Thinking Doing Talking Science

Thinking, Doing, Talking Science

- an overview for teachers

Introduction

Thinking, Doing, Talking Science (TDTScience) is an inclusive approach to teaching primary science which has been shown to significantly improve children's attainment and attitudes. It is based on over 20 years of educational research and pulls together a range of established good practice.

The research evidence for TDTScience comes from a Randomised Controlled Trial (RCT) funded by the Education Endowment Foundation (EEF) in 2013-15. This compared the attainment and attitudes of Year 5 children whose teachers had attended a TDTScience course, with those whose teachers had not. This was an 'efficacy trial' designed to find out if an intervention is effective and the research was carried out by the University of York. The TDTScience course was developed by Helen Wilson (Oxford Brookes University) and Bridget Holligan (Science Oxford).

"It's fantastic when our evaluations produce solid evidence that a particular approach has a positive impact on attainment. It's especially rewarding when they boost children's attitudes towards learning too. But the reality of robust educational research is that these results are the exception and not the rule."

Sir Kevan Collins, EEF Chief Executive Officer 2011-19 [talking about TDTScience]

On average, TDTScience children made three additional months' progress in science, with a particularly positive effect for girls and for children with low prior attainment (four months' progress). TDTScience appeared to have a positive impact on attitudes to science and there were indications that the approach was particularly beneficial for children eligible for free school meals (five months' progress).

"TDTScience is an inclusive, research-led approach to science which allows all pupils to positively engage in science through higher order thinking, practical-led science and focussed recording."

Teacher, Durham, 2023

"Giving time to think, talk and do in science results in highly engaged children with a deeper understanding of key concepts."

Teacher, Yorkshire, 2023

"The TDTScience research is a validation that science can be taught effectively without spoiling the children's enjoyment."

Teacher, Teesside, 2023

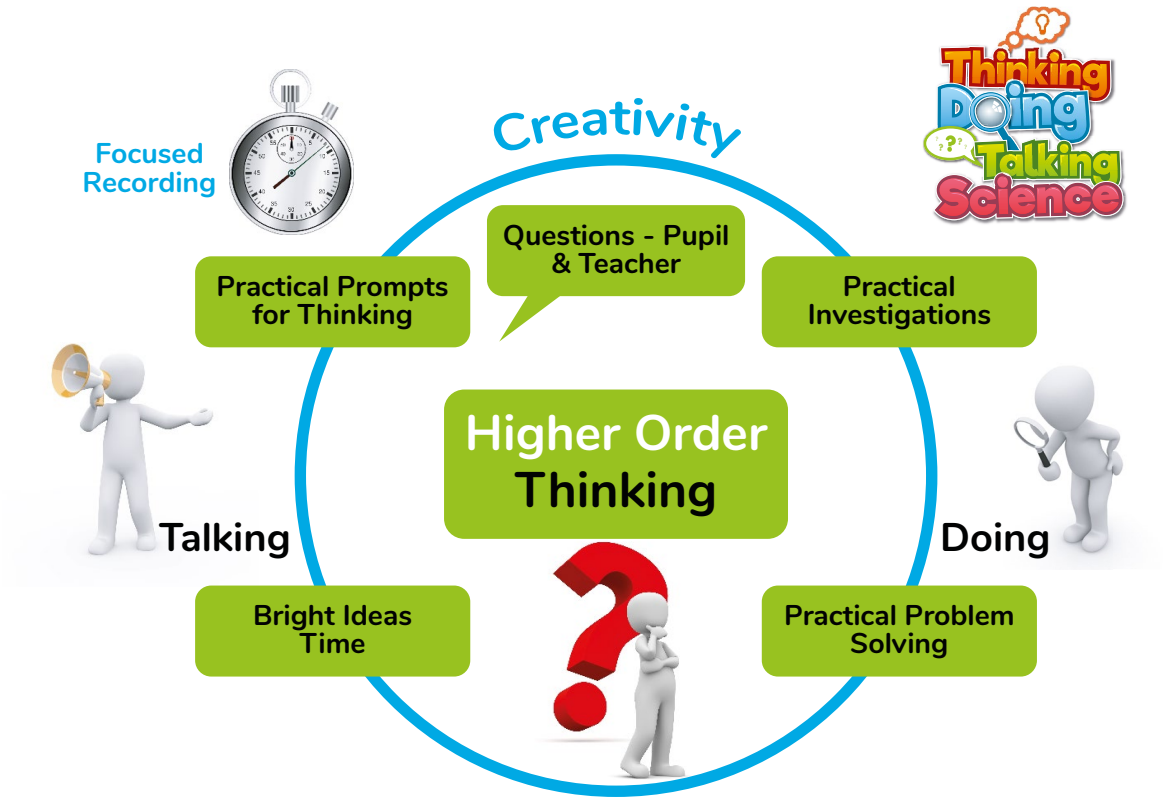
Who is this booklet for?

