Learning Journey: Plants

Age: 4-6 years old
Learning activities: Designing and planning investigations; Gathering, recording , explaining evidence; Evaluating knowledge.
Creative dispositions: Curiosity and motivation; Ability to work together; Imagination; Ability to come up with something new
Synergies: Questioning & curiosity, Reflection and reasoning
Contextual factors*:* Location, Materials and resources, Grouping

Background

School setting: Kindergarten school in rural area.

School policy for science: Linked to the National Curriculum.

Curriculum links:

- Identify different kinds of seeds.
- Identify the factors that affect plants' growth.
- Asking relevant questions and using different types of scientific enquiries to answer them.
- Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions.

Setting the Scene

Focus

The focus of this project was on developing children's **questioning** and **curiosity** and providing them with **opportunities to express beliefs**, to **gather** and **explain evidence**, so as to **foster their reflection and reasoning**. I wanted to make a difference to children's understanding of scientific **inquiry** and their attitudes and knowledge concerning the **Nature of Science**.

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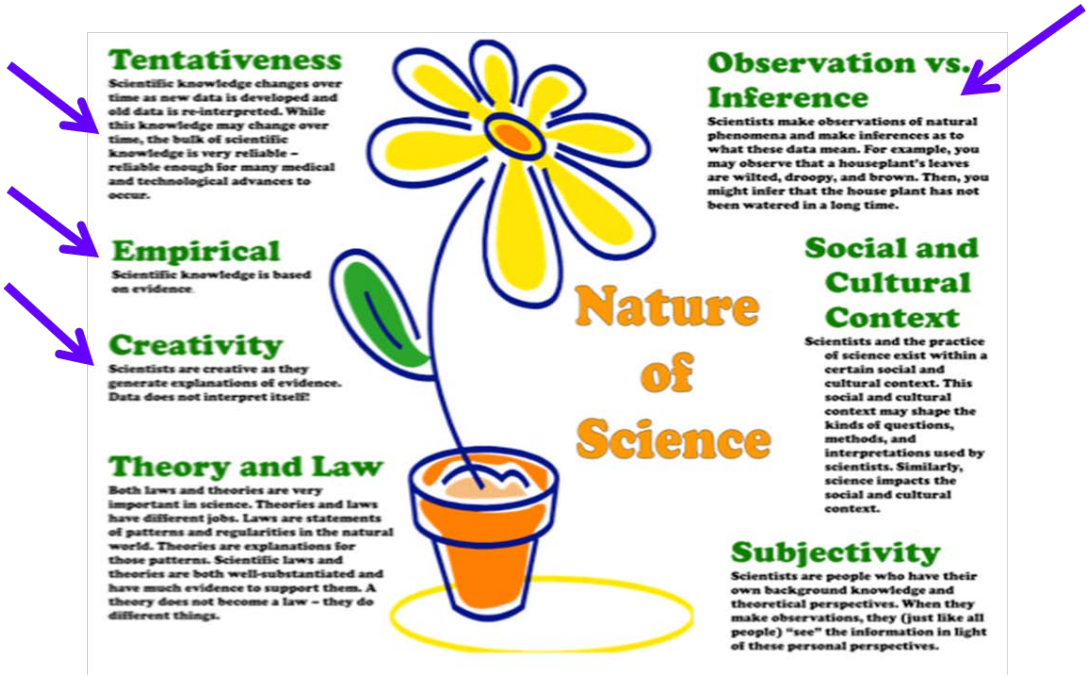
Features of the Nature of Science (Akerson et al., 2010: 69)



The arrows show features of the Nature of Science I hoped children would begin to recognise across the project.

Rationale

The children were already strong at collaborating and independent learning, personally motivated & generally on task. I wanted to build on this, through my **scaffolding and involvement**, fostering children's **motivation** in terms of **being a scientist** and using **scientific skills**, to get them **actively curious** about **scientific investigations**. I was concerned to allow opportunity for children's **problem solving and agency**. I wanted the children to steer the direction of their learning and to feel they were part of the processes of **gathering**, **explaining** and **communicating evidence**.

Implications for my planning and teaching

The implications for my planning and teaching were to foster **scientific inquiry** by **designing and planning investigations** and promoting **problem solving and agency**, by offering a range of opportunities for children to develop their questions and ideas through active investigation, and for **recording and reflecting** on their learning in a variety of ways.

