CEYS
Creativity in Early Years Science Education

Curriculum Materials

Learning Journey

A Liquid Tower

Erasmus+

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Learning Journey
A Liquid Tower

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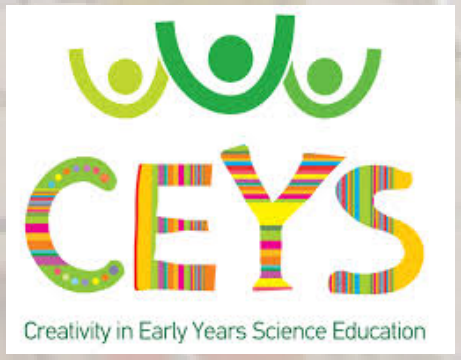


Achtergrond

School setting: Urban school with about 140 children

Age: 6-7 year

School policy:

There is a fully equipped building for STEM education (De STEMpel) with a lab, a LEGO studio, a kitchen, a workplace and a research room. Every class at the school spends at least one day a month on STEM activities

Profile of children : 22 children in a fairly homegeneous class group with three repeaters and one child with dysphasia.

Setting the Scene

Focus

The students build scientific **insights** by **working together** constructively. In addition, I want to focus on **motivation, dialogue, curiosity and reflection** of the children. I also want to increase their **language skills**.

Rationale:

With this activity, I want to build on the **prior knowledge** (sinking and floating solids) and the **interests** of the children (amazement when mixing yellow and blue water during paint class). In addition, I want them to **communicate** with each other, share their findings in an organised way and **reflect** on the results.

Implications for my planning and teaching

The class is subdivided into **small groups**, each with a (grand)parent as a supervisor. By dividing the class into small groups, every child is given the opportunity to participate in the experiment. The **(grand)parents** encourage the children to communicate with each other, share findings and reflect on the results. In this way, all children can have a successful experience which will motivate them to participate.

Links to CLS Framework

Learning activities: questioning, gathering evidence, making connections, explaining evidence, communicating explanations.

Creative dispositions: motivation, able to make connections, curiosity, ability to work together, thinking skills

Synergies: dialogue and collaboration, questioning and curiosity, motivation and affect, reflection and reasoning.

Contextual factors: Activity during open-school day: (grand)parents visit the class. During the activities they help guiding the groups. For science activities, it is nice to work in small groups. The additional facilitators are certainly an added value.

Overview of the learning journey

Starting point:
prior knowledge about sinking and floating of solids and mixing liquids during paint class

During open class day, one parent pours milk into coffee in a transparent cup.

Yellow and blue lemonade mix into green lemonade

These two experiments lead to the research questions: Do all liquids mix? Which liquids can float and which sink?'

I mix oil and water. The children observe and describe what they see.

The students notice that oil forms 'little spheres' in water and that oil and water do not mix.
Transfer: This leads to a class discussion and an experiment about 'environmental pollution with oil'

Children experiment with soap to remove oil. Class discussion on the applicability of soap in environmental disasters

Back to the research question: Which liquids can float and which sink?

Children study in small groups which liquids float and which sink.

The children exchange results and by doing so find a solution to make a liquor tower.

The students make a complete liquid tower in their groups.

The children show the results to each other and exchange experiences.

- **Starting point**:
  - Earlier observations and insights of the children are used as a starting point.
  - Research question: *Do all liquids mix? Which liquids can float and which sink?*
  - With this information the students will construct a liquid tower.
- **Learning journey**:
  - The students build on their prior knowledge about floating and sinking solids.
  - The students apply their knowledge to liquids.
  - They transfer their knowledge to situations they know (e.g. environmental disasters with oil spills).
  - They investigate in groups of four which fluids float and which fluids sink. They try to rank the different liquids.
  - They share conclusions and give each other information. Missing information is provided by me/the facilitators. Thus, a joint solution for making a liquor tower is found.
  - The insights are further explored when designing and making a lava lamp.

Developing the learning journey: Starting point from two previous lessons

Activity: During paint class a child observed that mixing paints leads to other colours. Children share similar experiences spontaneously .