This booklet is for primary teachers who would like to understand more about the TDTScience approach to teaching science and what it looks like in practice. Although it is an overview, it also provides examples of strategies that teachers can use. More information is provided at the end of this booklet about how to access a TDTScience course, as well as links to other support and resources that are based on, or aligned with, the TDTScience approach.

The TDTScience Approach

TDTScience is an inclusive approach which focuses on the development of cognitively challenging (THINKING), practical (DOING) and interactive (TALKING) primary science lessons. Teachers enable all children to think and talk about scientific concepts through dedicated discussion times, they provide all children with a wide range of opportunities for creative investigations and problem-solving for knowledge and skills development and they focus the children's recording on the learning objectives so time is prioritised for purposeful practical science.

The diagram below gives an overview of the TDTScience ethos. The core aim at the heart of the approach is to improve the level of conceptual challenge in primary science by the encouragement of children's higher order thinking; exploiting every opportunity to infuse deeper thinking throughout the normal curriculum. The Bright Ideas Time is a dedicated discussion slot in every lesson, using a range of inclusive prompts to stimulate children's thinking and talking. This can also include teacher demonstration-based 'Practical Prompts for Thinking'. Focused recording supports effective assessment, whilst ensuring that children's science curriculum time is not dominated by writing.



"We have built in Bright Ideas Time at the start of each lesson, re-examined how we teach the practical side of science and being more focused with this. We have dramatically reduced actual recording in books and hopefully made this more focused too. We have really tried to develop the overall understanding and skills of the children through higher order thinking with tailored questions, which has promoted many good discussions in class."

Teacher, Durham, 2023

Encouraging Higher Order Thinking in Primary Science

At the heart of the TDTScience approach is the concept of extending children's thinking in science by encouraging Higher Order Thinking (HOT). There are many definitions of HOT, but one way of expressing the idea is given below:

'Higher order thinking occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations.'

Lewis, A. and Smith, D. (1993) 'Defining Higher Order Thinking', Theory into Practice 32(3)

It is more important than ever to encourage children to develop skills which enable them to think critically rather than accept any information provided to them at face value. After all, any question can be answered simply by using an internet search, so how can we equip children to discern whether the answer they obtain is reasonable? How can we distinguish between conspiracy theories and facts?

Bloom's Taxonomy of Educational Objectives was developed back in 1956 but is still relevant when considering how to maximise the opportunities for HOT. It is important to note that learning facts and the recall of knowledge is foundational and essential. However, including more higher order tasks and questions in lessons to support deeper thinking leads to improved understanding and learning. The understanding of content knowledge is embedded and enhanced through thinking about it.

"Science is all about thinking and the enjoyment of thinking deeply"

Coates and Wilson (2003)

"The children are much better critical thinkers now."

Teacher, Teesside, 2023

"Education is what is left when you have forgotten everything that you learnt"