Important features in my planning were: a) learning both outdoors and indoors to activate children to plan their investigations; b) the combination of digital and hands on activities as educational material that help children to research their own questions; c) group work, because I aimed to build on children's collaborative skills to foster sharing of ideas, identifying and solving problems and reflecting on their developing knowledge and understanding.

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Outline of learning activities and resources

Starting points

The first three activities were designed to elicit children's ideas about science and scientists:

- **What is this thing called Science?** Children drew images and shared views about what Science is. It acted as reference point during our investigations of children's thinking about the Nature of Science.
- **Who is a scientist?** Children drew images and shared views about who is a scientist and what scientists do.
- **Hello Mrs Science**. 'Mrs Science' (puppet) came into the classroom and asked children about what scientific issues they would like to learn more with her: Plants including Trees, Mankind, Animals including Dinosaurs, Air-Light-Water, Planets.

These experiences acted as reference points during our investigations into different kinds of plants.

Learning journey

Children collaborated in different types of inquiry to find out more about plants, using both first and second hand sources, hands-on and digital educational material, so as to develop a scientific attitude and approach.

- **Can children record and collect data and suggest ideas about plant investigations?** Children observed the variety of plants outdoors to see what they could find out at first hand. They kept records of what they already knew and their developing ideas . They agreed what to find out further and the way to do it.
- **Planting seeds.** Children were given different kinds of seeds to plant, using visual instructions to direct them.
- **Keeping data.** They examined the seeds' growth closely, identified evidence about it, and kept notes (including images) in their own 'Scientist's Book'.
- **Making predictions and investigating.** Children made predictions about the factors concerning a plant's growth. They carried out investigations about the humidity, light, air and ground needed for a plant to grow.
- **Library and Internet research**. Children researched questions they could not answer at first hand through printed and digital educational material .
- **Constructing a 2D model of a plant.** Children collaborated in pairs to make with clay/plasticine 2D models of a plant, naming its parts, communicating their explanations and reflecting on their learning.

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Developing the learning journey

Starting points 1

Activity: What is this thing called Science?

Every child drew an image of what she or he believed Science is. We shared and discussed them as a class. It acted as reference point during our investigations about children's thinking for the Nature of Science.

Rationale

The purpose of this activity was to investigate **children's ideas about the Nature of Science**.

Children's responses

Photo 1: Example of children's drawings of 'Science'

The teacher asked ''What do you believe Science is?''
Children's responses: ''Science is a Robot''
''Science is Medicine''
''Science is a laptop or a PC''
''Science show us the truth.... what is real''.

Reflections

Evidence of children's creative dispositions was shown in their initiative in their drawings and explanations, using their imagination.

Linked to my focus, I learned from this activity that children's ideas about NoS are plausible, despite being naive.

Implications

Children's ideas about Science needed to become more refined.

Starting points 2

Activities: What do children think about scientists?

All the class brainstormed their ideas and definitions. Every child drew an image of their own ideas about scientists and their work.

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Rationale:
This activity provided an opportunity for me to investigate **children's ideas about scientists** and their work.

Children's responses

Teacher: Draw someone you think is a scientist

Photo 2: Examples of children's drawings of scientists

Following children's drawings the teacher asked "What do you think scientists do?"

Some of the children answered "Scientists think, ...they observe, ...they test, ...they look again and think what they have done''.

Reflections
Children showed their ability to come up with something new.

Children had the opportunity to express their beliefs and thoughts about Scientists and their work.

Implications
Children needed to begin to see themselves as scientists.

Starting points 3

Activities: Hello Mrs Science.
'Mrs Science' (hand made puppet) came into the classroom. She had a long conversation with children about Science and Scientists. Then she asked children about what scientific issues they would like to learn more about with her assistance.

Rationale
It gave me a starting point for **planning investigations** that children were interested in.

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Children's responses

Photo 3: Children with 'Mrs Science'

Mrs Science: *''What would you like to learn with me?''*

Children pointed Plants - Trees and Flowers, Mankind, Animals - Dinosaurs, Air / Light / Water and Planets.

Reflections

Children showed their **ability to make decisions** about their own investigations.