Rationale: I want to build on this spontaneous observation and on the curiosity of the children. In addition, they have recently learned about sinking and floating solids.

Hey, my yellow paint makes my blue water green !?

That's like the milk in my mom's coffee, which turns light brown.

Analysis of children's answers:
The children are **amazed** by and **curious** about mixing liquids. They **link** this to situations they know.

Reflections of the teacher:

- The children are **motivated** and **curious**.
- They already have **prior knowledge** about sinking and floating solids.
- I would like to give them more time for free exploration, but need more supervisors for these practical experiments so that **all children** can be adequately **addressed**.

Implications for planning:
I would like to **build on the children's curiosity** during the next lessons and them **experiment**. During open class day, **(grand)parents** will be able to guide and coach these activities.

Developing the learning journey: building on previous experiences

Activity: Children observe what happens when you mix coffee and milk and when blue and yellow lemonade is mixed.

Rationale: I want to remind the children of what happened before in order to recreate the motivation and curiosity they felt at that moment.

Teacher's questions: *What do you see? What do you notice?*

Hey, you can make green lemonade by mixing yellow and blue lemonade!

Analysis of children's answers:

- The children **observe and describe** their observations correctly.
- They **do not yet link** this to the previous theme 'sinking and floating of solids'.

Reflections of the teacher:

- **Correct observations** are important in **inquiry**. This was a simple experiment to remind the children of making good observations and to **motivate** them for the lesson.
- I also want to **build on what we did** the previous lessons about sinking and floating.

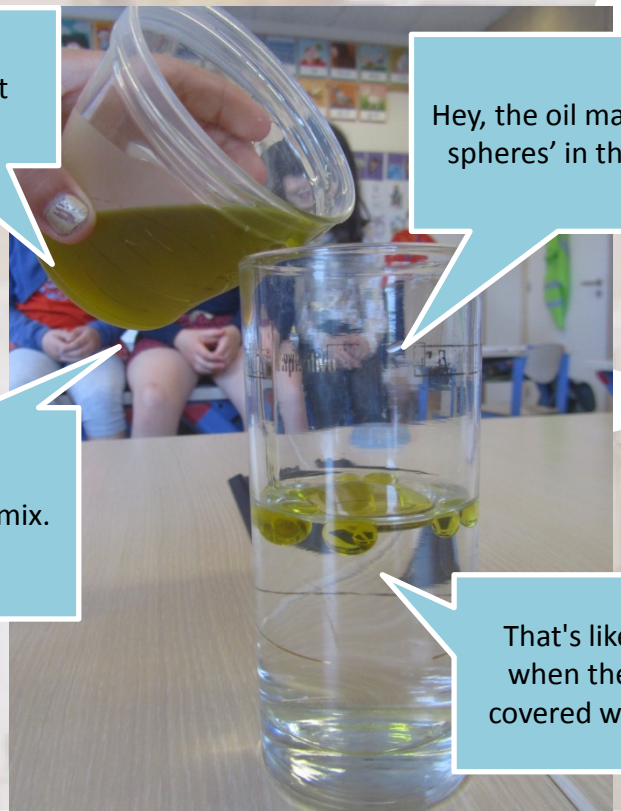
Implications for planning:
I want to create **amazement and curiosity** about the fact that some liquids do not mix. The students will **connect** this to the previous lesson about sinking and floating.

Developing the learning journey: experiences with liquids that do not mix

Activity: Children try to mix oil with water and observe what happens.

Rationale: I want to build on the insights they gained about sinking and floating of solids.

Teacher's questions: *What do you think will happen when you mix oil and water? What happens? What does this remind you of?*



Analysis of children's answers:

- The children have different **prior knowledge**.
- They **observe** that not all liquids mix.
- They **relate** this experience to their own experiences and to the lesson about sinking and floating.

Reflections of the teacher:

- The children have different **prior knowledge**. Some children link the experiment to what they know from their experiences (e.g. images of environmental disasters on television) and from class (sinking and floating).
- Children get the opportunity to **exchange** about this.