Albert Einstein

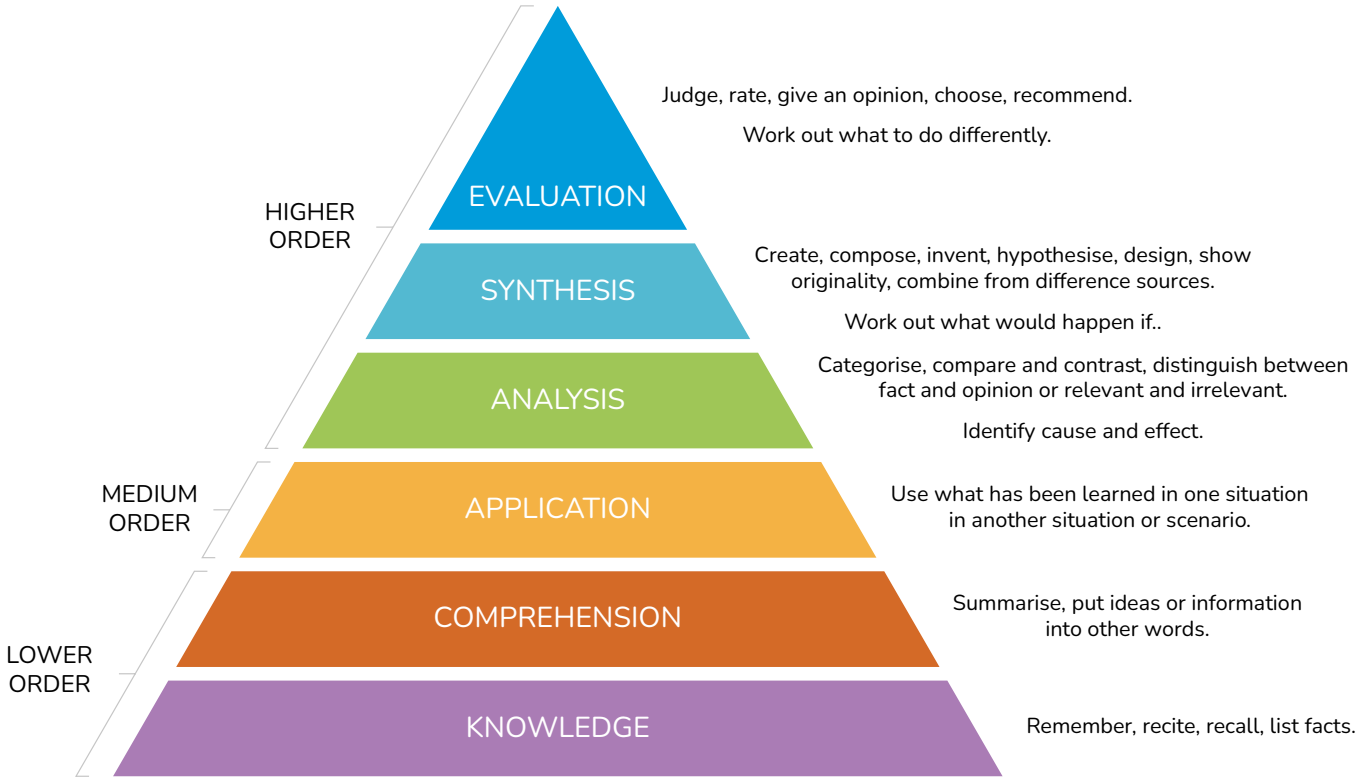
"I'm more confident in teaching deeper learning and developing deeper thinking in science."

Teacher Lancashire, 2023

"I talk less and they think more!"

Teacher, Teesside, 2023

Bloom's Taxonomy and Building Blocks



Science Inside the Black Box (Black & Harrison, 2006, published by GL Assessment) was developed as part of the original Assessment for Learning work, and gives a useful summary which fits very well with the TDTScience approach and the importance of HOT for learning. It suggests the essential ingredients for lessons should be:

- Challenging activities that promote thinking and discussion
- Rich questions
- Strategies to support all learners in revealing their ideas
- Opportunity for peer discussion about ideas
- Group or whole-class discussions which encourage open dialogue

"TDTScience is an approach to learning that involves a careful blend of creative, practical and enquiry-based strategies, which help to promote knowledge retention, engagement and independence. Promoting higher order thinking and knowledge/skills in equal measure."

Teacher, Staffordshire, 2023

Bright Ideas Time

The TDTScience approach recommends that every science lesson includes a dedicated time for thinking and talking, called the Bright Ideas Time (BIT). The aim is to encourage children's Higher Order Thinking (HOT) in an inclusive environment where all ideas and responses are valued, where it is appropriate to take risks in thinking and where discussing the big ideas of science is more important than finding the 'right' answer.

The BIT need only take 10 minutes, and is similar to a mental starter, but could equally be used as a plenary or at a transition point in the lesson. It can be used from EYFS through all the primary age ranges and across all topic areas.

"Pupils are more able to verbalise in a scientific way. They have retained more knowledge and applied skills more efficiently as they have progressed. Their acceptance of others' ideas and the ability to change their own, as they listen to one another, especially during the Bright Ideas Time is having an impact in all areas."

Teacher, Staffordshire, 2023

"Pupils are finding it easier to ask questions and share what they already know. There is more confidence in discussing science and more thinking."

Teacher, Devon, 2023

Top Tips for the Bright Ideas Time

- Use the 'think, pair, share' approach or other 'no hands up' techniques
- All responses should be respected and valued, as long as a justification can be given
- The strategies provide inclusive challenge – everyone can participate
- Responses should be verbal – the approach is designed to encourage discussion rather than writing
- Children's responses can be used by the teacher to elicit understanding
- Teachers should not have a single 'right' answer which they are hoping to hear from children
- Misconceptions can be noted and addressed separately
- Choose examples carefully to link to the relevant topic
- Remember it takes practice for children (and teachers) to become used to the approach where there is no single 'right answer'

The main strategies used in the BIT are described on the following pages.