This **motivated** children to engage in the 'scientific world'.

Implications

Children needed opportunities to carry out the investigations they had decided.

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Developing the learning sequence

1 Initial explorations

Activities: Can children record and collect data and suggest ideas for our plant investigations?

In small groups the children observed plants outdoors, different kinds of plants including trees, their flowers and leaves to see what they could find out at first hand. They kept records of what they already knew, their developing ideas and what they wanted to find out further.

Rationale

This provided an opportunity for me to find out what children knew, spot knowledge gaps and raise questions. This was an opportunity to observe **children's agency** and curiosity, their **scientific skills** in particular their **questioning** and **recording of data**.

Children's responses

Photo 4: Examples of children's questions

Reflections

Children are born to ask, wonder and search, even if not systematically.

Children began to understand the need for more systematic investigations, including recording of data.

Children showed initiative in asking questions and showed their ability to gather evidence and make connections.

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Implications
Children needed support to help them become more systematic in their explorations and reflect on their learning.

2 Reflection on the outdoor activity – identifying questions for investigation

Activities:
The children and I created a diagram of what children knew, what they wanted to learn and how they would be able to achieve it.

Rationale
This activity aimed to support children in **gathering ideas** in a systematic way, identifying their own **questions** and recognize the need for **scientific thinking** and **investigation**.

