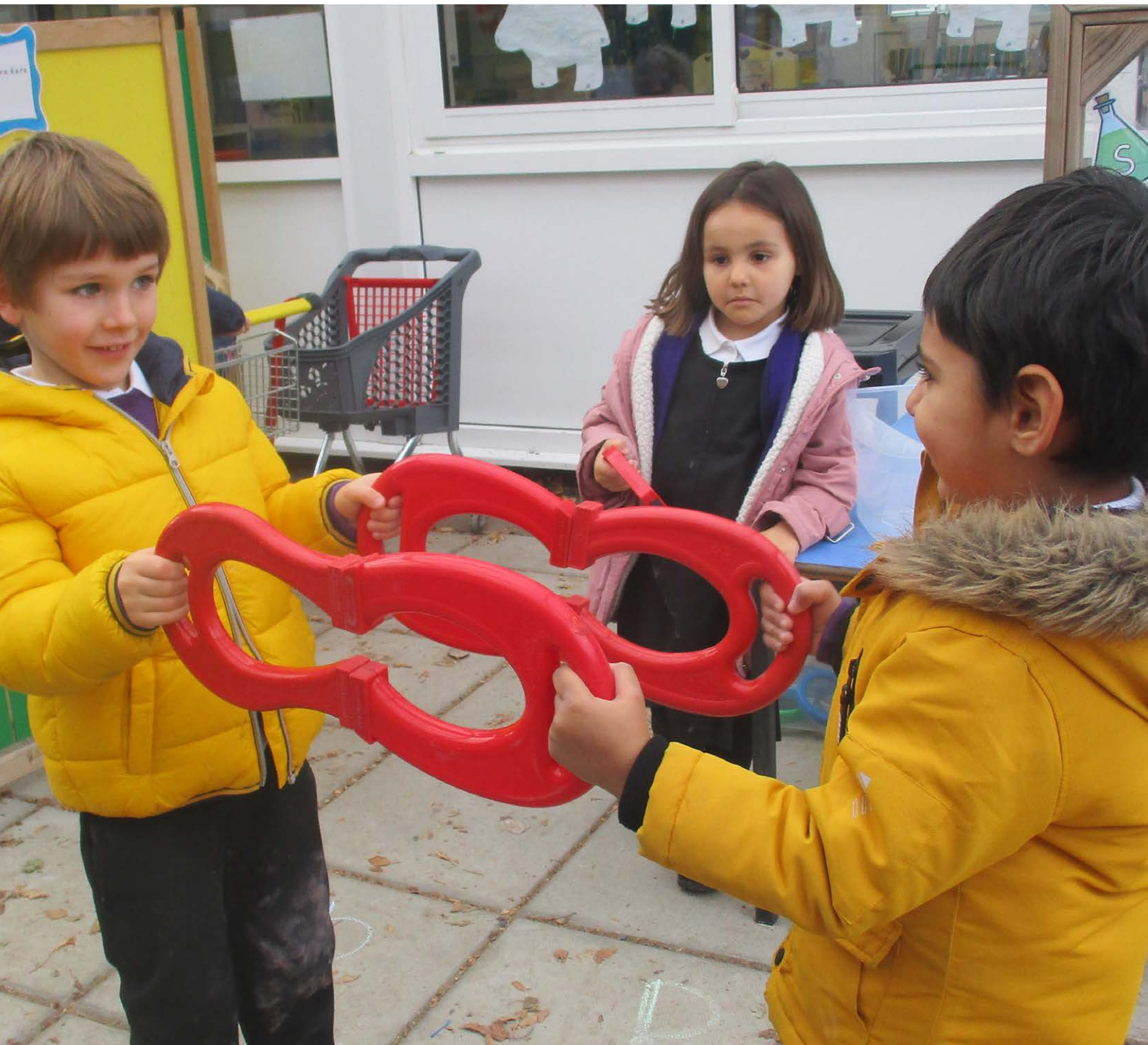
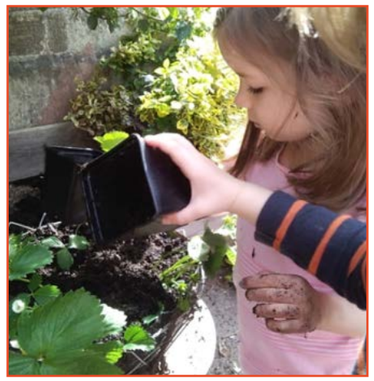
# Early Science

## Guidance from the Teacher Assessment in Primary Science (TAPS) project

**June 2022**



# The place of science in the Early Years

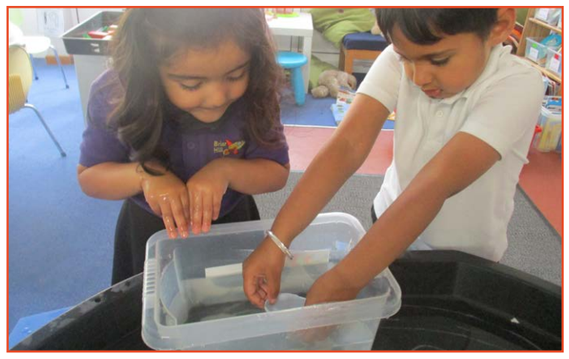


Young children are natural scientists, exploring and enquiring about their world from the outset.

