

Talk Is Not Enough

What Makes Oracy Work in Secondary Science?

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Oracy has moved from the margins to the mainstream of English education policy. But the research on talk in science classrooms carries a warning that enthusiasm often skips over: more talk does not reliably produce more learning. This article sets out what the evidence says, where it is thin, and the six conditions that seem to separate productive science talk from pleasant noise.

The oracy moment

Few ideas in English education have gained ground as quickly as oracy. In October 2024 the Oracy Education Commission, chaired by Geoff Barton, published *We Need to Talk*, arguing that oracy should become a "fourth R" with equal status to reading, writing and arithmetic (Oracy Education Commission, 2024). A year later, the independent Curriculum and Assessment Review, chaired by Professor Becky Francis, recommended a new national oracy framework to guide teachers and support good practice, and the government committed to developing one (Department for Education, 2025a; 2025b). Voice 21, the charity most closely associated with the movement, reports working with over a thousand schools (Voice 21, 2024).

For science teachers, this is both an opportunity and a risk. The opportunity is obvious. Science is a subject in which pupils must learn to reason about invisible entities, defend claims with evidence and use words whose scientific meanings differ from their everyday ones. Talk is an obvious tool for all of these. The risk is less obvious but just as real: that oracy becomes another whole-school initiative layered onto lessons as an activity ("turn and talk to your partner") rather than built into how science is taught. A department can tick every oracy box and still see no improvement in pupils' understanding of electric current or natural selection.

The argument of this article is simple. Talk is necessary for learning science well, but it is not sufficient. The research suggests that talk improves learning only when certain conditions are met. Those conditions are specific, and most of them are about the *quality* and *structure* of talk rather than its quantity. The sections that follow set out what we mean by oracy in science, what the evidence does and does not show, and six conditions that appear to make the difference.

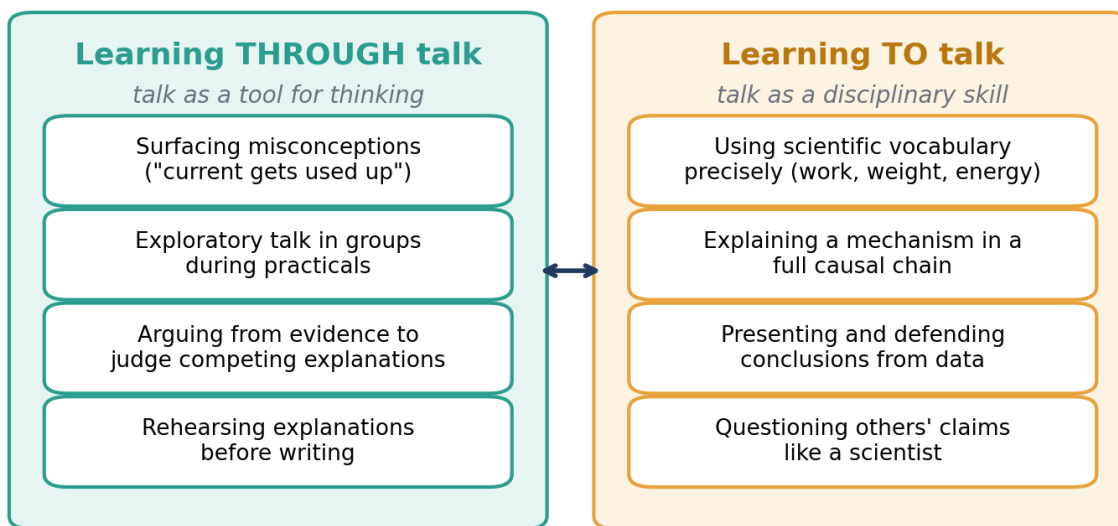
What do we mean by oracy in science?

The most useful distinction in the oracy literature is between **learning through talk** and **learning to talk** (Mercer, Warwick and Ahmed, 2017; Oracy Education Commission, 2024). The first treats talk as a tool for thinking: pupils articulate half-formed ideas, test them against others' and refine them. The second treats talk as a skill to be taught: pupils learn to speak in ways valued by a discipline, an audience or a purpose.

In science, both matter and they reinforce each other (Figure 1). When pupils argue in small groups about whether a heavier ball falls faster, they are learning *through* talk; the disagreement brings

their ideas into the open where they can be examined. When they learn to frame an explanation as a causal chain ("the particles gain energy, so they vibrate more, so..."), they are learning *to* talk like scientists. A pupil who has not learned the second struggles to benefit from the first, because they lack the language to make their reasoning precise.

Oracy in science has two jobs



Effective science lessons plan for both, and each strengthens the other.

Figure 1. The two jobs of oracy in science. Learning through talk uses dialogue to develop understanding; learning to talk develops the disciplinary ways of speaking that make that understanding precise.