Children's responses

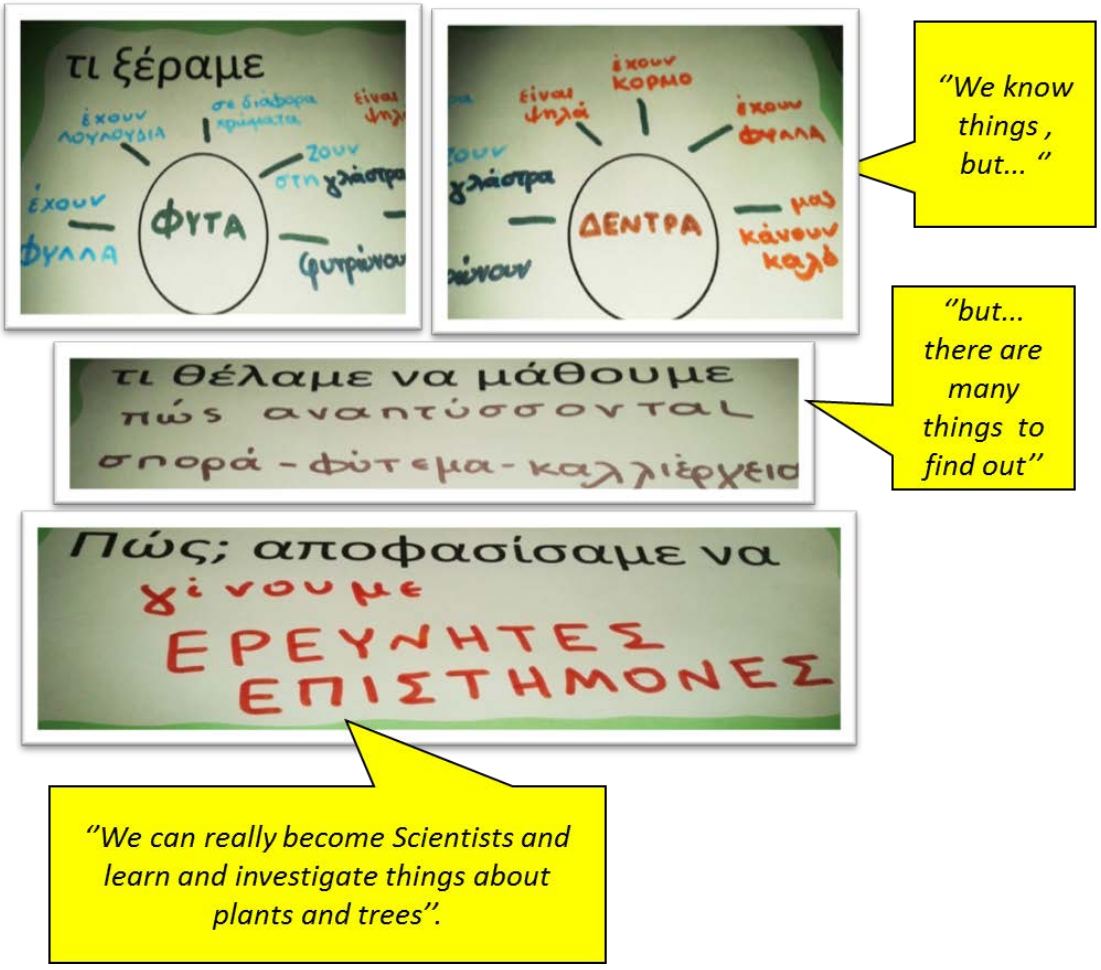

Photo 5: Examples of children's concept maps

Reflections
Children should have help to make diagrams with written words.

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Children identified their investigation focus and **made connections** with what they already knew.

Children have begun to see themselves as Scientists.

Implications
To develop children's awareness of scientific skills and processes.

3 Conducting their own investigations

Activity 1: Planting seeds.
Every child planted seeds, using visual instructions to direct them.

Photo 6: Children planting seeds

Afterwards the teacher showed the class some photos of scientists keeping data and began a conversation about it. Children were motivated. to express their ideas and opinions about this scientific method. Children accepted her suggestion to adapt a "Scientist's Book" for organizing their observations on the plants.

Children's responses

Photo 7: Children making their own 'Scientist's Book'

Every child took his own "Scientist's Book" and made an image of his/hers first action (planting). Many of them made a four-staged image.

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Photo 8: Examples of children's drawings of planting seeds

Activity 2: Keeping data.

Every child observed its plant every 2-3 days and recorded data in the 'Scientist's Book'.

Photo 9: Children recording data in their 'Scientist's Book'

Children's responses

"After we plant, then there is a seed growing yellow...."

Photo 10: Examples of children's drawings of germination

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Activity 3: Making predictions and investigating.

Children in small groups made predictions and investigated the factors needed for seeds to grow.

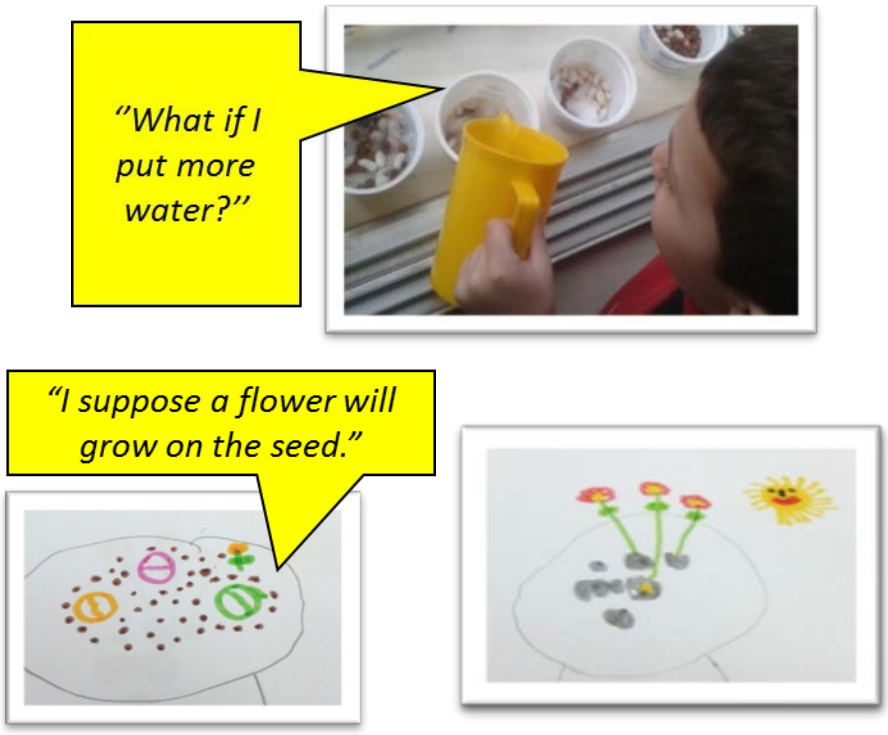

Photo 11: Examples of children's questions and predictions

P. said: ''What if I put more water?'' "I suppose there will be flowers on the seeds after some days and I must check if I am right".