Gopnik et al. (2001) describes the infant as the 'scientist in the crib': as the adult studies the child, so the child studies the adult and the world around them (p3-4). Although not necessarily named explicitly in early years curricula, science can be seen everywhere: in the growing of plants, the naming of animals when exploring what lives under a log, the making of playdough and the exploration of sand and water in continuous provision. As well as the 'specific area' of 'Understanding the World', the statutory guidance for England lists three characteristics of effective teaching and learning: 'playing and exploring; active learning; creating and thinking critically' (DfE, 2021: 16), all of which support the development of scientific skills. This guidance considers underpinning principles for effective and developmentally appropriate practice in early science.

# Playful exploration

Early science can be seen as playful exploration, using senses to explore the world, developing the key scientific skill of observation



Open-ended, first-hand experiences which are owned by the child are motivating and engaging as they may proceed at their own pace – there are no time constraints for an infant exploring a rattle with their mouth or toddler pouring water between different containers. Children learn through interaction with their environment, developing foundational scientific concepts, for example, that cars need a push to move around the track or that hot chocolate will cool down over time. Playful exploration is the precursor to later science investigations (Johnston 2010) and providing opportunities for such concrete sensory enquiries enables shared moments of attention and discussion of shared experiences, which is particularly important for those from disadvantaged backgrounds. The Creative Little Scientists European study found 'playful experiences' and 'hands-on, minds-on exploratory engagement' (Cremin et al., 2015) to be essential elements for scientific development. 'Minds-on' notes the importance of the thinking and dialogue that goes alongside the exploration, which may be supported by the adult.

# Adult role: interaction

The adult has many roles in their science interactions with young children:

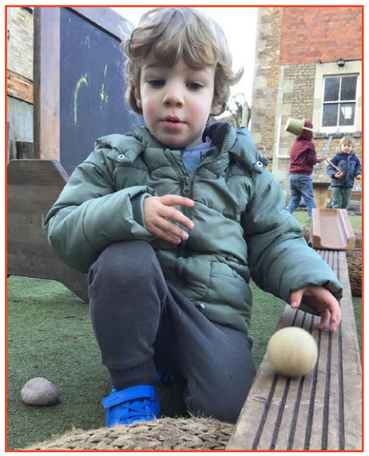
- Relationship builder: interacting with and attuning to the children to develop a trusting relationship.
- Role model: showing an interest and positive attitude towards science and using appropriate science vocabulary.
- Listener: valuing the unique child's voice and interests, e.g. listening to their 'working theories' arising from their explorations.
- Scaffolder: sensitively responding and supporting children's explorations, e.g. by wondering or opening possibilities, by commenting or naming to help with communication and vocabulary, by providing an additional resource or provocation.
- Co-constructor: developing dialogue, e.g. through 'person-centred' questions (Harlen and Qualter, 2014) and 'sustained shared thinking' (Siraj-Blatchford et al., 2002).

Adults move between these roles, and others, fluidly, aiming to interact rather than interfere (Fisher, 2016). The interplay is dependent on the child and the individual situation, with practitioners aiming for a balance between adult and child-led explorations. For example, in continuous provision, the child may lead the learning and the adult follows, as the child notices, explores and tests in their water play. On other occasions, the adult may lead the learning in a playful way, for example, in cooking and gardening opportunities.

# Adult role: environment and resources

**An enabling environment will provide open-ended opportunities for scientific exploration:**

- Science opportunities in continuous provision e.g. sand and water play, construction, vehicles, playdough, sensory table such as herbs to cut and grind.
- Outdoor provision that includes living things e.g. growing area, forest school, mud kitchen.
- A range of diverse, open-ended resources e.g. natural materials like pine cones and shells, containers, large loose parts such as ramps, tubes and materials for slides.
- Provocations or invitations to learn e.g. baking, bubble making, torches/mirrors for exploring light, instruments for exploring sound, magnetic bottles (see next page).
- Play, observe & ask children questions to find out what they are thinking and to scaffold their learning whilst they are exploring – see PSTT EY resources.
- Science opportunities in fiction and non-fiction texts e.g. using traditional stories to set up a problem solving context like building a house for the Three Little Pigs or making a waterproof shelter for Incy Wincy Spider.



