Learning Journey: Water resistance

Experiments with water: which materials are water resistant and useful to repair the shoe?

Age group: 5-6
Learning activities:
Designing or planning investigations, making connections, communicating explanations, gathering evidence
Creative dispositions*:*
Ability to make connections, curiosity, thinking skills
Synergies:
Play and exploration, questioning and curiosity, problem solving and agency

Background Information

School setting: rural area
School policy for science: The school participated in several research projects (STEM, healthy food, technology …), so they are very open to innovation
Profile of children: children are used to explore materials in small groups. The teacher regularly plans exploratory activities starting from questions the children ask.
Contextual factors:
During the school year we did several scientific experiments, always starting from informal moments and spontaneous questions of the children. The children are motivated to do the experiments, and are always very enthusiastic to explore.
Context starting point: During circle time Henri is tinkering with his shoes. A piece of red leather comes off, and the more he plays with it, the more it loosens. Finally he tears off a part of the top layer of his shoe.
He doesn't mind the fact that a part of the red protective layer is missing, he only sees a stain.
After break he comes back in the classroom with wet shoes, because it rained. After 30 minutes his shoes are dry, but he notices that the stain is still wet, that it doesn't dry easily.

Setting the Scene

Focus

The focus of this project was to develop children's curiosity to promote learner's abilities to make connections and develop their thinking skills, and their understanding of the purpose of specific materials. I wanted to explore possibilities to develop children's abilities to estimate and predict results, and to look for ways to let them make record of their findings.

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I wanted to let them experiment with different materials and develop their thinking skills. This way I wanted them to understand why specific materials are chosen for specific purposes, so they would be able to point out which materials were most appropriate to solve their problem.

Rationale

I want to teach children to be more aware of what happens around them, so they no longer let this pass by unnoticed. Sometimes their curiosity is provoked spontaneously, but if children don't act on it, this curiosity fades away.
By experimenting they learn more about the specific characteristics of the materials.

The implications for my planning and teaching

Content: Often unforeseen situations can seem uninteresting, but I want to use those moments as starting points for scientific experiments. Because of the spontaneous character of the situation, motivation of the children is very high to act on it.
Learning activities: experimenting and exploring are important factors to discover characteristics of materials.

Outline of learning activities and resources

Day 1:
(1) Group discussion about the torn leather, the wet stain and how it can be repaired.
Children suggest to look for a similar fabric to repair the shoe.
(2) Children collect materials similar to the leather.
Children are motivated to explore the materials, and to find out if they are water resistant.
(3) Children explore water resistance of all kinds of materials in an exploration corner. They make a record of what they discover (worksheet).
Children find out which materials are water resistant, and are curious to find out what makes them water resistant.
Day 2:
(4) Children built on their findings; they explore the water resistant materials.
Children apply their knowledge to find a solution for the shoe.
(5) Children apply their knowledge and understanding of water resistance; they try to make the cloths water resistant to repair the shoe.

Developing the Learning Journey

Starting Point

During circle time Henri is tinkering with his shoes. A piece of red leather comes off, and the more he plays with it, the more it loosens. Finally he tears off a part of the top layer of his shoe.

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He doesn't mind the fact that a part of the red protective layer is missing, he only sees a stain. He doesn't care 'because the shoes are not new anymore'. 'My mom will buy new shoes anyway' is his answer.
After break he comes back in the classroom with wet shoes, because it rained. After 30 minutes his shoes are dry, but he notices that the stain is still wet, that it doesn't dry easily. 'Miss, how come it stays wet?', he asks.

Reflections and implications

Henri was curious and motivated to find out why the stain was still wet, even though the rest of the shoe was dry. I wanted to let him communicate his ideas with the other children, and start from their curiosity and questions to let them explore materials, making them feel ownership over the exploration process.

Developing the learning sequence

Activity 1

I choose not to give him the answer myself, but I return the question back to him. 'Yes, why?' The other children hear what is going on, and spontaneously they come to listen and to participate in the conversation. Everybody agrees: Henri shouldn't have tinkered with his shoe. Can the shoe be repaired? Henri cannot find the piece he tore off. He wants to glue it back on. The other children suggest to look for a similar fabric, to repair the shoe. Unfortunately, we don't have this kind of fabric in our classroom.

Reflections and implications

I suggested the children to look for similar materials. Since we didn't have exactly the same fabric, I told them we would have to examine which materials were useful and which weren't. I felt it would support children's understanding and ability to make connections if they decided which materials they wanted to examine.