Implications for planning:
I want to respond to the experience and motivation of the children, so I will **go deeper into the questions that arose** about the oil spills.

Developing the learning journey: experiences with oil cleaning

Activity: Children become aware of the problem of oil pollution: they watch pictures and a video about the subject and carry out an experiment with soap.

Rationale: I want to raise awareness of the potential effects of oil spills in water. In addition, I want them to think about the function of soap.

Teacher's question: *What do you notice?*

Analysis of children's answers:

- The children are **committed** to the subject and learn how to save birds covered with oil.
- They **observe** that because of the soap the oil does not float on the water anymore.
- The children think **spontaneously about solving the problem**. They formulate solutions and think critically about it.

Reflections of the teacher:

- I think it's important that children have a **positive vision on the future**. They experience that **environmental problems** are caused by people, but they **can also be solved by people**.
- I want children to experience that they can **create beautiful things through knowledge**.

Implications for planning:

I will **build further on the insights** of sinking and floating of solids. I want to **extend** these insights to liquids. In addition, I want them to **work constructively** and exchange information.

Developing the learning journey: making a liquid tower

Activity: The children get five different fluids and investigate which fluids float and/or sink. The children work in groups of four each with one supervisor. The children make predictions and make connections with previous activities.

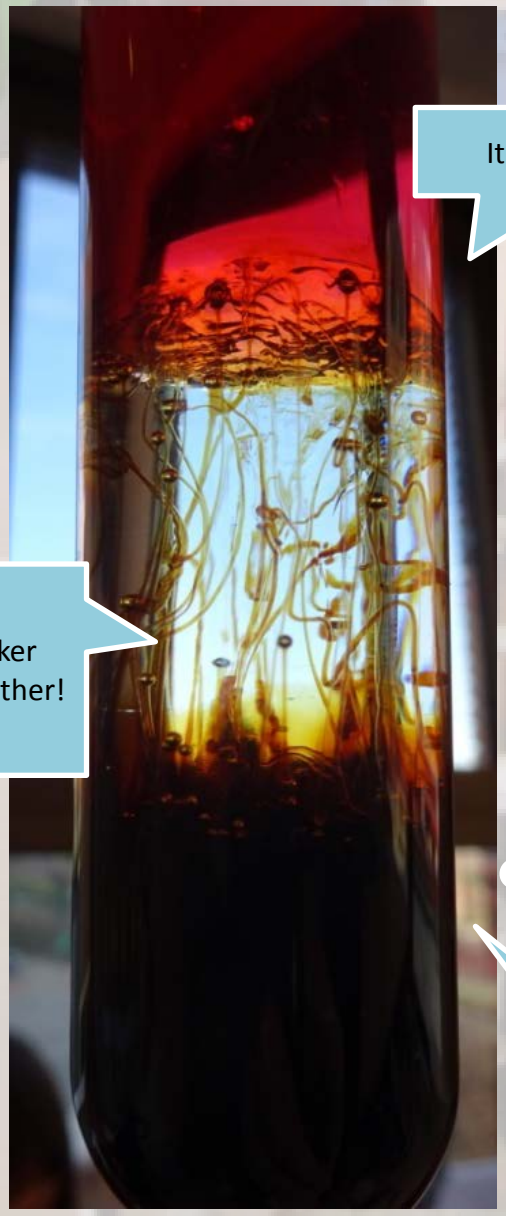
Rationale: I want all the children to be involved and addressed during the experiments, not just the leaders of the group. I have chosen to use a limited amount of material to simplify the exchange of the results. In this way, they will notice that you can build on the results of other groups, as scientists do. I want them to link these new experiences to their knowledge about sinking and floating.

Questions from the supervisors/teacher: *What do you think will happen? Is your prediction correct? What does this remind you of?*

It (oil) does not like water and does not want to mix!

Hey, that doesn't mix. It just lies on top of the other!

Developing the learning journey: making the liquid tower (sequel)



Analysis of children's answers:

- The children **observe** what is happening and describe this to each other.
- They **understand** that liquids can also float and sink, just like solids.
- They **record their observations** so that they can exchange them later with the other groups.