Odd One Out

The most accessible teaching strategy to start a BIT is the Odd One Out. Children are presented with three or four items and are asked to choose and justify how one of them is the 'Odd One Out'.

Odd One Out Example: water, chocolate and paper

Possible answers might include:

Paper is the odd one out because it...
"is white"
"can be folded"
"will burn with a flame"
"isn't consumable"

Water is the odd one out because it...
"is transparent"
"is a liquid"
"is in a cup"
"occurs naturally"

Chocolate is the odd one out because it:
"is brown"
"melts when you heat it"
"is wrapped up"
"is delicious!"

- Children have the opportunity to be creative in their thinking and they can draw on their observations as well as their understanding of the properties of the materials.
- The more time teachers can allow for children to keep sharing responses, the deeper the thinking will be.
- The challenge can be increased by asking specific groups of children to focus on one item and think of as many reasons as possible why it is the Odd One Out.

Further examples:

Key Stage 1
Living things: a teddy bear, a cat, a daffodil
Living things: a root, a leaf, a flower
The seasons: a child dressed in spring, summer, autumn and winter clothes

Key stage 2
Electricity: a battery, a light bulb, a switch
Sound: a guitar, a piano, a triangle
Earth and space: the Earth, the Moon, the Sun

Positive, Minus, Interesting

Edward de Bono is credited with inventing the concept of Positive, Minus Interesting (PMI) as a creative lateral thinking strategy. Given a specific scenario, children are encouraged to consider positives, minuses and interesting points.

PMI Example: Human skeletons are completely flexible

Possible answers might include:

Positives: No one would suffer broken bones, people could fold up and fit into small spaces
Minuses: Our internal organs would not be well protected, it would be difficult to reach up high
Interesting: Gymnastics may no longer be a competitive sport, we might not be able to jump

- Asking children to consider positives, minuses then interesting ideas one at a time gives structure and focus and maximises the opportunity for HOT.
- After practice with the approach, children could choose whether their idea is positive, minus or interesting.
- To increase the challenge, the teacher can ask groups of children to focus on one category (positive, minus or interesting) and think of as many ideas as they can which fall into this category.

Further examples:
Living things: A world where humans are the only living things
Forces: Wood is a magnetic material
Earth and space: Humans living on Mars

The Big Question

The Big Question is an open-ended question linked to a scientific concept which demands deeper thinking before answering. As an approach The Big Question is more challenging to introduce than Odd One Out or PMI, but when used effectively it can foster inclusive discussions which promote HOT, and give children a chance to show the level of thinking they are capable of!

The Big Question: How do we know that the Earth is a sphere?

Possible answers might include:

- Water doesn't fall off the edge so it can't be flat
- The Moon and Sun look like circles, perhaps the Earth is too
- When a ship disappears over the horizon, the last thing to be seen is the mast
- Different stars can be seen in the sky near the horizon at different places on Earth
- Because gravity comes from the centre of the Earth, because a sphere is the smallest shape you can make from the centre, it would most likely be pulled up into a sphere (this is an actual answer from a Year 6 child!)

Further examples:

- Living things: What is a seed?
- States of matter: Where do puddles go?
- Earth and space: What is between the Earth and the Sun?

Teachers are sometimes apprehensive about using The Big Question because they worry that they do not have a clear answer for it themselves, or they are concerned they will not be able to answer supplementary questions which arise.

- It is perfectly acceptable for teachers to say "I don't know!" Science is all about asking questions and not all can be answered easily, or at all.
- When further questions arise, these may be 'parked' on a flipchart – the teacher may then choose which ones to address later.
- Big Questions focus on developing understanding of scientific concepts rather than leading into possible investigations.

In 'Science Inside the Black Box', Paul Black and Christine Harrison describe the difference between 'skinny' questions and 'rich' questions. Teachers need to use a range of question types for different purposes. 'Big Questions' are examples of 'rich' questions.

Skinny questions:

- Check children's knowledge
- Often one word answers
- Seeking facts

Rich questions:

- Open ended
- Needs time to think – can't usually answer immediately
- Answers generally require one or more sentences
- Sometimes children need to ask other questions to work towards main question
- Tend to prompt further questions
- Need to make links, apply ideas, give reasons

Practical Prompts for Thinking

Practical Prompts for Thinking (PPT) is another strategy that can be used in the Bright Ideas Time. PPT are teacher-led demonstrations presented to stimulate children's thinking and talking for deeper understanding. They can be 'wow' demonstrations such as a Film Canister Rocket, with the aim being to use them to go beyond the 'wow' and to provide an opportunity for HOT by asking why or how questions. PPT can also be more everyday examples such as Icy Water and Feeling Friction Force.

