

Curriculum Materials

Learning Journey

A Wisp of Air



Erasmus+

The CEYS project has been funded with support from the European Commission under the Erasmus+ programme (2014-1-EL01-KA201-001644).

Learning Journey

A Wisp of Air



An Cordeels
Sint-Bavobasisschool



Background

- Urban setting
- School uniform
- Social & ethnical mix
 - Many children not fluent in Dutch
- No dedicated classroom to organise courses in Science Technology Engineering and Mathematics (STEM)
- This is the 3rd STEM-lesson in the year
 - Children are looking forward to these courses
- Children age 7-8



Focus

- Increase participation and motivation to find creative solutions:
- Enrich children's language and discussion (dialogue)
- Encourage children's questions and reflection about what they see (reflection)
- Stimulate children to look for logical explanations and reasons (reasoning)
- Work collaborative in heterogenous groups (collaboration)



Synergies: dialogue and collaboration, reflection and reasoning

Learning activities: Questioning, making connections, explaining evidence, communicating explanations

Creative dispositions: motivation, ability to come up with something new, ability to work together, thinking skills.

Rationale

I wanted every child to be involved in the process – children to really cooperate with each other and discuss problems with each other by asking questions. It was also important that every child had a feeling of success. In this way they would remain motivated for school.

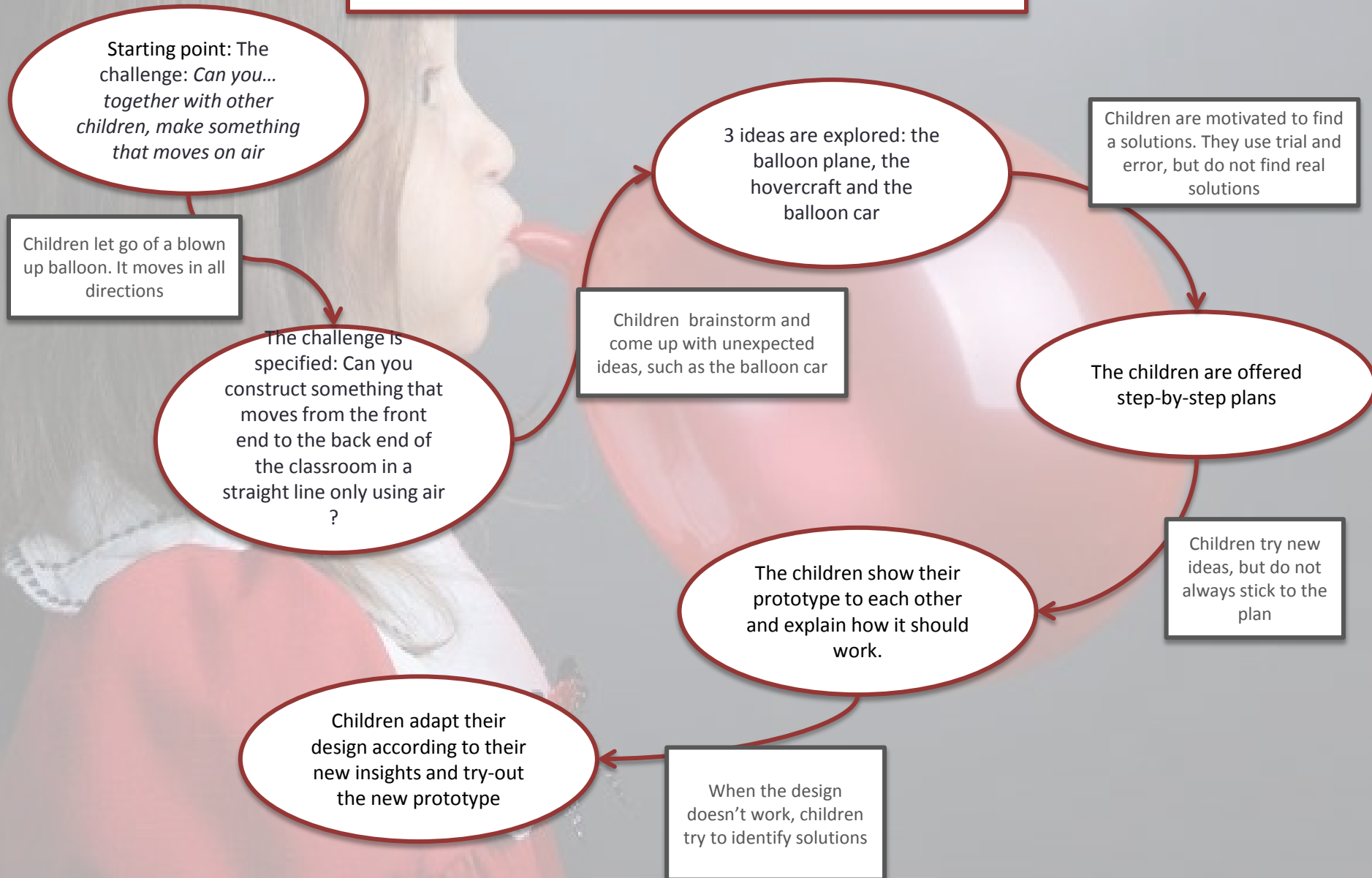
I wanted to find out:

- How can I involve every child in this activity?
- How do I stimulate them to discuss problems with each other?
- How do I teach them to ask each other questions?
- How will the children remember the new knowledge?

The implications for my planning and teaching

- Increase participation:
 - Wide range of materials and objects are supplied.
 - We start from a challenge
- Success story for every child
 - By using step by step guides and instruction videos
- Enrich their language (dialogue)
 - New vocabulary on post-its attached to the blackboard to improve their dialogue
- Ask each other questions
 - Make a note of 'question' words
 - Reflect about what they see and ask questions about it (reflection)
 - Stimulate children to look for logical explanations and reasons (reasoning)
- Work collaborative in heterogeneous groups (collaboration)
 - Let them choose, a maximum of 4 members is allowed

Overview of Learning journey



- **Starting point:**
 - The challenge: *Can you... together with other children, make something that moves on air?*
- **Learning journey:**
 - The children first try out a few solutions without additional background information.
 - They get a lot of material: balloons, rope, clothespins, tape, CD's, caps of sports water bottles, straws, construction paper, scissors, ...
 - The children get information sheets with additional information in order to reach a solution.
 - The children present their solution to each other and give explanations.



Developing the learning journey: Starting point (5')

Activity: letting go of a blown up balloon

Rationale: the children will get a challenge. In this phase I want to **motivate** them for this challenge and they become interested in the topic. I want to give them the opportunity to **reason** ...

Teacher questions

*What happens with the balloon?
What made it move? Who can
explain this?*

*There is an engine
in the balloon,
making it fly...*



*It's like an
engine!*

... just like a car

The children

- put their ideas into words
- think ahead: trying to find scientific **explanations**.
- start explaining, **clarifying** and comparing.

- Children are motivated
- They already have scientific ideas
- There are some misconceptions

Implications:

I notice this really motivates the children. I want to address some **misconceptions**. The challenge will give the children the opportunity to investigate their ideas. Children will be able to **connect** what happened here with the challenge.

Developing the learning journey: Ideas for moving on air (5')

Activity: brainstorm

Rationale: The challenge should be clear for all the children. In this way they will be stimulated to **discuss different solutions** and they will be stimulated to **come up with new ideas**.

Teacher questions and comments:

Can you construct something that moves from the front end to the back end of the classroom in a straight line only using air ?

- The children **reflect** on every idea, deciding if the idea matches the criteria of the challenge and how well it might work.
- They have **original, unexpected ideas** (car)

- My open questions, challenge the children to reflect.
- Children become more **critical** about their solutions and start to question each other
- My warm connection with the children, encourages them to **communicate** their thoughts.
- They have some **unexpected ideas**

Implications:

The children have some ideas which they want to test. They have **ownership** and are **motivated** to work on their own ideas (car). They want to **cooperate in groups** they chose themselves. This is what they will do during the next activity

Letting go of an inflated balloon as we did...