Reflections of the teacher:

- The children practice their **language skills**.
- They are able **to correctly record** their observations. Not all liquids are compared, so they need more information.
- **Maybe I was too steering during this experiment**. But I wanted the groups to have a successful experience when making the liquor tower

Implications for planning:
The groups were not able to compare all liquids with each other. The different groups will need to **exchange their results**. When necessary, I or the facilitator will provide more information.

Developing the learning journey: making the liquid tower (sequel)

Activity: Children exchange their findings. In this way they notice that through communication and cooperation they can achieve more and better results. The facilitator or I gives more information when this is needed to make a liquid tower. Based on their results and the additional information, they can make a complete fluid tower.

Rationale: I want to make the children aware that communication and cooperation lead to better results. In addition, they learn other skills such as ordering and ranking during this lesson.

Questions of the teacher: *How could you rank the fluids from 'heavy to light'? What did you notice?*

Analysis of children's answers:

- The children **classify and rank** which liquids sink and which floats.
- They notice they do not have all the knowledge yet because they have not compared all the liquids with each other. They notice that **they need the results of the other groups**.

Reflections of the teacher:

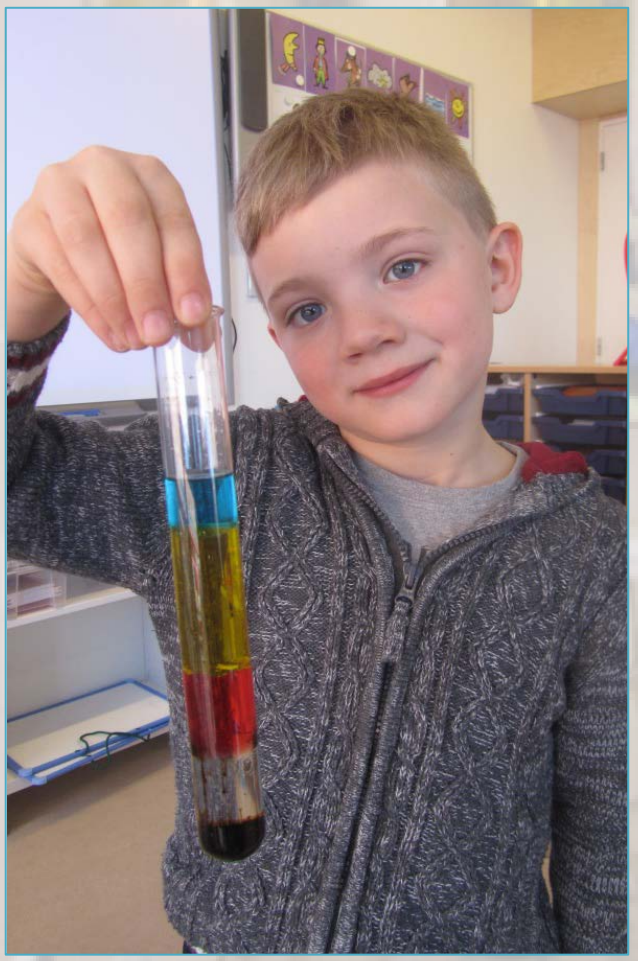
- The children see in that **collaboration and communication is important** to achieve more and better results.