# Using assessment

**Ongoing formative assessment involves tuning into the child and using this understanding to make professional judgements, for example, about whether to intervene to challenge thinking at a particular point in time.**

A lot of this will be happening in the practitioner's head and does not need to be recorded. However, real time documentation such as learning stories, floorbooks and working walls can be a useful way to explore the learning process with the child and their family.

Ongoing formative assessment also supports practitioner reflection and can be summarised for summative purposes when required.

## FURTHER RESOURCES

- PSTT Early Years resources, including Provision Maps linked to topics, stories and nursery rhymes: pstt.org.uk/resources/curriculum-materials/eyfs-science
- Further TAPS examples: pstt.org.uk/resources/curriculum-materialsassessment
- Pan London Assessment network Early Years resources: planassessment.com
- STEM stories: nustem.uk/eyfs-stem-stories
- Bristol Early Years Characteristics of Effective Learning: bristolearlyyears.org.uk/early-learning/characteristics-of-effective-learning
- Early Science research summary - use of play and role of the adult: ase.org.uk/resources/journal-of-emergent-science/issue-22

## *References*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Johnston, J. (2010) Exploration and investigation. In Cooper, L., Johnston, J., Rotchell, E. and Woolley, R. (Eds) *Knowledge and understanding of the world.* London: Continuum, pp8-29.

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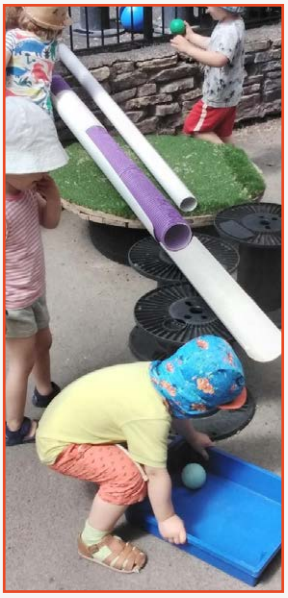
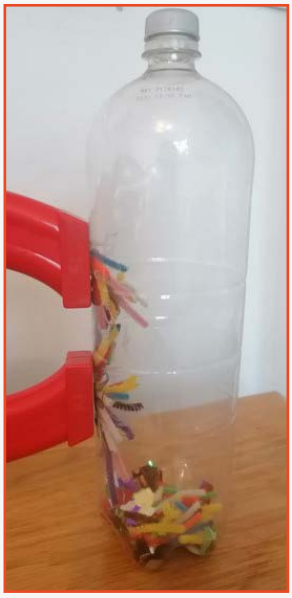
# Examples from settings



## Continuous provision: Loose parts

At Ashgrove Park Nursery, children were exploring the loose parts in the garden. They found a big tube and some guttering and started putting balls down the tubes. Other children noticed what was going on and tried their own ways to make balls go down the tubes. All children realised that the tubes had to be up high to make the ball roll down. They used all different types of loose parts and resources to make their tubes high enough for the balls to run down.

Download this learning story **here**



## Magnets provocation: magnetic bottles

In the Reception class at Briar Hill Infant School, plastic bottles containing mixtures of magnetic and non-magnetic items were left in the 'science lab' area for the children to explore with magnets. Children explored with magnets inside and outside, finding objects that were magnetic.

Download this learning story **here**

## Outdoor learning: Forest school sticky mud

After a period of rain, the children from Noah's Ark Nursery explored the forest school area in a variety of ways. For example, some children found that it was more slippery when trying to balance on the logs. Others observed that the mud was squelchy and sticky under foot, leading to stickiness testing on a tree.

Download this learning story **here**

## Dropping provocation: Exploring cupcake cases

Children from Atelier Nursery dropped cupcake cases from above their heads. They dropped the cases from an upright position and watched them fall. Once they landed the children retrieved them and repeated, trying different positions and jumps.

Download this learning story **here**

## Outdoor learning: Caring for a beetle

At Filton Avenue Nursery School and Children's Centre, a child had been digging in the sandpit when they discovered a beetle. The children were concerned about the insect staying in the sand. They carried the beetle from the sandpit to the planting area and put it in a pot with mud, talking with the adult about how they might look after it.

Download this learning story **here**

For further examples see: pstt.org.uk/resources/curriculum-materials/assessment

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Thanks go to practitioners from the following Early Years settings for their examples of practice which can be found in this booklet and on the TAPS website: Ashgrove Park and Clyde House Day Nurseries, Atelier Nursery, Briar Hill Infant School, Filton Avenue Nursery School and Children's Centre, Noah's Ark Pre-School, Laurel Avenue Community Primary School and Plympton St Mary's Infant School.

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