Demonstrations can also provide good opportunities for teacher explanation, but the TDTScience approach advocates using them with higher order questioning to elicit children's own ideas first, so the thinking of all children can be valued and any misconceptions noted.

PPT Example 1: Film Canister Rocket

This PPT is best done outside, in a tray on the ground, with children 3m away. It involves a film canister about a quarter full of water. A Vitamin C tablet is added, the lid put on tightly, and the canister placed upside down on the tray. Questions for children could include:

- Why does the film canister separate from its lid and fly up into the air?
- What do you think would happen if this experiment was done in a different type of container (e.g. a zip-loc bag)?
- If you were going to investigate this reaction what variables could you change to explore what affects how high or how fast the rocket goes?

PPT Example 2: Icy Water

This PPT is a transparent glass of water with ice cubes in it, left to stand for 10 minutes so that condensation is visible on the outside of the glass. If possible, each table of children could have their own glass of icy water to observe closely. Questions for children could include:

- What do you observe is happening to the ice cubes in the glass? Why?
- Where do you think the droplets of water on the outside of the glass have come from (and why has this happened)?
- Have you ever noticed this effect happening anywhere else?

PPT Example 3: Feeling Friction Force

This PPT is two books interleaved together about 20-30 times. Ask a child to help you to separate the books by pulling on the spine of one book while you pull on the other. Questions for children could include:

- Why is it so hard to pull the books apart?
- What forces are acting on the books when we try to pull them apart?
- How could I make it easier to pull the books apart?

Practical Science for Thinking, Doing and Talking

Although the examples in this booklet are taken from the TDTScience 4-day course, there is no such thing as a 'TDTScience practical'; the TDTScience approach can be applied to any practical activity that children might do in science – from card sorts and simulations to investigations and problem solving. It is about being clear about the learning objectives (LO) that the activity is being used to serve ('purposeful practicals') and maximizing the opportunities for thinking (inclusive challenge) in the way that the activity is structured. The children focus their recording on the teacher's chosen LO(s) for the activity. Here are some examples to illustrate:

Investigation: What's the best paper towel?

Tips for Higher Order Thinking

- Provide a scenario in which a paper towel is required as a springboard into the investigation.
- Allow children access to 3-4 types of paper towel for exploration and then discuss with them what could be meant by 'best' and what relevant properties of the paper towel could be assessed through enquiry (e.g. absorbency).
- Support small groups of children (e.g. 3-4) in formulating a suitable, more specific, investigation question and allow them some creative control of variables and/or method of paper towel comparison. Requiring children to ask for the equipment they think they need increases the challenge.

Learning Objectives (LO) and Focused Recording

- A knowledge-based LO could link to properties and changes of materials e.g. compare absorption/strength of different paper towels.
- A working scientifically LO could link to any element of the investigation process, e.g. 'to plan a fair test' or 'to draw a conclusion from results'.
- Children would carry out the whole investigation but only record against the LO that the teacher has chosen as the focus for the practical.
- It is important to note that the LO is NOT to find out which is the 'best' paper towel. There is no single 'right' answer and different groups will reach different conclusions.

Pattern Seeking: Investigate levers

Allow each group of children access to a simple lever/fulcrum but with a mass taped in place at one end (see image below).

Tips for Higher Order Thinking

- Allow children time to explore for themselves how it feels to lift the mass when the fulcrum is kept in the middle but they change the position of the finger that is pushing down. Can children identify a pattern?
- Repeat, with children moving the position of the fulcrum rather than the position of the finger pushing down. Can children identify a pattern?
- A push meter could be used instead of a finger to measure how big a push force is needed.

Learning Objectives (LO) and Focused Recording

- A knowledge-based LO could be to put the observed pattern into words as a conclusion. For example, 'the longer/shorter the distance between my finger and the fulcrum, the smaller/bigger the force needed to lift the mass.'
- A working scientifically LO could be to explain why it was important to keep the weight taped in place at one end of the lever for this investigation or to make accurate measurements.
- Children would carry out the whole investigation but only record (verbally or in writing) against the LO that the teacher has chosen as the focus for the practical.