''What if we put our pots and seeds on the heating machine?'' "Then the seeds will become taller really soon".

Rationale

These activities were designed to foster children's scientific thinking and skills, such as observation, collecting data, making predictions and planning investigations.

Reflections

Children really enjoyed keeping data and observing the growth of the seeds. They investigated factors empowered by their motivation and curiosity.

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Implications

Not all questions were answered. Children needed opportunities to carry out further research and represent their learning.

4 Further research and evaluating ideas

Activity 4: Children in small groups answered questions **searching books and the Internet**. The focus was on information that they could not readily find at first hand in the classroom.

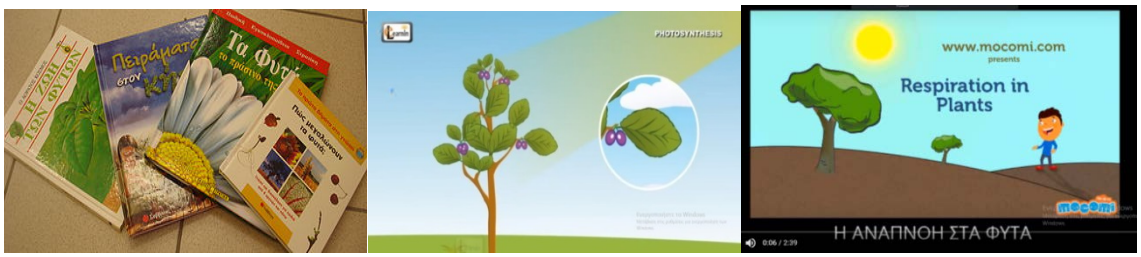

Photo 12: Examples of sources of information

Children's responses

Photo 13: Examples of children searching for information

A .noticed: ''So, when we don't know something, we search for the answer''.

M. opened his book and said: "I'm gonna learn now how to plant potatoes in my yard".

Activity 5: In pairs the children made 2D-models with clay/plasticine of different plants. Then they stuck post it labels on every part they created. They could refer to class made charts when stuck.

Children's responses

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Photo 14: Examples of children's 2D models

M.and P. had written the words "leaves" and "roots" on the learning wall, while A. noticed ''Roots are like hands of the flower or the tree underground".

Then P. asked: *"What if the tree is burned? I heard it's bad".* M. stopped and said *"Now that we became scientists, we can search for it".*

Reflections

The combination of printed and digital educational material seemed to reinforce children's knowledge, because it **motivated** them and gave answers to their curiosity.

Scientific modeling through 2D/3D representations is a useful **assessment tool** for evaluating children's knowledge.

Reviewing learning across the project

- Children started by having broad ideas about Science, mainly in relation to technological artefacts, and rather stereotypical ideas about NoS and the work of scientists. These were diagnosed using drawings and brainstorming.
- Puppet 'Mrs Science' motivated them to start **thinking about science in more personal terms**.
- During their initial explorations in the outdoors and based on their **observations** on the field (real plants) they started developing their own questions for investigation.
- More controlled investigations helped them experience a number of inquiry processes, develop inquiry skills and experience first-hand the **empirical** nature of science.
- The use of multi-modal ways of recording, representing, searching for, **interpreting and evaluating evidence** in the 'Scientist's Book' and when

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working in teams enhanced their experience of science as a **creative endeavour**, while at the same time re-inforced their **self-concept as 'scientists'**.

- Finally, their reflections on their learning gave them a first-hand experience of the **tentative nature of science** at they had to explain their ideas and be confronted with alternatives.

Developing inquiry skills and creative dispositions

From developing the learning journey, at starting point 1, evidence of children's creative dispositions were the initial drawings and explanations they made, using their imagination.

At starting point 2, children had the opportunity to express their beliefs and think critically about Scientists and show their ability to come up with something new. And at starting point 3, they were motivated into the 'scientific world' by "Mrs Science".

During the initial investigation, children asked initial questions and showed their ability to gather evidence and make connections. They began to understand that scientific method must be systematic. Children designed their investigations and made connections. They should have help to make diagrams with written words, because of their small experience in writing. It made me rethink that children are born to ask, wonder and search, even if not systematically.