The Oracy Framework developed by Voice 21 and researchers at the University of Cambridge breaks oracy into four strands: physical (voice and body language), linguistic (vocabulary and register), cognitive (reasoning, building on and challenging ideas) and social and emotional (listening, turn-taking, confidence) (Mercer, Warwick and Ahmed, 2017). In whole-school programmes the physical strand often gets the most visible attention, because posture, projection and presentation are easy to see and coach. In science, the cognitive and linguistic strands do most of the work. A beautifully delivered explanation of photosynthesis that confuses energy with matter is still wrong.

Why science, in particular, needs talk

Science has long been described as a language as much as a body of knowledge. Lemke's classic study *Talking Science* argued that learning science largely means learning to talk science: to use its words, patterns of reasoning and ways of relating ideas (Lemke, 1990). Wellington and Osborne (2001) made a similar case for secondary classrooms in England, arguing that language is not an optional extra in science teaching but one of its central difficulties. The EEF's guidance report on secondary science puts it plainly: learning science involves learning a whole new language, and teachers need to develop pupils' fluency in it (Education Endowment Foundation, 2018).

Three features of science make talk especially important.

- **Science explains the invisible.** Particles, fields, energy stores and genes cannot be seen. Pupils build mental models of them, and those models are often wrong in predictable ways.

Talk is one of the few ways a teacher can see a model at work, because explaining forces a pupil to commit to a mechanism.

- **Science is built on argument.** Scientific knowledge is established by weighing claims against evidence and alternative explanations. School science often presents conclusions as settled facts, which hides this process. Structured argument puts it back (Driver, Newton and Osborne, 2000; Osborne, 2010).
- **Science words are deceptive.** Everyday words such as *work*, *weight*, *power*, *energy*, *reflect* and *random* have specialised meanings in science. The EEF singles out words like *valid*, *random* and *spontaneous* as needing explicit teaching precisely because pupils think they already know them (Education Endowment Foundation, 2018).

There is also a practical reason that every science teacher preparing pupils for GCSE will recognise. Extended-response questions, such as the six-mark questions in GCSE science, reward a connected explanation: a sequence of linked steps rather than a list of keywords. Examiners regularly see answers that contain the right words in the wrong order, or a correct conclusion with the mechanism missing. Many of these are not failures of knowledge but of articulation. Pupils have rarely been asked to say the whole explanation out loud before being asked to write it.

What the evidence says, and what it does not

The headline evidence for oracy is encouraging. The EEF's Teaching and Learning Toolkit rates oral language interventions as high impact for very low cost, with an average of around six months' additional progress, based on a large body of studies (Education Endowment Foundation, n.d.-a). The Toolkit notes that "interaction for learning is a key aspect of these interventions" and that "the evidence is strongest on interventions that are integrated with the existing curriculum". It also finds larger effects where more disadvantaged pupils take part.

But the same entry contains caveats that matter a great deal for secondary science teachers. Most of the studies come from early years and primary settings rather than secondary schools. Many were not independently evaluated, which tends to inflate effects. And on subject outcomes the Toolkit is explicit: "A small number of studies test whether oral language interventions improve science and maths outcomes. The impact on achievement in these subject-specific tests is not clear" (Education Endowment Foundation, n.d.-a).

The more specific trials tell a more cautious story (Figure 2). In the EEF's efficacy trial of Dialogic Teaching, Year 5 pupils in 76 schools made around two months' additional progress in science, with similar gains in English and maths (Jay et al., 2017). A follow-up looking at Key Stage 2 results found no impact, though many schools had not continued the approach into Year 6 (Education Endowment Foundation, n.d.-b). Thinking, Doing, Talking Science, a primary programme designed to make science lessons more discussion-rich, produced about three months' additional progress in an efficacy trial of 40 schools. In a larger effectiveness trial across 205 schools, with less training and preparation time, there was no evidence of impact on average, although pupils eligible for free school meals made a small gain (Education Endowment Foundation, n.d.-c).