Activity 2

I suggest the children to look for materials to test if they absorb water, and materials that are water resistant. Since we do not have exactly the same fabric, we have to examine which materials are useful and which aren't. The children collect all kinds of materials, to find out which materials are suitable to repair the shoe. They choose what they want to examine, and they decide not only to examine fabrics, but all kinds of materials, to see if they are water resistant.

Reflections and implications

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The children were very curious, and motivated to explore the materials, and to find out if they were water resistant. They started designing and planning their investigations, which they could carry out in the following activity.

Activity 3

I install an “exploration corner” in the classroom. In this corner several children start exploring the water resistance of the fabrics and other materials in the exploration corner. Soon a lot more curious children come to the corner to see what happens. The children want to start testing the materials right away. Every child wants to test every piece of fabric himself, even though they can see the result of the experiments if they look at what other children do. They like exploring the fabrics so much, they just can’t get enough of it. They exchange materials and assignments without me interfering.

I provide a large water tank, plastic cups, a large variety of fabrics and other materials to be tested, and rubber bands to attach the fabric to the plastic cup. I add water syringes and a smaller water tank, and several materials to spray water on. I give the children a worksheet, to note down which materials are water resistant and which aren’t.

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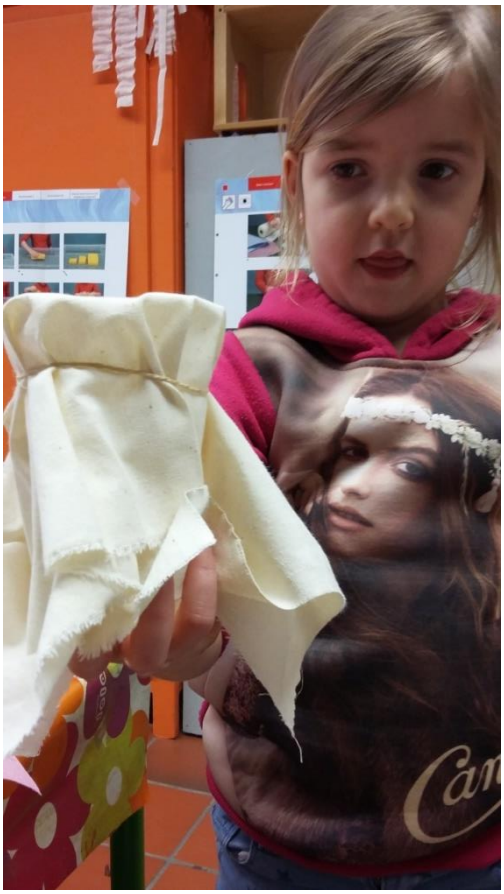
In some cases the children spray water on the materials on the table. Sometimes they spray water on the materials after attaching it on a plastic cup. Some children first fill the cup with water, and turn it over after attaching the material to the cup. This way they can see how much water runs through the material.



The children learn to make predictions. Will this material be permeable for water or not? We ask the other children: do they make the same predictions? And why? Sometimes they can see small holes on the material, what makes them decide the water will probably run through. Or they describe the material as soft, what means (for them) that the water will run through.
We discover that certain fabrics are water resistant, in contrast to what they expected. The fabric doesn't look special to them, how can it retain the water? 'Miss, that's weird! How is it possible that the water doesn't run through this fabric?' I decide not to tell them yet…

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I encourage them to note down their findings on the worksheet, so we can see which fabric is water resistant, and which absorbs water. With a little encouragement, they succeed to note everything down. We look for a 'dry corner' to fill in the worksheet. I guide this part of the activity by questioning the children. 'Could you see the water drop on the fabric? Or did it disappear? Could you see water on the other side of the material? Or did you only see it on one side? Is every side of the material the same? Do you get the same result if you turn it around? Can you still see the water drop after a while? Or did it disappear after all?"

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The children can play in the water tank all day. Because of this longer period of exploration, they can discover that the effect of the water on the materials changes over time. Some materials look water resistant at the start in the beginning, but turn out not to be. For example they discover that cork needs a lot of tome to absorb water. Although it doesn't seem to absorb the water in the beginning, it does after a longer period of time. Or they discover that one side of a leather patch absorbs water, but the other side clearly doesn't; the water drop remains visible on the surface. I keep on asking questions: 'If I wanted to make a shoe out of this material, how can I use this fabric? Which side should be on the outside?'