Problem-Solving: Protect an egg

Tips for Higher Order Thinking

- Practical activities framed as problem-solving always set up opportunities for HOT as children have to apply their skills and knowledge to meet the challenge. e.g. Use the materials provided to protect an egg (in a zip-loc bag) when it is dropped from 3m or thrown over 2m.
- Limit the materials available to children and give each small group (3-4 children) the same items e.g. a thin plastic bag containing: envelope, paper, card, balloon, string, sheet of sticky labels, sheet of newspaper.

Learning Objectives (LO) and Focused Recording

- A knowledge-based LO could be to show how the properties of the materials used relate to the purpose they were chosen for.
- A working scientifically LO could be to evaluate the egg protection systems to identify the design features which were most effective.
- The focused recording could be to label a photo of the egg protection system e.g. to identify which materials used for which purpose or to identify design features that helped to protect the egg.

"TDTScience offers opportunities for children to think like and be a scientist, creating and carrying out investigations to aid their learning."

Teacher, Devon, 2023

Simulation: Acting out the motions of the Earth and Moon

Tips for Higher Order Thinking

- Giving children opportunities to act out simulations or to create models can enable HOT and deeper learning compared to just being told 'the facts'.
- Start with the Big Question 'what causes night and day to occur?' and, following the discussion, ask children (in pairs) to act out the motion of the Earth around the Sun.
- Follow this task with a whole-class demonstration using two volunteers. The Sun volunteer remains stationary (but could have a torch to shine at the Earth person) and the nose of the Earth volunteer represents the UK. As the Earth volunteer rotates slowly on the spot ask the class what time of day it is for every quarter of a full turn (e.g. midday, 6pm, midnight, 6am). Volunteers can also model the additional motion of the Earth revolving (orbiting) around the Sun (1 year).
- This modelling exercise can be repeated for the movement of the Moon around the Earth – with pairs of children acting it out for themselves to start with followed by a whole-class demonstration with two volunteers. The Moon rotates on its own axis at the same speed that it revolves (orbits) around the Sun (28 days) so we only ever see one side of the Moon.
- It is very hard (but funny to try – children will remember it!) to model all aspects of motion at once e.g. combining the Earth motions with the Moon motions.

Learning Objectives (LO) and Focused Recording

- To explain day and night with reference to the movement of the Earth
- To describe the movement of the Earth relative to the Sun
- To describe the movement of the Moon relative to the Earth

"The children have been really enthused by what we have planned. They have loved the increased practical side and have been able to discuss their predictions and suggest reasons why something did or did not happen. For the Space topic we spent one lesson purely discussing various theories and questioning aspects which they wanted to find out more about. "

Teacher, Durham, 2023

Card Sort: Life cycles

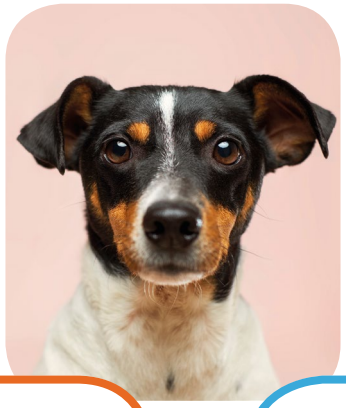
Provide small groups of children with cards to sort for the lifecycle stages of e.g. butterfly, dog, frog, hen. Once children have organized the photos into a sequenced set for each animal, additional tasks can be given (children could choose one) to provide opportunities for HOT.

Tips for Higher Order Thinking

- Ask children to choose two of the life cycle sets and use post-its to note differences between them.
- Ask children to look at all the life cycle sets and use post-its to note the things they all have in common.
- Ask children to look at all the life cycle sets and use post-its to note advantages and disadvantages for each one.
- Ask children to share what questions arose as they were doing their chosen task.

Learning Objectives and Focused Recording

- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.
- Photos could be taken of the sequenced life cycle, along with annotated post-it notes.



"My science lessons are now more practical, with more discussion and greater emphasis on focused recording, rather than recording every aspect all the time. Planning to ensure that working scientifically is always clear, both within the lesson and for children."

Teacher, Durham, 2023

"Now, when children see science on the daily timetable, there's an audible buzz! The children love the experiments we have been carrying out and the fact that they are far more in control of the investigating with less emphasis on the written recording of all the aspects of the investigation."

Teacher, Lincolnshire, 2023

Crafting a TDTScience Lesson

Key Questions for Teachers

- **Is the aim of the lesson to develop the children's skills; knowledge and understanding; or both?**
- **What will be the focused learning objective(s)?**

The learning objective is clear so that recording carried out by children is focused on the learning intention. Teachers may consider the lesson to be focused on skills or on knowledge and understanding, or sometimes (but not always) both.