As the circus of the main activities began, children really enjoyed keeping data and observe the growth of the seeds. They experimented with the factors using their motivation and curiosity. They recognized that in spite of their actions, scientists would always face new questions to answer, and this is important as long as they know where to search.

The combination of printed and digital educational material seemed to enforce children's knowledge, because it motivated them and gave answers to their curiosity. Through the last activity children evaluated their knowledge by self- and peer-assessment

Overall Reflections

Children's progress

Child 1 (M., 4.5 y.o. boy):

M. (while observing the seed): "A scientist like me studies every change in the seeds."

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Photo 15: Child 1 studying how the seeds change

Child 2 (A., 5.7 y.o. girl):

A. (while gathering evidence): "These seeds made me observing and thinking more."

Photo 16: Child 2

Child 3 (P., 5.4 y.o. boy):

P. (while drawing on his own): "I suppose there will be flowers on the seeds after some days and I must check if I am right."

Photo 17: Child 3's drawing

Review of children's progress

Children showed some evidence of their growing awareness of **scientific inquiry skills and processes**. Activities fostered a **positive attitude** to science and greater appreciation of the **Nature of Science.** For example:

- Children talked explicitly about key features of working as scientists – for example the importance of **making observations, thinking about and checking results**.

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- They showed **curiosity** and began to recognise that science involves asking **questions and testing predictions**.
- They suggested **new ideas**, **gave reasons** for every decision they made and **reflected on their learning**. Their ideas and explanations seemed **plausible** and **creative**.
- When the conversation was about their learning, children used to say "Now, we are Scientists we know how to learn anything we want to know or how to search for it".

Teacher role

- Using different approaches to find out about children's images and ideas of scientists, and the use of the puppet Mrs Science, fostered interest and discussion about science and scientists that we could refer back to across the project.
- It was important to give children **opportunities for working scientifically** themselves – making their own decisions. At the beginning of the programme my involvement was stronger, but during the project **children took more control** of their investigations through their own curiosity and questioning, reflection and reasoning.
- The initial explorations provided a stimulus to foster **children's curiosity and questioning**.
- My support to children's reflections on their outdoor experiences - through class discussion and the recording of children's ideas in a diagram - played a key role in children identifying what they already knew and **generating their own questions** for investigation.
- It was important then to provide opportunities for children to carry out **their own investigations** using both first and second hand sources.
- There were ongoing opportunities for **assessment** during the process including peer assessment and self assessment. The processes of representing and sharing ideas offered opportunities for **evaluating and reflecting on learning** – both for the children and as a teacher.
- Throughout my questions were focused on **scientific processes** and on **children's attitudes to the Nature of Science**, they were mainly open-ended

Classroom environment

Location indoors and out, grouping to encourage collaboration and the combination of hands-on and digital educational material contributed to children's inquiry and creativity.

Group work was an important feature in my planning. I aimed to build on children's collaborative skills and through it they foster their sharing of ideas, identify and solve problems and reflect on their developing knowledge and understanding.

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Next steps for learning and teaching

- Build on their growing confidence as young 'scientists' to plan and carry their own investigations.
- In the long term I would like to explore more features of NoS with the children and extend their knowledge of what scientists do, through finding out more about different scientists and their work.

Reflection questions for the reader

- In what ways would you support children's understanding about how science works?
- What are your views about NoS and how do they affect your teaching?
- How could you help children recognise and talk about the scientific inquiry processes and skills they are developing and their links to NoS?

Practical Information

Resources:

1.printed books about plants' growth

2. digital educational material www.bgfl.org/plants and https://youtu.be/tkFPyue5X3Q?list=PL_J-AyLJZjWCV8hONkunXn6RdvQfVX65N

Tasks - Lesson plans:

1. Activities investigating children's ideas about science (2 days)
2. Activities investigating children's scientific skills (1 day)
3. Activities investigating & developing children's ideas about plants/trees (1 month)
4. Activities assessing the valuation of the implementation (2 days).

Follow up activities:

- Create the life cycle of a flower or a tree with multiple educational material (on board games – 3D representations with clay/plasticine/playdoh – claymation movie- embodied simulations)

Investigations

Investigate what happens to a plant/tree when it 'dies'.
Investigate the benefits of plants in people's life.

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