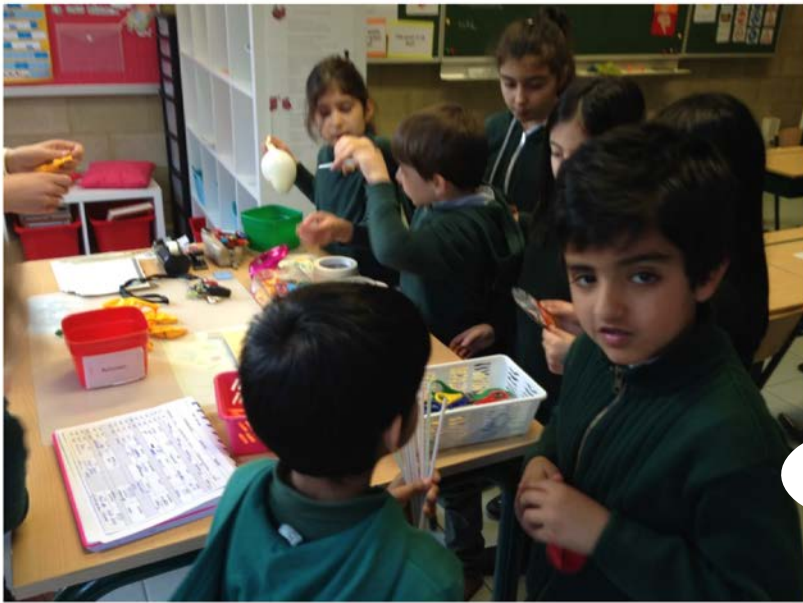
... but the balloon will not fly in the 'right' direction. The balloon needs a steering wheel

We can attach the balloon to a car. When air leaves the balloon, the car will move.

Developing the learning journey: Let's get to work (12')

Activity: Exploring the different materials and experimenting with them

Rationale: Children want to test their ideas. In this way they will be able to investigate if their ideas work. They will need to **reflect and reason** with their peers in their group which materials are suitable. They need to **collaborate** to find a solution.



- The children explore new ideas freely.
- Their ideas will not always lead to good solutions, but they are motivated to keep on searching...

I gave the children opportunities to freely explore their ideas. In this phase, I do not want to intervene. Most groups do not find a working solution, but I really want the children to have a successful experience.

Lets attach wings to the balloon... this will help to make it fly...

And lets connect several balloons to each other. Maybe it will fly further...

Implications:

It is hard for the children to find a solution. To keep them **motivated**, the children will get more concrete information on how to find a working solution

Developing the learning journey: Let's use additional information to find a solution (12')

Activity: Children get step-by-step guides to find a working solution

Rationale: The step-by-step guides will increase their intrinsic **motivation**. It will stimulate them to **connect** the dots and to let them have a successful experience

Teacher questions and comments:

Why doesn't it work? Look carefully to what is happening. Think about what you might adjust. What would be the effect if the balloon is inflated more?



The children rush into the task and are not analysing the step by step guide enough.

The children use a lot of trial and error. Not all of them find it easy to keep on trying. I ask questions to encourage them to reason and keep on searching for a solution. When they present their results to each other, they will have the possibility to reason with their peers.

Implications:

To make sure the children **reason** about their solutions, they will present their solutions to each other. They will get the opportunity to optimize their design based on their **explanations**

Developing the learning journey: Let's present our solutions to each other (15')

Activity: The children present their solutions to each other

Rationale: They will **explain and communicate** what they did. **They will find out themselves** why their vehicle is not working and optimize their **solution**. In this way, by experimenting, they will find **evidence** that their **scientific ideas** are (in)valid. They will realize that by thinking together they can find a solution.

Activity 1: The balloon plane

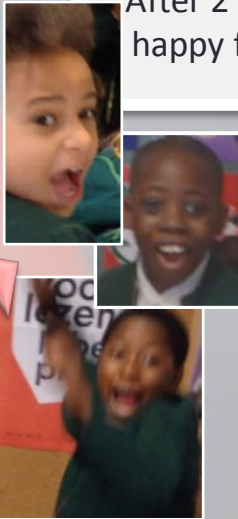
What did you expect to happen?



