Talking Like a Scientist: Seven Steps to Improving Disciplinary Literacy

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- To **learn about science**, pupils need to learn about the different ways in which scientists engage in their work: through reading, **talking**, writing and representing science. This is called **disciplinary literacy**.

Osborne, 'Learning to read Science', 2016

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- It is **not** the same as teaching generic literacy strategies needed to interpret any text. Instead, it involves pupils learning how individuals within a discipline '**structure their discourses**, **invent** and **appropriate vocabulary** and **make grammatical choices**'.

Shanahan, 'What is disciplinary literacy and why does it matter?', 2012

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- Research shows, however, that pupils are routinely expected to **pick up** knowledge of disciplinary literacy **implicitly**.

Kang, 'How is Disciplinary Literacy addressed in the science classroom?', 2016

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- By defining explicitly in the curriculum what aspects of disciplinary literacy pupils need to know, and why, **pupils can be made aware of the aspects of literacy that are peculiar to science**. For example, pupils will need to learn how to read and write in the passive voice and learn that many words have multiple meanings depending on context, for example ‘cell’ and ‘model’.

Osborne, ‘Learning to read in Science’, 2016

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- So here we are… evidence-informed, highly transferable across subjects, and specifically aligned to how scientists read, write, **speak** and think.
- The common thread is that disciplinary literacy in science is not simply improving general literacy. It is about helping pupils **use language as scientists do**: hypothesising, explaining, evaluating evidence, identifying patterns, and justifying conclusions.

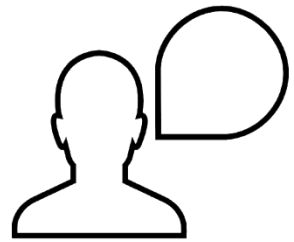
1. Explicitly Teach Scientific Vocabulary

What it involves

- Move beyond keyword lists and definitions. Teach vocabulary through morphology (prefixes, suffixes and roots), contextual use, multiple exposures and purposeful retrieval.

Teachers should:

- **Pre-teach critical vocabulary** before practical or theoretical learning.
- **Explore word origins** and meanings.
- **Model the correct use of terminology in speech** and writing.
- **Revisit** vocabulary frequently through **retrieval practice**.



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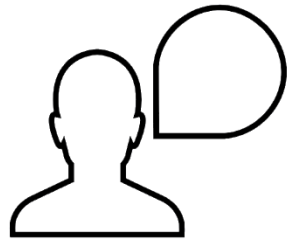
1. Explicitly Teach Scientific Vocabulary

Key benefits

- **Improves comprehension** of scientific texts.
- **Reduces cognitive load** during learning.
- Supports **more precise explanations**.
- Improves attainment, particularly for disadvantaged pupils.



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1. Explicitly Teach Scientific Vocabulary

Science curriculum example

KS3 Biology: Cells

Rather than simply defining "photosynthesis", explore:

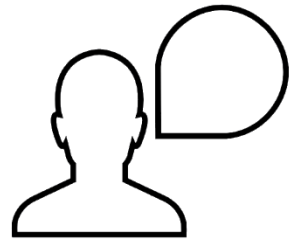
- photo = light
- synthesis = putting together

Pupils then explain:

"Photosynthesis is the process by which plants use light energy to synthesise glucose.“

instead of:

"Plants make food."



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2. Use Structured Talk Before Writing

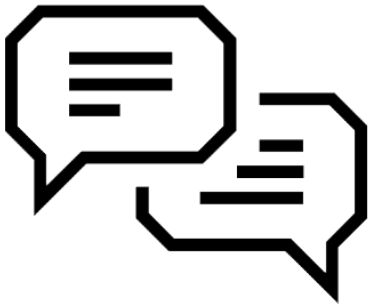
What it involves

Provide deliberate opportunities for pupils to rehearse scientific thinking aloud before committing ideas to paper.

Strategies include:

- Think-Pair-Share
- Turn and Talk
- Structured debates
- Verbal reasoning tasks
- Partner explanations

Provide sentence stems to scaffold discussion.



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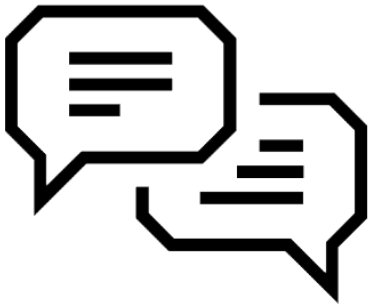
2. Use Structured Talk Before Writing

Key benefits

- Develops scientific reasoning.
- Improves confidence with technical language.
- Makes misconceptions visible.
- **Leads to higher-quality written responses**.