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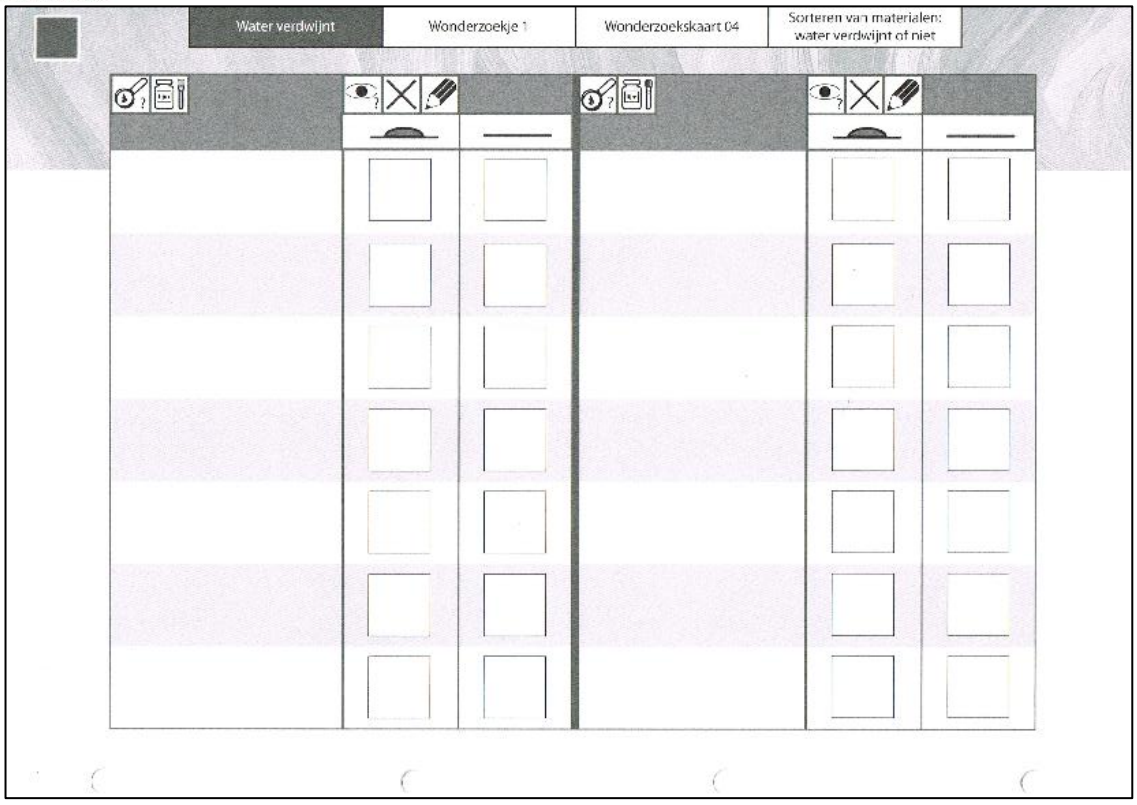

Worksheet from the manual '*Wonderzoekers, onderzoekjes met water voor kleuters*' ('*Experiments with water for young children'*)

Reflections and implications

The children discovered that certain fabrics were water resistant, in contrast to what they expected. The fabric didn't look special to them, so they were curious to know how it retained the water. This led to the following activity: exploring waterproof materials, making connections and trying to make materials waterproof.

Activity 4

During this activity the children find out that there is only one fabric where water doesn't pass through. After a while I take this specific piece of fabric, and repeat that it is weird indeed that this is the only fabric that is completely water resistant. 'Could they have done something special with this fabric?' Children respond: 'They made it like this in the factory!' I return the remark: 'Maybe we can do something with our cloths, to make them water resistant?' At the start they couldn't find a useful solution. Until I referred to the worksheet. 'We have some water resistant materials on the table, take a look at your worksheet.' A couple of children come up with the idea to combine fabrics with other material. For example: cover it with tin foil. 'But it doesn't stick, it loosens'. At the start, there is a lot of tinkering, they seem to have difficulties finding a solution. Until one child mentions: 'Miss, we need that stuff that sticks, like on our folders'. I give them the adhesive foil he refers to, and they start testing it. They find out it works on the dry clothes. The fabrics that are already wet, don't stick to the foil. But the dry cloths stick, and the water can no longer pass through it!

Reflections and implications

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The children gathered evidence, and now they could make connections between what they had observed and the problem they wanted to solve. They could gather all their findings now and share them with each other (communicating explanations).

Activity 5

After repairing the shoe there was a group conversation, where children communicated their findings with the whole group. They described what they found out, and discussed what would be the best solution for this problem.
This activity showed that the exchange of ideas is an important phase in explorations. It also showed that agency is an important aspect: starting from real-life situations and questions children ask, makes the exploration relevant to children, provokes the use of problem-solving skills and increases motivation.