It didn't move. Can you explain this?



Wow!! Yippie!



After 2 trials: happy faces!

There is too little air in the balloon

The wings are too heavy

Let's cut off the wings and try again

- The children come up with solutions
- They are motivated to solve the problem

I provide enough time for discussion and adaptation of the design. In this way, they can adapt their design and have successful experiences. I think this is crucial to keep children motivated.

Developing the learning journey: Let's present our solutions to each other

Activity: The children present their solution to each other

Rationale: They will **explain and communicate** what they did. **They will find out themselves** why their vehicle is not working and optimize their **solution**. In this way, by experimenting, they will find **evidence** that their **scientific ideas** are (in)valid. They will realize that by thinking together they can find a solution.

Activity 2: The hovercraft



How can I attach this CD to the balloon?



The string around the balloon prevents the air from escaping.

What is happening?
Why doesn't it move?



Wow! It really moves

The holes in the disc don't match the ones in the balloons.

I think successful experiences are crucial to keep children motivated. I provide enough time and discussion to find a good solution.

- The children come up with new solutions
- They are motivated to solve the problem

Developing the learning journey: Let's present our solutions to each other

Activity: The children present their solution to each other

Rationale: They will **explain and communicate** what they did. **They will find out themselves** why their vehicle is not working and optimize their **solution**. In this way, by experimenting, they will find **evidence** that their **scientific ideas** are (in)valid. They will realize that by thinking together they can find a solution.

Activity 3: The balloon car



Why is the car not moving?

Can you explain what made the car move?

The air leaving the balloon, pushes the car in the other direction

Yeay!!

We need a bigger balloon.

The car is too heavy.

There is too much tape. So the balloon cannot be inflated enough.

I notice that the children are really **reflecting** on the problem

The children come up with **new solutions and explanations**. They are really **motivated** to solve the problem.

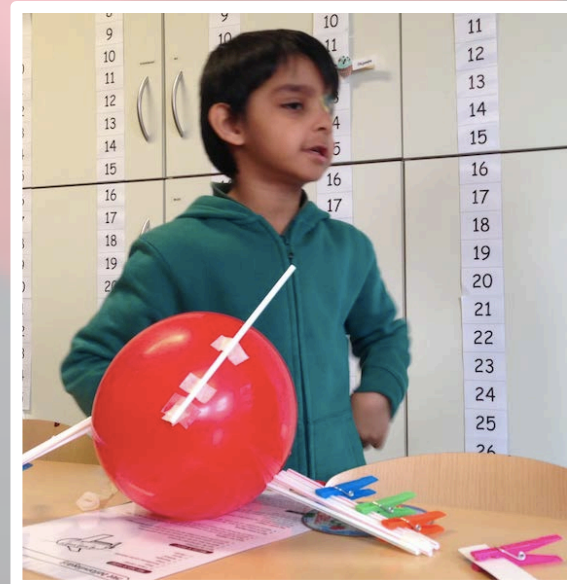
Implications:

The **connections** the children made through **reasoning** and **collaboration** need to be secured. They need to see other applications, so they will be able to transfer the insights. Therefore, we will explore these further during new experiments. To secure this, the insights will be recorded in lapbooks.

Results of the activities

What progress did the children make related to the aims of the sequence?

- All the children were really **motivated** to solve the problem (motivation). They were **looking for solutions** themselves as soon as they started exploring the different materials. Some groups really **cooperated** and worked together to find a solution (dialogue and collaboration, ability to work together).
- They found **unexpected solutions** for the problem (ability to come up with something new) and found **explanations** for the phenomena themselves (thinking skills).
- The children used their **previous knowledge** of the materials to come up with hypotheses (making connections, reflection and reasoning). Testing their first prototype gave them ideas on how to improve it to reach the goals.
- The children are **not asking enough questions**, there is need for the teacher to push them to do so. During the exchange of solutions however children started to reason more spontaneously (questioning).
- The children were **stimulated to explain the activity and communicate problems** they encountered along the way (explaining evidence, communicating explanations).