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2. Use Structured Talk Before Writing

Science curriculum example

KS4 Physics: Energy Transfers

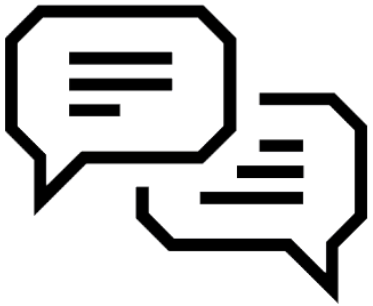
Prompt:

"Which energy transfers occur when a toaster heats bread?“

Sentence stems:

- “Initially, electrical energy is...“
- "This is transferred into...“
- "Evidence for this is...“

Pupils verbally rehearse explanations before completing exam-style questions.



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3. Model Scientific Writing Explicitly

What it involves

Show pupils exactly how scientists construct explanations, conclusions and evaluations.

Use:

- Live modelling
- Worked examples
- Shared writing
- Visualisers

Think aloud as you write.



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3. Model Scientific Writing Explicitly

Key benefits

- Makes expert thinking visible.
- Reduces uncertainty around extended writing.
- Improves organisation and precision.
- Supports examination success.



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3. Model Scientific Writing Explicitly

Science curriculum example

KS4 Chemistry: Rates of Reaction

Teacher models:

> "As temperature increases, particle kinetic energy increases. Therefore, collisions occur more frequently and with greater energy, increasing reaction rate.“

Explicitly discuss:

- causal connectives
- scientific terminology
- explanation structure



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4. Teach Reading Like a Scientist

What it involves

Scientists do not read texts passively. They interrogate evidence, evaluate claims and interpret representations.

Teach pupils to:

- Annotate texts.
- Identify evidence.
- Question claims.
- Evaluate reliability.
- Summarise key ideas.



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4. Teach Reading Like a Scientist

Key benefits

- Improves scientific literacy.
- Enhances critical thinking.
- Supports understanding of contemporary scientific issues.
- Develops evidence-based reasoning.



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4. Teach Reading Like a Scientist

Science curriculum example

KS4 Biology: Vaccination

Pupils read an article about vaccine uptake and annotate:

- Claim
- Evidence
- Scientific explanation
- Reliability of source

Discussion prompt:

"What evidence supports the author's argument?"



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5. Use Sentence Stems and Academic Language Frames

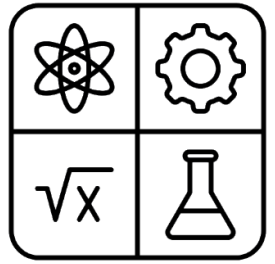
What it involves

Provide scaffolds that support pupils in constructing scientifically accurate explanations.

Examples include:

- “The evidence suggests...”
- “This indicates that...”
- “A possible limitation is...”
- “The independent variable was...”

Gradually remove support over time.



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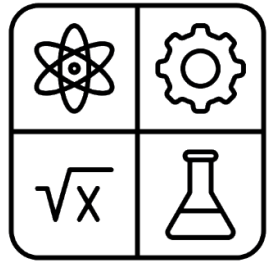
5. Use Sentence Stems and Academic Language Frames

Key benefits

- Increases quality of oral and written responses.
- Supports lower prior attainers.
- Encourages precise scientific language.
- Reduces reliance on informal language.



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5. Use Sentence Stems and Academic Language Frames

Science curriculum example

KS3 Working Scientifically

During practical evaluations:

Instead of:

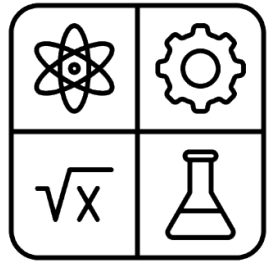
> “It wasn't very fair.”

Pupils use:

> “The reliability of the results may have been reduced because...”

Or

> “A limitation of this method was...”



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6. Make Disciplinary Thinking Visible Through Evidence-Based Explanations

What it involves

Teach pupils to routinely connect:

1. Observation
2. Evidence
3. Scientific knowledge
4. Conclusion

A useful structure is:

Claim → Evidence → Reasoning (CER)



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6. Make Disciplinary Thinking Visible Through Evidence-Based Explanations

Key benefits

- Develops scientific argumentation.
- Encourages deeper thinking.
- Reduces unsupported conclusions.
- Aligns closely with examination requirements.



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6. Make Disciplinary Thinking Visible Through Evidence-Based Explanations

Science curriculum example

KS3 Chemistry: Acids and Alkalis

Prompt:

Which solution is most acidic?

