Talking to think: a hands-on minds-on approach to practical work

Naomi Hennah describes how oracy can be developed in the school laboratory to facilitate learning and teaching science

Why oracy matters in practical science

Oracy is the pedagogical approach of '*developing the ability to speak and listen effectively in a range of contexts*' (Mannion, 2024). Students' thinking processes are exposed through talk, and their understanding may be articulated and refined through conversation.

Practical tasks allow students to experience phenomena first hand and engage with the scientific method. However, as Millar and Abrahams (2009) note, students often struggle to apply scientific principles and explain their understanding, even when they can successfully carry out these tasks. Oracy supports hands-on and minds-on practical work (Hennah, Newton and Seery, 2022).

Planning laboratory talk

To help students make sense of scientific concepts, practical lessons can be structured into three phases, with each stage offering opportunities for talk and reflection:

1. **Pre-task phase:** Introduce key concepts and specialised vocabulary, and demonstrate the practical task. The teacher models the scientific language students will need during the practical, such as dimple tray, sodium hydroxide and red litmus paper.
2. **Practical task phase:** Allow students to use the language they have learnt as they conduct the experiment. Encourage them to verbalise their predictions and observations as they work through the procedure. As the teacher circulates in the class, they could also ask students to name the equipment or chemicals they are handling, to rehearse vocabulary.
3. **Post-task phase:** Engage in metalinguistic discussions where students reflect on the experiment, analysing their results and how the language they used helped them describe scientific phenomena. This can be achieved by completing a class results table and encouraging students to use the vocabulary and concepts introduced in the pre-task phase.

By intentionally planning these phases, teachers can create opportunities for meaningful talk, which helps students link their practical experiences with scientific concepts.

Testing solutions with litmus paper

Consider the classic practical task of using litmus paper to identify acids and alkalis. The hands-on goal is for students to observe the colour changes in litmus paper when exposed to different solutions. The minds-on goal is for them to articulate what those colour changes mean scientifically.

A traditional results table might look like the one shown in Table 1.

Table 1 A traditional results table

Test solution	Observation with red litmus paper	Observation with blue litmus paper
Hydrochloric acid	no change	turns red
Sodium hydroxide	turns blue	no change
Unknown A	turns blue	no change
Unknown B	no change	no change

This table captures the observations but doesn't prompt deeper thinking. To encourage more meaningful discussion, we can add a 'Prediction' column for students to hypothesise the outcomes and an 'Interpretation' column for them to discuss what the results mean, as shown in Table 2.

Adding these columns encourages students to think critically about their predictions, analyse results and draw scientific conclusions, which fosters richer discussions about their findings. For example, a prediction column prompts students to hypothesise outcomes before testing, encouraging them to think more deeply about the nature of the solutions they are working with. During post-practical discussions, students can explore ideas such as recognising alkaline solutions as hydroxides or understanding that the nature of unknown solutions can only be determined through testing.

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The results table serves as a scaffold, helping students link their observations to underlying scientific concepts as they must discuss and decide what to write in each column. This structured dialogue allows the teacher to listen in and assess whether students are successfully connecting observations with scientific ideas, and to identify which groups can deduce, for example, that a solution is neutral.

The benefits of oracy in the laboratory

Regularly practising oral communication in a scientific context helps students articulate their thoughts clearly and confidently, preparing them for future

Table 2 A results table with predictions and interpretations

Test solution	Prediction	Observation with red litmus paper	Observation with blue litmus paper	Interpretation of result
Hydrochloric acid	blue litmus will turn red	no change	turns red	the solution is an acid
Sodium hydroxide	red litmus will turn blue	turns blue	no change	the solution is an alkali
Unknown A		turns blue	no change	the solution is an alkali
Unknown B		no change	no change	the solution is neutral

Box 1 A 60-minute lesson in practice

Pre-task phase, 0 to 15 minutes: The lesson begins with students copying or pasting a blank results table into their notebooks. This is followed by a teacher-led, whole-class discussion that outlines the experimental procedure, including demonstrations of key points. Safety considerations and important terminology are highlighted throughout this introduction.

Practical task phase, 15 to 40 minutes: During the whole-class practical activity, the teacher carefully coordinates the process to ensure time is reserved for discussion. For instance, students will collect and set up equipment in an orderly fashion, and the teacher will ask the class to pause and listen for further instructions at key moments. Questions about the results table will guide students' focus and discussion before starting the experiment. During the task the teacher asks students to name the equipment or chemicals being handled to promote the use of specialised vocabulary. After the practical activity, students will be directed to stop and clear away in a structured manner, before returning to their seats. The teacher will guide the students to discuss their results with their neighbours to form a general conclusion, such as '*only acids turn blue litmus paper red*'.

Post-task phase, 40 to 60 minutes: In the final part of the lesson, the teacher uses cold calling to involve students in completing a class results table. To maintain focus, it is essential that students only speak one at a time while the rest of the class listens actively. The teacher will repeat or rephrase student responses to model proper use of key terminology. If a student struggles, another will be invited to either build on or challenge the information, reinforcing peer engagement and active listening.

presentations and professional discussions. Oracy supports effective communication in groups, ensuring that ideas, responsibilities and solutions are shared, and leading to stronger collaboration and mutual learning. By embracing oracy, teachers can ensure that their students are not only doing science but also thinking about, discussing and understanding it on a deeper level.

For further information please read the case study "What are they talking about?" A sociocultural linguistic approach to practical task effectiveness (Hennah, 2023).

Tips for talk

- Establish discussion rules such as one person speaks at a time, listen and respond to each other, and encourage everyone to participate.
- Make sure that students talk and do practical work in set groups determined by your seating plan to minimise moving about the room and to build group cohesion.
- When a student answers a question during teacher-led discussion, respond by asking another student if they can add to or challenge the answer. This will encourage students to listen to each other and evaluate the answer given.

Talk for thinking and learning does not just happen, it needs to be planned for, scaffolded and practised before it becomes embedded.

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