Children's progress



Leentje

- A bit shy
- Social
- Mild tempered
- Needs time
- Small motoric problems

Behaviour during and after the STEM-activities

- Shows curiosity and motivation;
- She dares to stand out and tries to solve the problem nobody else chose;
- More talkative, describes what she sees.



Sheela

- Speaks English at home
- Creative
- Enclosed
- Sweet
- Sometimes needs a push

Behaviour during and after the STEM-activities

- She really pushes through and show perseverance and motivation to solve the problem;
- She is more talkative and cooperative. She tries to explain what's happening.



Asaad

- Speaks Arabic at home
- Active
- Boaster
- Quickly frustrated
- Impulsive

Behaviour during and after the STEM-activities

- Realizes failing is OK and acceptable;
- Really focused on success, switches teams to one that is making more progress. Shows will to cooperate to find a good solution.

Reflections

What progress did the children make related to the aims of the sequence?

- Children are able to **come up with scientific explanations**, and can share insights with each other.
- Children are very motivated to **ask research questions**, they realise it is hard to find an explanation for natural phenomena.
- They realise that using **scientific terminology/ question words** helps them to explain their opinions and insights.

Unexpected outcomes for the children

- They found other **creative solutions** than the ones prepared by me, for example the balloon car.
- When forming the teams, friends grouped together. This didn't always turn out in good results. While evaluating, they told why their experiment failed: they lost too much time talking about details or didn't get along...

What did children say about their learning?

- They experienced **they can learn from each other**, both in working as a team, or within the different experiments.
- Children know each other well: who has a good insight in certain processes, who is a good leader, who is less good at keeping up with the rest... While they learn how to express their learning process, they evolve in their initiative to take action. Timid children get confirmation of their ideas when a test succeeds, and will dare more the next time.

Reflections

Teacher role

- I tried to follow their ideas as much as I could, even when it was not quite obtainable. It's important to me that they follow their own ideas, and that I **allow them to fail**. In this way they will need to reason why it doesn't work and find a valid solution (reflection and reasoning)
- I tried to **improve their language and vocabulary** they were using (dialogue). A secondary goal was to note question words on the blackboard (reflection and reasoning). Because of a tight time schedule, it wasn't easy to give that the attention it deserved.
- I challenged, together with the class teacher, the groups to **make predictions** of their experiments. That way we hoped to minimise the amount of trial and error : making them think first about what they were going to test. Also, I tried helping them to formulate their sentences in this way: "I thought it would... but now I see that... because..." (reflection and reasoning).

Classroom environment

- During the STEM-courses, the children really have the feeling that THEY can find the solutions. They feel free to use the whole classroom and the available materials. If they needed other materials, the children were free to use them.
- The classroom environment is a safe environment where children have 'ownership' of the ideas. They don't feel any restrictions or limits to propose new ideas. They also came up with new ideas in the other courses about the same theme. A safe environment is crucial to stimulate creativity.
- A 50 minutes lesson was really short. More time could have improved the discussions of the children.

Reflection questions for the reader

- How do you encourage reflection and reasoning during science lessons?
- How do you encourage your children to expand their language and vocabulary during STEM lessons?
- When were you surprised by the creative ideas of the children in your classroom? Were you able to create opportunities in the classroom to work on these ideas? How did you do this?

Developing the Learning Journey: Continuous Provision and follow up activities

Next steps

- Next steps on the same subject: The children experimented more with air and wind. They came up very quickly with the right materials in order to complete the challenges.
- They made a **lapbook to record their insights**