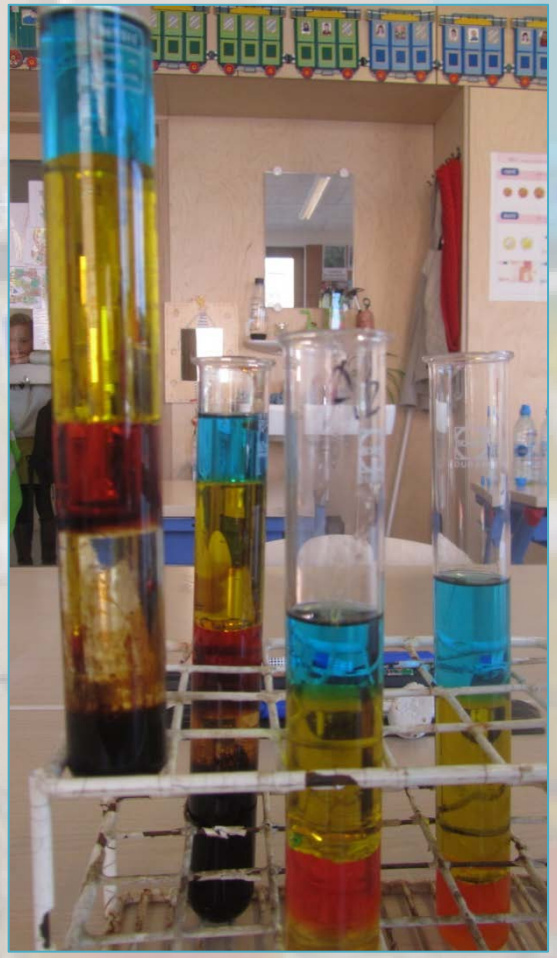
Implications for planning:
The children will **use the collected information** to build a liquid tower.

Developing the learning journey: making the liquid tower (sequel)

Activity: Children make a liquid tower based on their experiences and knowledge.

Rationale: Knowledge leads to a beautiful creation. Children see that you can use and apply knowledge to make something beautiful.





Children’s progress

Why is the oil making ‘little spheres’ in the water?

The students do a STEM activity on a monthly basis. I noticed that by now they know and apply the approach of such an activity. For example, the students share their observations and insights spontaneously with each other.

By working in small groups with more supervisors and a less scholastic approach, students who are more withdrawn become more open and spontaneous. They get the opportunity to be really involved and to tell more about their experiences. In this way, their language is also encouraged.

Children know that asking scientific questions and curiosity are part of a STEM activity. Sometimes they ask difficult scientific questions which are not researchable. E.g. during the experiment 'water and oil’: “What does the detergent do with the oil on the birds' plumes so they can fly again?”

Reflections

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

- Children were able to link their insights from previous lessons and from their lives to what they did during this lesson.
- The students had sufficient ownership to find solutions to the problems they faced (e.g. oil-polluted birds, making a beautiful liquid tower).
- The children started working with a scientific approach: they made predictions and tested it with experiments and observations. They experienced the importance of recording and communicating results to achieve better results.

Unexpected outcomes for the children

- Children often continue these experiments at home. They are really curious to learn more about the subject.
- For this STEM activity, I divided the group in five homogeneous groups. Some students performed less than before because they were not in the same group as their friend(s). I did not expect this to have such an impact. During previous STEM activities, they were always allowed to choose their own group.
- Children often ask unexpected questions. They really want to know how the observed phenomena can be explained.

What did children say about their learning?

- Children expressed they were very proud when they finished the experiment.
- During the many informal chats with parents, I often notice that the children tell a lot more about these activities to their parents than about regular language, math and world orientation lessons. Often, children continue these activities at home and sometimes they try the experiment again at home.

Reflections

Teacher role

- The (grand)parents guided the experiments. They were instructed to give all the children the same amount of attention (both during the experiments and during the discussion).
- As a teacher, I asked questions to broaden the children's observations: *Have you noticed that?, What do you see?,...* I addressed their prior knowledge: *How do you know that?, Have you ever experienced that before?*. I also learned them to make predictions and test those predictions. I modelled this for them during the lesson*: I suspect this will happen because I think that …, Oh, something else happened, how could this be explained, did I overlook something?*
- In the future, I want to focus even more on the Nature of Science. For example, by asking children researchable questions, and pointing out more explicitly that they are working in the same way as scientists do.
- I had the feeling that I was focusing too much on the product and less on the process during this lesson. I felt like the activities were too steered. Next time I want to give children the opportunity to be more creative: *What materials could we try-out? Can we create our own liquor tower? How do we want it to look like? ...*

Classroom environment

- The more assertive children often take the lead, while others take much less initiative. In groups of two, children often cooperate better. Unfortunately, partner work is not always possible because of practical reasons such as insufficient materials, too little space, insufficient number of supervisors, etc. In order to stimulate quiet students, I sometimes use ‘role cards’ where their task is described (e.g. material master, leader, reporter, executor, ...)