Which Bright Ideas Time prompt?

Every TDTScience lesson includes a Bright Ideas Time, with a discussion using a prompt such as Odd One Out, PMI, a Big Question or a Practical Prompt for Thinking. Prompts are carefully chosen to connect the discussion to the topic of the lesson.

Which practical?

The practical part of the lesson can be an investigation or a problem-solving challenge; for some topics other active learning approaches are appropriate such as a simulation or card sort.

Where and how to encourage children's Higher Order Thinking?

This is a key question to consider when crafting a TDTScience lesson. The TDTScience approach can be applied to any science curriculum, so it is likely that existing lesson plans and schemes of work can be adapted by focussing on opportunities to develop HOT.

What will the children record and how will the teacher assess?

Focused recording means that children only record what is directly related to the learning objective(s) rather than writing down everything they do in a practical lesson. This makes their work sharply assessable by the teacher and releases time for thinking, doing and talking. Focused recording can involve drawings, tables, photographs or audio or video recordings.

Example of a Crafted Lesson

Practical Title: Design a Wind-Dispersed Seed

Focus and Principles: Crafting a lesson based on TDTScience strategies.
Before this lesson/practical children could be asked to find out more about the different ways that plants use to disperse their seeds (research using secondary sources).

Bright Ideas Time

Related discussion prompts which encourage Higher Order Thinking include:

- **Big Question:** What is a seed?
- **Odd One Out:** different types of seed (with different dispersal mechanisms)
  Can do as a seed sorting exercise instead if there are enough examples of real seeds for pairs or small groups of children to sort (using their own criteria).
- **Big Question(s):** Why do plants need to disperse their seeds? Why do wind dispersed seeds need to fall slowly rather than quickly?

Practical Activity

Challenge: Use the materials provided to create the 'best' wind dispersed seed design.

Making a 'best' design for a wind dispersed seed and iteratively improving it is modelling the process of evolution because the 'best' designs in nature are the ones most likely to survive and reproduce.

Equipment per pair/group:
One thin plastic bag containing:

- Part pack of post-it notes (square)
- Paper e.g. A4 x 3
- Pair of scissors, masking tape
- Small ball of blu-tac or plasticine
- A few paper clips
- 3 art straws
- Light material (e.g. tissue paper sheet)
- Other craft materials (optional)

Timers and measuring tape or meter rulers may also be useful. A simple paper helicopter template may be useful to assist children who find open design challenging.

Suggested group size: 2-3

Time: 45 mins (in addition to Bright Ideas Time discussion)

Science: Wind dispersed seeds are typically light so they can float and glide on air currents and travel further away from the parent plant. Some seeds have parachute designs that use air resistance to slow their fall from the tree. Others have 'helicopter' designs that use spinning (autorotation) to slow their fall from the tree.

Possible Learning Objectives:

- The structure of fruits or seeds relates to how they are dispersed from the parent plant. Plants disperse their seeds to increase the chance that they will grow into new plants, with less competition for space, light, water and nutrients.
- The main types of seed dispersal are DIY (drop/roll or 'pop'), wind, water or via animal.
- To predict, test, evaluate and improve
- To take accurate measurements, recording data and reporting findings

Tips:

- Additional design criteria could be that the seed it is small enough to fit inside a paper cake case. Children could also be given a specific bead or bean for the seed core.
- A cheap litter picker could be used to test falling seeds from a greater height.

Focused Recording:

Link to the chosen learning objectives. One example could be:

- Draw a picture of your seed design (or a photo).
- Label the features of your seed design and explain why they helped it to fall more slowly (so it could travel further from the parent plant). Could request that this is done using reference to forces (e.g. gravity, air resistance).

Other Links:

- https://www.woodlandtrust.org.uk/blog/2019/08/seed-dispersal/
- https://schoolgardening.rhs.org.uk/Resources/Lesson-Plan/Seed-dispersal

A TDTScience lesson planning template

The focused learning objectives:

Knowledge and understanding:

Working scientifically skills:

Related Bright Ideas Time:

Practical – an investigation or problem solving activity, or other active learning such as a simulation (acting ideas out), research from secondary sources, or a card sort:

Where is the Higher Order Thinking?

Focused Recording method (which allows assessment of learning objectives):

"I have thought more carefully about the format of each lesson. I have started to use a HOT activity to start every session which has been very popular with the children. I have been making sure that I only have a small amount of new information in each lesson and that we cover it in different ways ... I try to teach less but in more depth. I feel much more comfortable in my science lessons and I've tried to use the various ways suggested to teach scientific enquiry skills; something I struggled with previously."