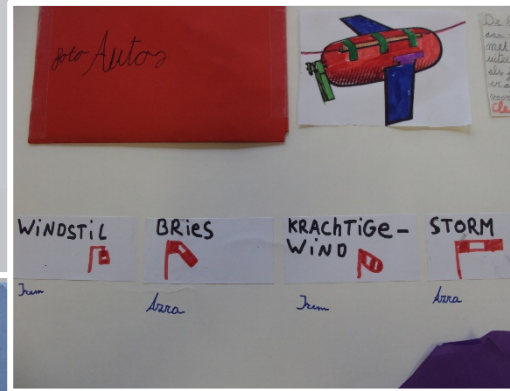
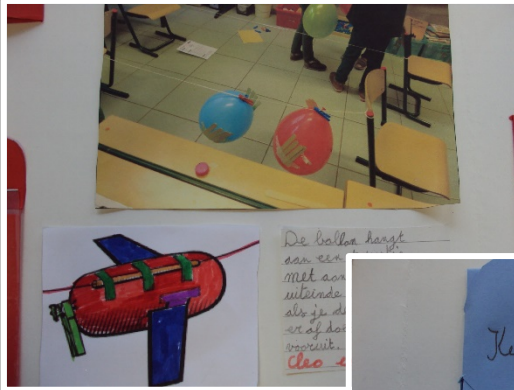
Review of children's progress

- They come up with **more ideas**.
- They realise they are getting a chance to research things.
- The children became **more critical** in their choice of materials. They are choosing now with the experiment in mind.
- **Expressing themselves is still difficult**. They are not using the new vocabulary.
- **Explaining causality is still very hard**. This needs more stimulation.

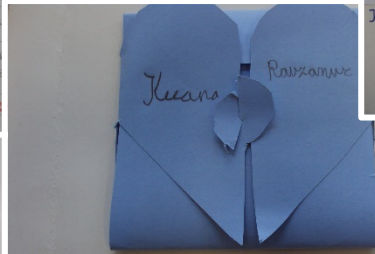


Making a soundscape for the book
'The Umbrella' by Ingrid and
Dieter Schubert

The lapbook



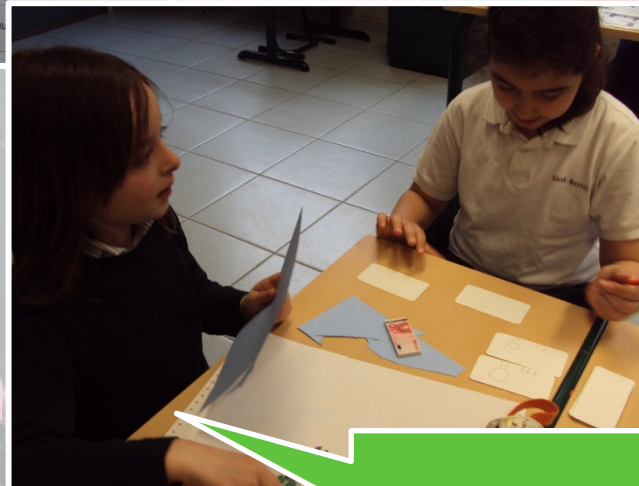
What did we learn?



wij hebben een memory over



CKeena. Ransanne



We are making a 'memory' game!

Resources



<http://www.schooltv.nl/video/luchtdruk-handig-om-iets-mee-op-te-tillen/>

'Hallo wereld! We gaan de lucht in.' Published by The expertise Centre of Science & Technology Noord-Holland/Flevoland, September 2012

A wisp of air: Mikado 2, World Orientation, publisher: Pelckmans

The balloon plane:

- https://www.e-nemo.nl/media/filer_public/9c/cf/9ccf6821-5f99-42c0-8c8e-583fc523ac3e/1straalmotor.pdf

The hovercraft:

- https://www.e-nemo.nl/media/filer_public/ed/5d/ed5d04fa-1963-4157-a866-e706860cb0f8/4zweven_op_lucht.pdf
- <http://auto-en-vervoer.infonu.nl/diversen/78036-alle-informatie-over-hovercrafts.html>
- <http://www.sciencespace.nl/technologie/artikelen/4040/de-hovercraft>

ACKNOWLEDGEMENTS

CREATIVITY IN EARLY YEARS SCIENCE EDUCATION (2014-2017)

WWW.CEYS-PROJECT.EU



The Open
University



© 2017 *CREATIVITY IN EARLY YEARS SCIENCE EDUCATION Consortium*

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.