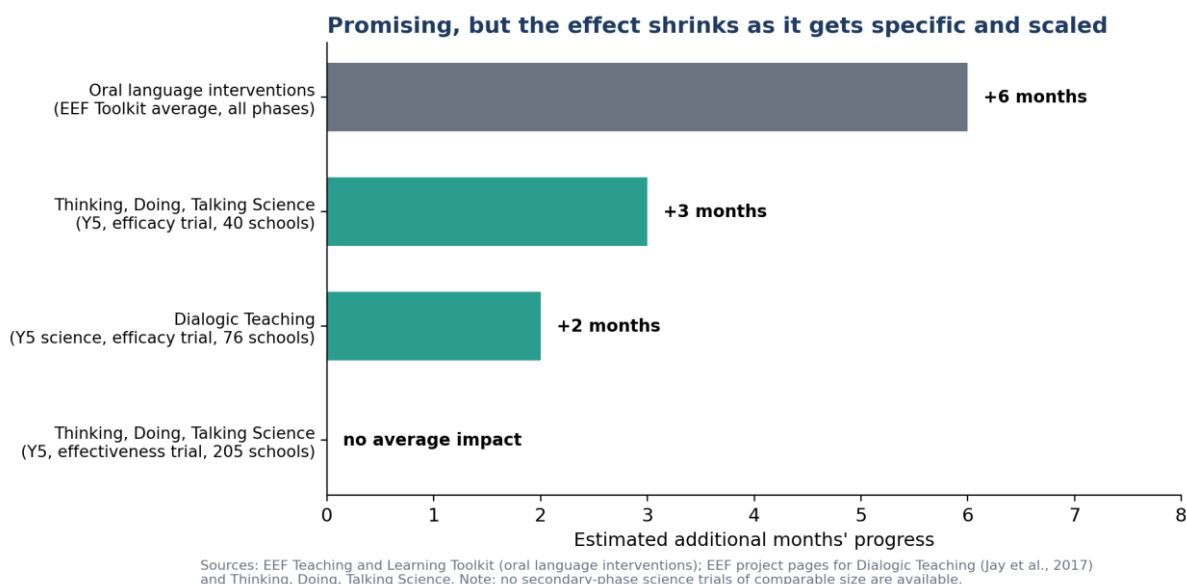


Figure 2. Estimated additional months' progress from selected EEF evidence on talk-based approaches. Effects are smaller in specific science trials than in the Toolkit average, and the largest trial found no average effect. All trials shown are in primary schools.

Two patterns stand out. First, effects tend to shrink as evidence gets more specific to science and as programmes scale up. Second, almost none of the robust trial evidence comes from secondary science classrooms. Secondary teachers are, in effect, extrapolating from primary research. That does not mean the approach is wrong, but it should make us humble about claims and careful about implementation.

The most useful study for understanding *why* talk sometimes works and sometimes does not is Howe et al. (2019). The research team video-recorded lessons in 72 Year 6 classrooms across England, coded every exchange between teachers and pupils, and related the patterns to pupils' end-of-year attainment and attitudes. Simply having lots of talk was not what mattered. What mattered was a combination: **elaboration** (pupils building on or evaluating previous contributions), **querying** (challenging or doubting ideas) and **wide participation**. When participation was high, more elaboration and querying went with higher test scores, even after accounting for prior attainment. When participation was low, the frequency of elaboration and querying made no measurable difference (Howe et al., 2019).

A study of 639 ninth-grade pupils in Czech schools points the same way (Šed'ová et al., 2019). Pupils who talked more, and especially those whose contributions involved reasoning, tended to achieve more, and this held regardless of socio-economic background or gender. But classroom-level counts of reasoning talk did not by themselves predict better outcomes. It seems to matter *who* is doing the reasoning, not just whether reasoning is happening somewhere in the room.

The picture that emerges is consistent. Talk is not an intervention in itself; it is a medium. Whether it helps depends on what kind of talk it is, who takes part, and how it connects to the content being learned. The rest of this article sets out six conditions, drawn from the research, under which talk seems most likely to improve learning in secondary science.

Condition 1: Talk has to be taught

The most consistent finding from Neil Mercer's research programme is that pupils do not, by default, talk in productive ways when put in groups. Mercer distinguished three types of group talk (Figure 3). In **disputational** talk, pupils disagree and make individual decisions; exchanges are short assertions and counter-assertions. In **cumulative** talk, pupils build positively but uncritically on each other's ideas, agreeing without testing. In **exploratory** talk, pupils engage critically but constructively with each other's ideas, offering reasons, challenging and reaching justified agreement (Mercer, 2000; Mercer, Wegerif and Dawes, 1999).

Three types of group talk (after Mercer, 2000)