Overall Reflections

Children's progress

Some children wanted to examine the same material over and over again. Even when other children told them the result of some explorations, they still wanted to repeat the same exploration themselves.
A couple of inquisitive children examined all kinds of fabrics and other materials. Those children didn't take the same material twice, because they already knew its characteristics (and remembered it).
Children were very enthusiastic. Days after the activity, they kept asking for the water tank, because they wanted to keep on exploring.
Because of the real problem, the fact that the answer was not so easy to find and the fact that the children could explore all kinds of materials they chose, curiosity, agency and motivation were very high.
Henri was curious and motivated to find a solution for his shoe. At the end of the series of activities, he could make the connection between the results of the explorations and his problem, and chose a solution based on evidence. He used his thinking skills during and after the exploration activities and group conversations.

(Henri) I will colour the stain with a red marker. And then I will use a piece of adhesive foil to make it water resistant.

Unanticipated outcome: I thought all children were going to choose the leather right away. I knew in advance it was water resistant, and it looked a lot like the fabric of the shoe. I would never have thought of using the adhesive foil. I was pleasantly surprised that someone came up with this idea. I thought they would have chosen materials like tin foil or clingfilm (more day-to-day materials). I experienced the 'eureka-feeling' together with the children.

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Review of children's progress

- Curiosity was high because we started from a real-life problem one of the children had. It also helped that children could think about what materials they wanted to explore: they could choose themselves, so they chose materials that made them curious: would those materials be water resistant?
- Because of the large variety of materials children could test all kinds of things, there were a lot of possibilities for exploration.
- Children were provoked to think about and analyse what they experienced, because of the questions I asked. This way they made connections and developed their thinking skills. I kept on asking, so they started to explore more in depth, instead of just 'playing' with the water.
- Children could communicate their expectations and findings. Communication was very strong in these activities, both at the start (predicting outcomes) and during the explorations (discussing their findings).
- The children themselves didn't ask that many questions, it was mainly the teacher herself that asked the questions. That didn't mean there was no enthusiasm, on the contrary.
- Children learned to note down their findings on the worksheet.
- The children did more than just 'playing with water'. They profoundly explored the materials, and were curious to find out the characteristics of the materials. They were amazed every time.
- They spontaneously communicated with each other.

➔ Children are always very enthusiastic when they can do explorations. It motivates me to try out new scientific activities. I begin to see more possibilities and more interesting starting points that spontaneously occur. I find it less difficult to see opportunities now. In the beginning I thought I had to provide complicated scientific activities, but now I know I can start from day-to-day situations. I can pick up interesting situations more easily, and use situations that occur unexpectedly.

Teacher role

Questioning and curiosity, teacher scaffolding and involvement: I had to keep asking questions and keep on communicating the whole time. It was very intensive. But I succeeded in asking questions, in response to what children said, discovered, asked,… This way they kept being motivated to try out new things and explore more in depth.
Creativity: I had to provide a large variety of materials, because the children came up with lots of ideas or materials to be tested. Practically, the materials needed time to dry after the first tests, so there had to be enough materials as a challenge for the other children, who came after the first group.

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Next steps for learning and teaching

Based on evidence of learning I will continue to discover alongside the children following their curiosity, interests and questioning to promote deeper thinking and inquiry.
I will make sure agency is high by letting them decide what materials to explore, and by letting them design and plan their investigations.
The more starting from questions of children and letting children communicate their findings and explanations has increased children's ability to use their thinking skills and to make connections.
I want to keep on fostering problem solving skills. I want to make sure children keep on looking for answers until they discover what they were curious about.
Time:
A lot of time was provided for this activity. The children could choose to play in the exploration corner the whole day. Everyone took his turn. Meanwhile they heard other children talk about their discoveries, or saw what happened when other children explored the materials.
Content:
Although I used the worksheet of a manual (*), I did more than was suggested in this manual. I used it as a support. However, it opened up the activity. I tried to use unexpected situations in the classroom as a starting point. This approach assures that children were highly motivated, and remember their findings after a longer time.

Reflection questions for the reader

- In what ways do you build on children's questions and curiosity?
- How do you help children make connections between different experiences?
- In what ways do you connect unforeseen situations to science?

Materials

I used a worksheet from the manual '*Wonderzoekers, onderzoekjes met water voor kleuters*' ('*Experiments with water for young children*')**– more information on www.wonderzoekers.be (*)** (Martens V., Van Houte, H. et al (2009) Wonderzoekers: onderzoekjes met water voor kleuters. Uitgeverij Zwijsen, Antwerpen.)

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