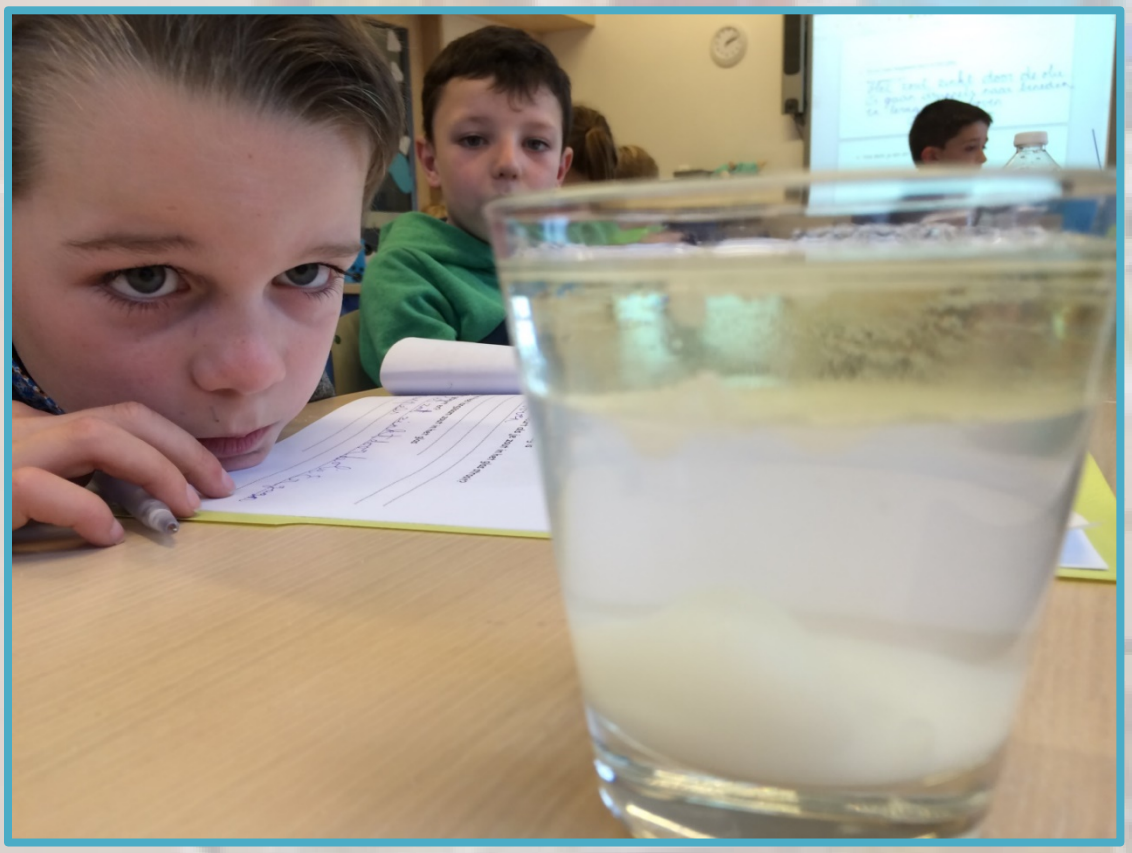
Reflection questions for the reader

- How do you practically deal with 'big groups' for such activities?
- How do you involve everyone in such activities? In other words how do you involve ‘followers’ more and how do you try to temper the ‘leaders’?

Developing the Learning Journey: Continuous Provision and follow up activities

Next steps

Based on the gained insights, we go one step further: *How can you make a 'heavy' fluid float?*
With this knowledge students will design a lava lamp.



Resources

- Video material about environmental disasters due to oil spills and information on how birds can be saved
  - https://www.schooltv.nl/video/koekeloere-in-de-olie/
- Experiments with oil and water
  - https://www.proefjes.nl/proefje/083
- The liquid tower
  - https://www.sciencespace.nl/het-allerkleinste/artikelen/4381/vloeistoftoren

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