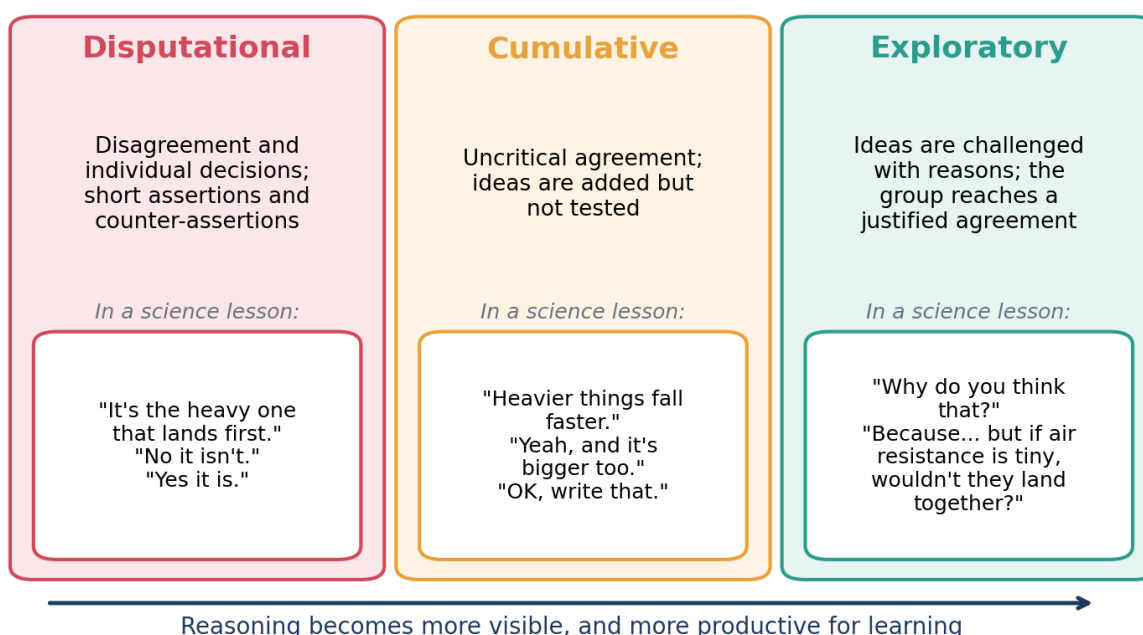


Figure 3. Three types of group talk, with illustrative exchanges about falling objects. Exploratory talk makes reasoning visible and is associated with better learning, but it rarely occurs without explicit teaching. Based on Mercer (2000).

Most unstructured group talk in classrooms is cumulative or disputational. Exploratory talk has to be taught, and Mercer's team showed that it can be. In the Thinking Together programme, classes agreed explicit ground rules for talk, such as "we ask each other for reasons", "we consider every idea before deciding" and "we try to reach agreement". Teachers then modelled and practised them. In a study focused on science, primary pupils taught this way used more exploratory talk, did better on reasoning tests and made gains in science understanding compared with control classes (Mercer et al., 2004). Dawes (2004) showed similar effects on the quality of science talk.

For secondary science, the practical message is that "discuss with your partner" is not a strategy. It is an invitation that most pupils accept by agreeing quickly or deferring to the most confident voice. What helps is:

- **Explicit ground rules**, agreed with the class and displayed, then referred to during group tasks, for example: "Has everyone given a reason?"
- **Modelling** by the teacher of what good exploratory talk sounds like, including a model of changing one's mind in response to evidence.

- **Talk prompts** that require reasons, such as "I think... because...", "I disagree with... because..." and "What's your evidence for...?"
- **Tasks that need talk.** A question with one obvious answer gives nothing to discuss. Questions with competing plausible answers, such as concept cartoons (Keogh and Naylor, 1999), predict–observe–explain tasks and "odd one out" activities, give exploratory talk something to work on.

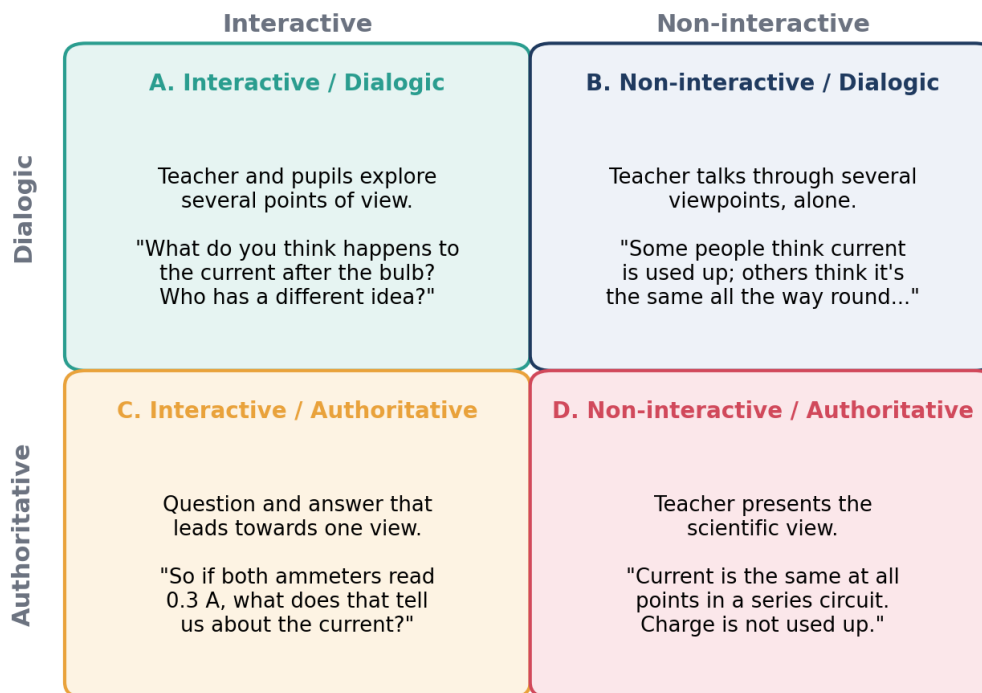
Concept cartoons deserve a particular mention for science. They present several characters giving different views on a scientific situation (for example, "the snowman will melt faster with a coat on"), with common misconceptions represented alongside the scientific view. Because the ideas belong to cartoon characters, pupils can criticise them without criticising each other, and their own misconceptions come into the open where the teacher can hear them (Keogh and Naylor, 1999).

