflection sheet (see below). We also asked the students to explain to us what they expect will happen when doing the test and also to write down the expectations. A team was only allowed to do a test after filling in the sheet.

Drawing: reflection sheet used for each iteration

After putting the weight on the rafts we asked the team to look and see what really was happening and to reflect on what they have learned. Every time a team was doing a test we used the reflection sheet and we asked the team to fill it in. We noticed that after two or three iterations our scientists were used to doing this themselves. The only thing they needed once in a while, was a gentle reminder.



It was great to witness the screams of joy and enthusiasm of each team when their first rafts actually floated. And the enthusiasm continued with every test the teams performed.

The weight each raft could carry rapidly increased with each iteration. All teams reached the 1 kg challenge and even went over it (some rafts could carry a weight of 4 kg at the end of the second afternoon!). However, we saw something else, and probably more important, happening too. During the first tests the young scientists tend to answer the question '*What happened*?' with a response like 'Yeah, *it floats!*'. After the second and third tests, the responses changed:

'I see the raft is bending a bit in the middle? We should make it stronger at this and this point'
'We don't have enough room to place more weight. We must make it bigger?'
'Are those plastic cups we put on as floaters really helping? We thought they would help but they're not even touching the water. Shall we pull them off to see what happens?'
'I see the raft is making water. We must solve this'

In the beginning of the workshop testing and experimenting was a bit scary for our scientists (and *testofobia* is problem if you are a scientist). *'What if it sinks', 'I am too afraid to put on the weight'*. At the end of the workshop our test lab was overused. Teams had to queue to perform tests. Our test lab became the bottleneck for our young scientists to make progress!

Reflection

We finalised the workshop by asking the teams to reflect on the following questions:

Can you describe the way we worked yesterday and today?
What do you think about this way of working?

The answers ('*small steps, testing to see if it works, working together but having our own tasks'*) clearly indicated that this class grasped the approach they had been following. The class even could reproduce how testing and experimenting was helping them to reach their challenge. This group of young enthusiastic students are clearly capable in applying scientific thinking.

Let's end this writing with an important lesson we have learned ourselves from this workshop. At a certain moment we asked one of our young scientists *'if he could ever have imagined that he would come this far. Exceeding the weight of 2 kg!*' His team had just tested their raft with a weight of 2600 gram. His answer was '*No, I never could have imagined*'. Then we asked the question: *'Did you think upfront that you could reach the weight of 1 kg'*. His somewhat shocking answer was '*Yes, otherwise you wouldn't have given us the assignment*'.

This was a clear reminder for us: be very careful not to limit the aspiration and imagination of others by the standards, challenges and guidelines we set. When was the last time you stop trying to fly just because someone told you that you don't have wings?

Please, keep on trying,
Jasmin and David