Pupil response:

Claim: Solution A is the most acidic.

Evidence: It had a pH of 2.

Reasoning: Solutions with lower pH values contain a higher concentration of hydrogen ions and are therefore more acidic.



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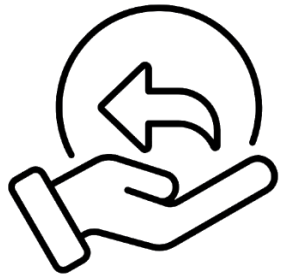
7. Use Retrieval Practice Focused on Scientific Language

What it involves

Retrieval activities should revisit both scientific concepts and the language used to express them.

Examples:

- Vocabulary quizzes
- Frayer models
- Sentence completion tasks
- Explain-it-again activities
- "Use these three words correctly" challenges



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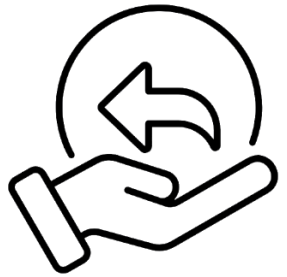
7. Use Retrieval Practice Focused on Scientific Language

Key benefits

- Strengthens long-term retention.
- Improves fluency with scientific terminology.
- Supports transfer between topics.
- Makes language more automatic.



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7. Use Retrieval Practice Focused on Scientific Language

Science curriculum example

KS4 Biology: Organisation

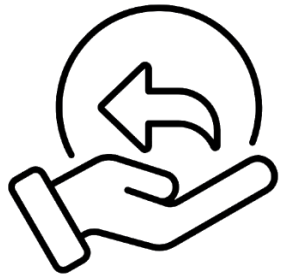
Retrieval prompt:

Use the following words in a scientifically accurate explanation:

- diffusion
- concentration gradient
- membrane

Expected response:

"Diffusion is the net movement of particles down a concentration gradient across a partially permeable membrane."



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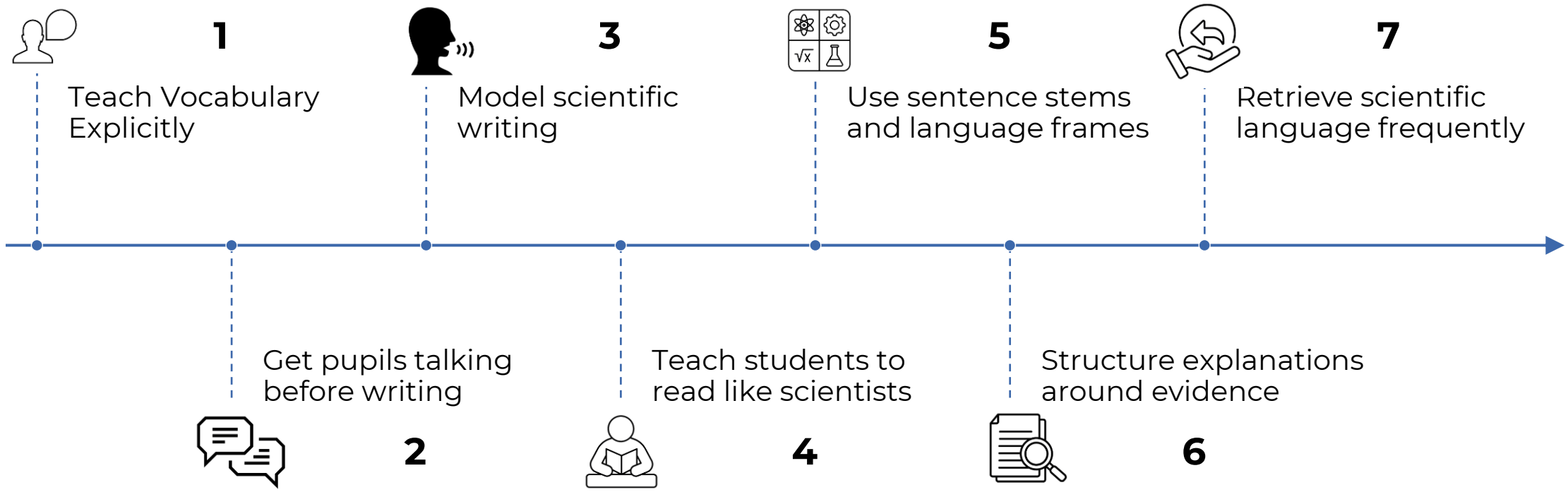
Talking Like a Scientist: The Magnificent Seven



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