Condition 2: The teacher orchestrates, moving between dialogue and authority

A frequent misreading of dialogic teaching is that the teacher should step back and let pupils discover the science through discussion. The research on science classrooms says the opposite. Science has canonical answers, and pupils will not reliably reinvent the particle model or the conservation of energy by talking among themselves. Talk has to be steered.

Mortimer and Scott's (2003) "communicative approach" is the most helpful framework here (Figure 4). It describes classroom talk along two dimensions. Talk can be **interactive** (more than one person contributes) or **non-interactive** (the teacher speaks alone). And it can be **dialogic** (several points of view are explored) or **authoritative** (the focus is one point of view, usually the scientific one). The result is four classes of communicative approach.

The communicative approach (Mortimer and Scott, 2003)



Good sequences move between quadrants: open up ideas (A), then bring them together (C/D), then apply them (A).

Figure 4. The four classes of communicative approach described by Mortimer and Scott (2003), with examples from teaching current in series circuits.

Scott, Mortimer and Aguiar (2006) argue that good science teaching is not about maximising dialogic talk but about managing a productive tension between the two. A teacher opens up pupils' ideas dialogically, then works authoritatively towards the scientific view, then opens up dialogue again as pupils apply that view to new situations. In their phrase, authoritative discourse acts as a "seed" for dialogic discourse, and vice versa. A lesson stuck in authoritative mode never discovers what pupils think; a lesson stuck in dialogic mode never gets them to the science.

The pattern most classrooms fall into is the one first described by Sinclair and Coulthard (1975): the teacher **initiates** with a question, a pupil **responds**, and the teacher gives **feedback** or evaluates (IRF). IRF is not inherently bad; it is efficient for checking recall. The problem is that it dominates, and that the third move usually closes the exchange ("Good, yes, it's the mitochondria"). Alexander (2020) argues that the most powerful lever is what the teacher does in that third move: rather than evaluating, the teacher can push the pupil or the class to build on the answer.

In practice, this means:

- **Asking for elaboration and challenge rather than confirming.** "Can you say more about why?" "Who can add to that?" "Does anyone see it differently?" These are the elaboration and querying moves that Howe et al. (2019) associated with better outcomes.
- **Using wait time.** Rowe's (1986) research found that teachers typically wait around a second before taking an answer or moving on. Extending that pause to three seconds or more led to longer, more reasoned and more speculative answers from more pupils.
- **Deciding in advance which mode a phase of the lesson needs.** At the start of a topic on electric circuits, the aim is to surface pupils' models of current, which calls for dialogic

talk. Once the ammeter readings are in, the aim is to establish the scientific view clearly, which calls for authoritative talk.

Condition 3: Talk is used to argue from evidence

If science is an argued subject, then pupils should argue in it. Driver, Newton and Osborne (2000) made the influential case that school science has largely failed to represent the argumentative nature of science, presenting conclusions without the reasoning that justifies them. Teaching pupils to construct and evaluate arguments addresses this gap and deepens conceptual understanding, because to argue well about an idea one has to understand it.

The most widely used tool for this is Toulmin's (1958) argument pattern, adapted for science classrooms by Osborne, Erduran and Simon (2004). An argument has a **claim**, supported by **data**, connected by a **warrant** (the reasoning that links data to claim), which may rest on **backing** (underlying theory). A strong argument also anticipates a **rebuttal**, the conditions under which the claim might not hold, and may include a **qualifier** indicating how confident we are (Figure 5).