Teacher, Lancashire, 2023

"I've changed the format of my science lessons to fit crafting a lesson. I've researched and bought into a scheme using a similar format to use throughout school."

Teacher, Teesside, 2023

TDTScience is Relevant and Evidence-based

Using the TDTScience approach in school addresses many of the current issues identified in relation to teaching primary science. Most importantly however, teachers can be confident that, being evidence-based, implementing the TDTScience approach will result in improved outcomes for all children, as well as increasing their enjoyment and attitudes towards science. The Education Endowment Foundation's Improving Primary Science Guidance Report (2023) draws upon TDTScience. Ofsted's Finding the Optimum: the Science Subject Report (2023), highlights a number of areas of good practice which align with the TDTScience approach. It also describes some opportunities for improvement, which TDTScience supports.

"Alongside [clear teacher explanations], pupils benefit from time to discuss ideas, answer questions and practise using the knowledge."	Children should be given time and opportunities to think and discuss their learning. The Bright Ideas Time is an ideal way to achieve this.
"...practical demonstrations have been shown to play an important role in helping pupils to learn science, involve minimal costs and can save valuable time."	Practical Prompts for Thinking are easily-resourced demonstrations included in TDTScience lessons as part of the Bright Ideas Time.
"The purpose of practical work is clear in relation to curriculum content so that practical activities can be set up and managed to develop pupils' disciplinary and/or substantive knowledge."	Purposeful practicals with clear learning objectives are a key feature of TDTScience.
"Teachers generally had secure subject knowledge. Clear explanations from teachers, alongside carefully selected teaching activities, supported the learning of specific content and played a key role in helping pupils to learn science."	Science subject knowledge for teachers is not a cause for concern. This is why TDTScience focuses on the approach to teaching science, exemplifying it across different topics and with subject knowledge notes for teachers to refer to, rather than taking the view that primary science teaching is improved purely by improving teachers' subject knowledge.
"Ensure that pupils have a secure knowledge of what has been taught, before moving on to more content. This should include checking whether pupils have specific misconceptions."	Teachers should identify misconceptions and address these. The Bright Ideas Time discussion techniques can be used to elicit children's understanding and therefore identify misconceptions. Focused recording ensures that work is sharply assessable by the teacher.
"Access to science-specific CPD is particularly important for primary teachers, given that they frequently teach outside their subject specialism, and that some reported a lack of confidence in teaching science."	TDTScience is a CPD course specifically designed for primary teachers. Ofsted recognise the value of training such as TDTScience for primary teachers.

"The children are now starting to think deeply without being asked and they are remembering more and making more links within their learning."

Teacher, Teeside, 2023

"When talking to children they are really enthusiastic about science and my class are now definitely better at talking about their understanding rather than the activity."

Teacher, Teesside, 2023

"The children certainly enjoy science a lot more. They are remembering the knowledge better as I present them with smaller 'chunks' so it is easier to review quickly."

Teacher, Lancashire, 2023

"The children have improved understanding of scientific vocabulary. Investigations show children taking ownership of their learning and their questioning has improved."

Teacher, Lancashire, 2023

"Children are more willing and able to discuss their ideas. We now use talk for science groups and the children get into these groups for Bright Ideas Time discussion and for practical investigations. As a teacher work is easier to mark and it is easier to move the children's learning on through feedback as there is a clearer learning intention for the lesson."

Teacher, Devon, 2023

"TDTScience is a practical approach to scientific learning that promotes higher order thinking and deeper understanding through a range of activities. It supports retrieval, vocabulary development and enquiry."

Teacher, Staffordshire, 2023

"TDTScience is a hands-on practical approach to infusing learning with the scientific method without sacrificing valuable substantive knowledge."

Teacher, Teesside, 2023

Further information about TDTScience courses

Courses run regularly at Science Oxford in Headington, Oxford OX3 8SB.

For details go to our website at: tdts.org.uk

— Accredited Trainer —

Courses are organised in collaboration with local partners such as local authorities and run by accredited TDTScience trainers.

For details check our website at: tdts.org.uk

Courses run regularly at the National STEM Learning Centre, York YO10 5DD.

For details see:

stem.org.uk/cpd

and search for “Thinking, Doing, Talking Science”

An online ‘taster’ 90 minute course, run for a whole school staff team typically as a twilight CPD session and introducing the Bright Ideas Time is available from Science Oxford.

For details see: scienceoxford.com/events/thinking-talking-science-1-bright-ideas-time

tdts.org.uk