Toulmin's argument pattern, applied to a physics claim

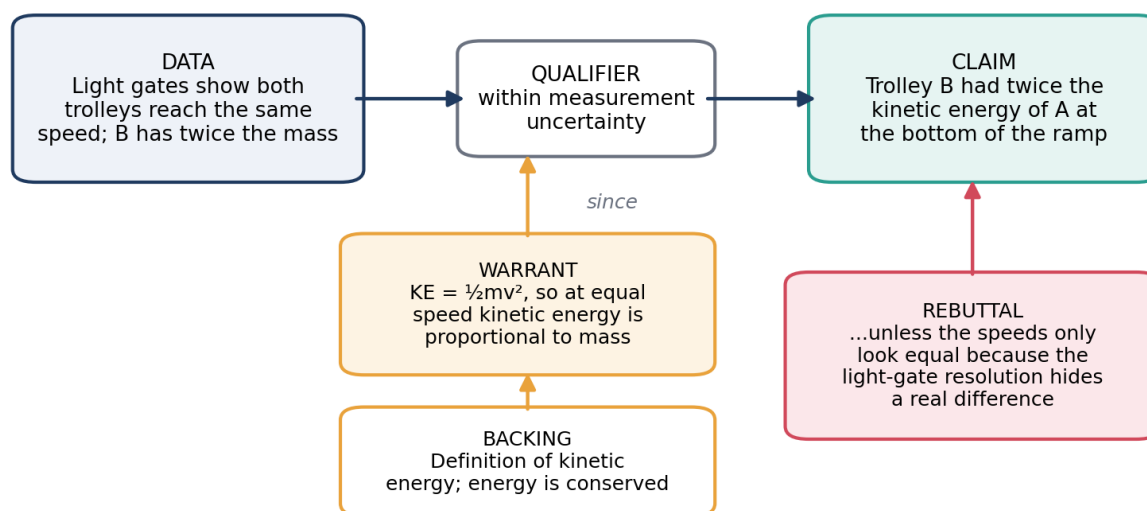


Figure 5. Toulmin's argument pattern applied to a physics claim about kinetic energy. Rebuttals are the hallmark of higher-quality argument and the hardest element for pupils to produce.

In the IDEAS project, twelve London science teachers developed and taught argumentation lessons over two years. The quality of pupils' argumentation, judged largely by whether they used rebuttals, improved, although the shift was gradual and needed sustained teaching (Osborne, Erduran and Simon, 2004). A related study found that teachers themselves needed time and support to learn to teach argument, especially to move beyond asking pupils for claims and towards asking for justifications and counter-arguments (Simon, Erduran and Osborne, 2006).

Argumentation tasks work best when there is a genuine choice between competing explanations. Useful formats include:

- **Competing theories:** two or three explanations of the same phenomenon, for example why a can collapses when cooled, and pupils decide which best fits the evidence.

- **Data-based disputes:** a set of results with an anomaly, and pupils argue about whether it should be discarded.
- **Socio-scientific issues:** nuclear power, vaccination or gene editing, where scientific evidence meets values, and pupils must distinguish between the two.
- **Claim–evidence–reasoning frames**, which are a simplified version of Toulmin's pattern that pupils can use in speech and then in writing (McNeill and Krajcik, 2012).

Osborne (2010) argues that critical discourse of this kind is not a bolt-on to learning science but central to it: the ability to distinguish a good argument from a poor one is part of what it means to understand science.

Condition 4: Vocabulary is used, not just defined

The EEF's secondary science guidance makes developing scientific vocabulary one of its seven recommendations (Education Endowment Foundation, 2018), and its secondary literacy guidance recommends both explicit vocabulary teaching and "opportunities for structured talk" (Education Endowment Foundation, 2019). The two belong together. Pupils who meet a word only on a slide or in a glossary rarely make it their own. Using it aloud, in full sentences and in context, is how it moves from recognition to production.

Beck, McKeown and Kucan's (2013) three tiers of vocabulary are helpful here. Tier 1 words are everyday words; Tier 3 words are subject-specific technical terms such as *mitochondria* or *refraction*; Tier 2 words are general academic words such as *infer*, *proportional* and *evaluate* that appear across subjects. Science teachers often focus on Tier 3 terms, which are new and obviously need teaching. But the more troublesome words are those that look like Tier 1 words and carry Tier 3 meanings: *work*, *power*, *weight*, *energy*, *force*, *cell*, *valid*.

Talk is the main way a teacher discovers that a pupil is using a word in its everyday sense. A pupil who writes "the force runs out" or "the battery's energy is used up making the current" reveals a model, and talking about it lets the teacher probe and correct it. Practical moves include:

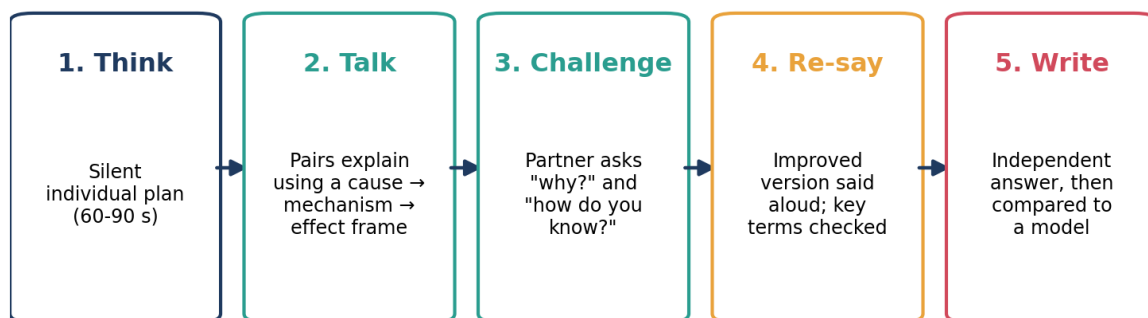
- **Insisting on full-sentence answers** that use the target word: "Say that again using the word *transferred*."
- **Sentence stems** that build precise relationships, for example: "As the ____ increases, the ____ ____ because..."
- **Contrasting everyday and scientific meanings explicitly**, for example: "In everyday life, *work* means effort. In physics, *work* is done only when a force moves something through a distance."
- **Low-stakes oral retrieval**, such as "explain to your partner what *specific heat capacity* means, using an example", which combines vocabulary rehearsal with retrieval practice.

Condition 5: Talk is a rehearsal for writing

One of the most practical uses of talk in secondary science is to prepare pupils for extended writing. A pupil who cannot say an explanation clearly will rarely write it clearly. Oral rehearsal lets pupils draft their reasoning before committing it to paper, and lets a partner or teacher spot gaps while they can still be fixed.

The sequence in Figure 6 turns this into a routine. Pupils first plan silently, so that every pupil has something to say. In pairs, they explain using a simple causal frame: cause, then mechanism, then effect. The partner's job is to ask "why?" and "how do you know?" at each step, which exposes missing links in the chain. Pupils then re-say an improved version, checking for key terms, before writing independently and comparing their answer with a model.

From talk to a 6-mark answer: a rehearsal sequence



Talk is the draft; writing is the final copy. The partner's questions do the job of a mark scheme.

Figure 6. A five-step sequence for using talk to prepare for an extended-response question. The partner's challenge questions play the role of a mark scheme, exposing missing steps in the explanation.

This connects to what examiners see. Weaker extended responses often contain relevant knowledge but fail to link it: a list of points rather than a chain of reasoning. Oral rehearsal with a partner who asks "why?" builds exactly the habit of linking that these questions reward. It also helps pupils with weaker writing skills to show what they understand, because the reasoning is built in speech before the extra load of writing is added.

There is a cognitive argument here too. Writing an extended explanation from scratch places a heavy load on working memory: pupils must recall content, organise it, choose vocabulary and manage spelling and grammar at the same time. Rehearsing aloud first deals with the organising and vocabulary, leaving more capacity for the written expression.

Condition 6: Participation is wide, not just loud

Howe et al.'s (2019) finding about participation deserves its own condition. Elaboration and querying helped when many pupils took part, and made no measurable difference when few did. In most science classrooms a small number of confident pupils contribute most of the spoken answers. A teacher can run a rich, dialogic discussion with five pupils while twenty-five watch, and come away believing the lesson was full of good talk.

This has an equity dimension. The EEF Toolkit finds that oral language approaches seem to help disadvantaged pupils more (Education Endowment Foundation, n.d.-a). But those pupils are often the least likely to volunteer in whole-class discussion. If participation is left to volunteers, the pupils who might gain most from talk will get least of it.

Practical approaches include:

- **No hands up, with thinking time first.** Every pupil is expected to have an answer ready, and the teacher chooses who speaks.

- **Paired talk before whole-class talk.** Every pupil rehearses an idea with one partner before anyone speaks to the class, so less confident pupils have a tested answer to offer.
- **Assigned group roles**, such as a reasoner, a challenger, a summariser and an evidence-checker, rotated so that every pupil practises each move.
- **Monitoring who talks.** Some teachers tally contributions for a lesson or two; the results are often surprising.

Putting it together: a lesson sequence on electric current

The six conditions are easier to see working together than in isolation. Consider a Year 10 sequence on current in series circuits, a topic where misconceptions are well documented and stubborn. Many pupils believe that current is "used up" as it passes through components, so that there is less current after a bulb than before it.

Opening up ideas (dialogic, Condition 2). The lesson begins with a concept cartoon showing three characters' views: current is used up by the bulb; current is shared between the bulbs; current is the same everywhere in the circuit. Pupils first commit individually to a view and a reason, then discuss in groups of three using the class ground rules (Condition 1). The teacher circulates and listens, noting which models are common, without correcting yet.

Testing ideas against evidence (Condition 3). Groups predict ammeter readings at three points in a series circuit, then build the circuit and take readings. Each group must make a claim, cite its data and give a warrant, using the claim–evidence–reasoning frame. When a group's readings differ slightly between positions, the teacher asks the class whether this is evidence that current is used up, or something else. The ensuing argument about measurement uncertainty is exactly the kind of rebuttal-rich talk that Osborne, Erduran and Simon (2004) found hardest to generate.

Establishing the scientific view (authoritative, Condition 2). The teacher then shifts mode and presents the scientific model clearly: current is the rate of flow of charge, charge is not used up, and what the bulb transfers is energy, not current. A simple analogy, such as a rope loop or a chain of moving charges, gives pupils a model to talk with. This phase is deliberately teacher-led. The earlier discussion has made pupils' existing models visible, so the explanation can address them directly ("Some of you said the bulb uses up current. Here's why the ammeters disagree with that...").

Using the words (Condition 4). Pupils practise distinguishing *current*, *charge* and *energy* aloud, using stems such as "The current is the same because..." and "The bulb transfers energy, not charge, because...". The teacher insists that pupils correct each other when the words are swapped.

Rehearsing an explanation (Condition 5). The lesson ends with a six-mark-style question: "A student says the bulb nearest the cell will be brightest because it gets the current first. Evaluate this claim." Pupils follow the think–talk–challenge–re-say–write sequence before writing independently.

Making sure everyone takes part (Condition 6). Throughout, the teacher uses no-hands-up questioning after paired rehearsal, and deliberately calls on pupils who held the "used up" model at the start, asking them to explain what changed their mind. Changing one's mind in response to evidence is itself modelled as a scientific virtue.

None of these moves is new or complicated. What makes the sequence work is that talk is placed where it does a specific job: making misconceptions visible, testing them against evidence, rehearsing the scientific view and preparing for writing. Talk is not added for its own sake, and the lesson does not rely on discussion alone to deliver the science.

The pitfalls: when oracy goes wrong

The case for oracy is strong, but it is not unqualified. Four pitfalls are worth naming.

Performance instead of thinking. Whole-school oracy programmes sometimes emphasise presentational talk: speaking confidently, projecting, standing well. These are valuable skills, but fluency is not understanding. A pupil can speak confidently about an incorrect model. In science, the test of good talk is whether it improves reasoning and understanding, not how polished it sounds.

Time cost. Discussion takes time, and science curricula are full. Talk that does not move understanding forward is expensive. The answer is not to avoid talk but to use it where it adds most value: surfacing misconceptions at the start of a topic, consolidating difficult ideas, and preparing for extended writing. Not every question needs discussion.

Cognitive overload. For novices meeting new and abstract content, open discussion can be overwhelming. Pupils cannot argue productively about something they do not yet know anything about. This is where Mortimer and Scott's framework helps: authoritative teaching of the core ideas has to come before, and alongside, dialogic exploration of them.

Whose talk counts? Researchers have raised concerns that oracy initiatives can implicitly treat certain accents, dialects and ways of speaking as more correct than others, and so disadvantage the pupils they aim to help. The Curriculum and Assessment Review's broad definition of oracy, which includes non-verbal communication such as sign language and alternative and augmentative communication, reflects some of these concerns (Department for Education, 2025a). In science, the priority should be the precision of the scientific reasoning, not conformity to a particular way of speaking.

Implications for science departments and leaders

If the six conditions are right, several implications follow for those leading science in schools.

- **Integrate oracy into the science curriculum rather than adding it on.** The EEF's finding that oral language interventions work best when integrated with the curriculum (Education Endowment Foundation, n.d.-a) suggests that oracy should be planned into schemes of work: which topics need dialogic exploration, which misconceptions need surfacing, which extended explanations need rehearsing.
- **Develop teachers' questioning and orchestration.** The trials show that effects fade when training is reduced (Education Endowment Foundation, n.d.-c), and teachers in the IDEAS project needed sustained support to teach argument well (Simon, Erduran and Osborne, 2006). One-off training days are unlikely to be enough. Instructional coaching focused on specific moves, such as asking follow-up questions or using wait time, may be more effective.

- **Build a shared departmental language for talk.** Common ground rules, sentence stems and argument frames used across all science classrooms make it easier for pupils to transfer skills and for teachers to build on each other's work.
- **Evaluate talk by its effect on learning.** Lesson observations or learning walks that count how much talk happens miss the point. Better questions are: who was talking, what kind of talk was it, and did it move understanding forward?
- **Contribute to the evidence base.** Because secondary science evidence is thin, departments that try approaches carefully and evaluate them honestly have something to offer the wider profession.

Conclusion

Oracy has never had a higher profile in English education, and science teachers have good reasons to welcome it. Science is learned through language, argued through evidence and assessed through explanation. Talk can help with all three.

But the research is clear that talk is not enough on its own. The gains come when talk is taught rather than assumed, when teachers move deliberately between opening up ideas and establishing the scientific view, when pupils argue from evidence, when vocabulary is used and not just defined, when speaking prepares pupils for writing, and when participation is wide rather than left to the confident few. Where these conditions are missing, a talk-rich classroom can produce plenty of noise and little learning.

The evidence also carries a note of humility. Almost all the robust trials come from primary schools, and the effects of talk-based programmes tend to shrink as they scale. Secondary science teachers are working at the edge of what the research can tell us. That is a reason not to wait for certainty, but to implement carefully, watch closely what pupils say, and judge talk by the only measure that finally counts: whether pupils understand more science because of it.

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