

Empowering Decision-making in the First-year Undergraduate Teaching Laboratory

Chemistry Teaching Laboratory

DEPARTMENT OF
CHEMISTRY

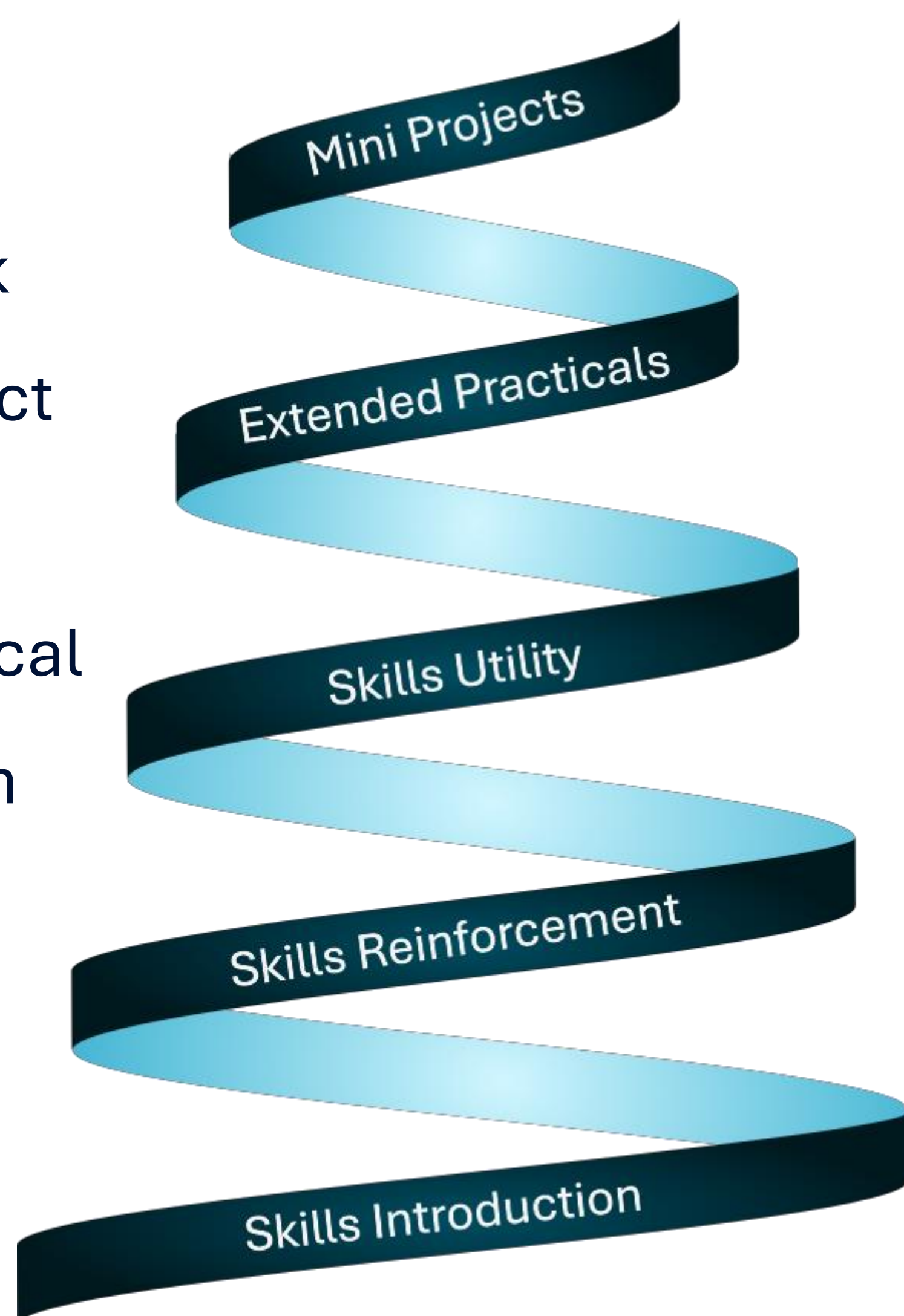


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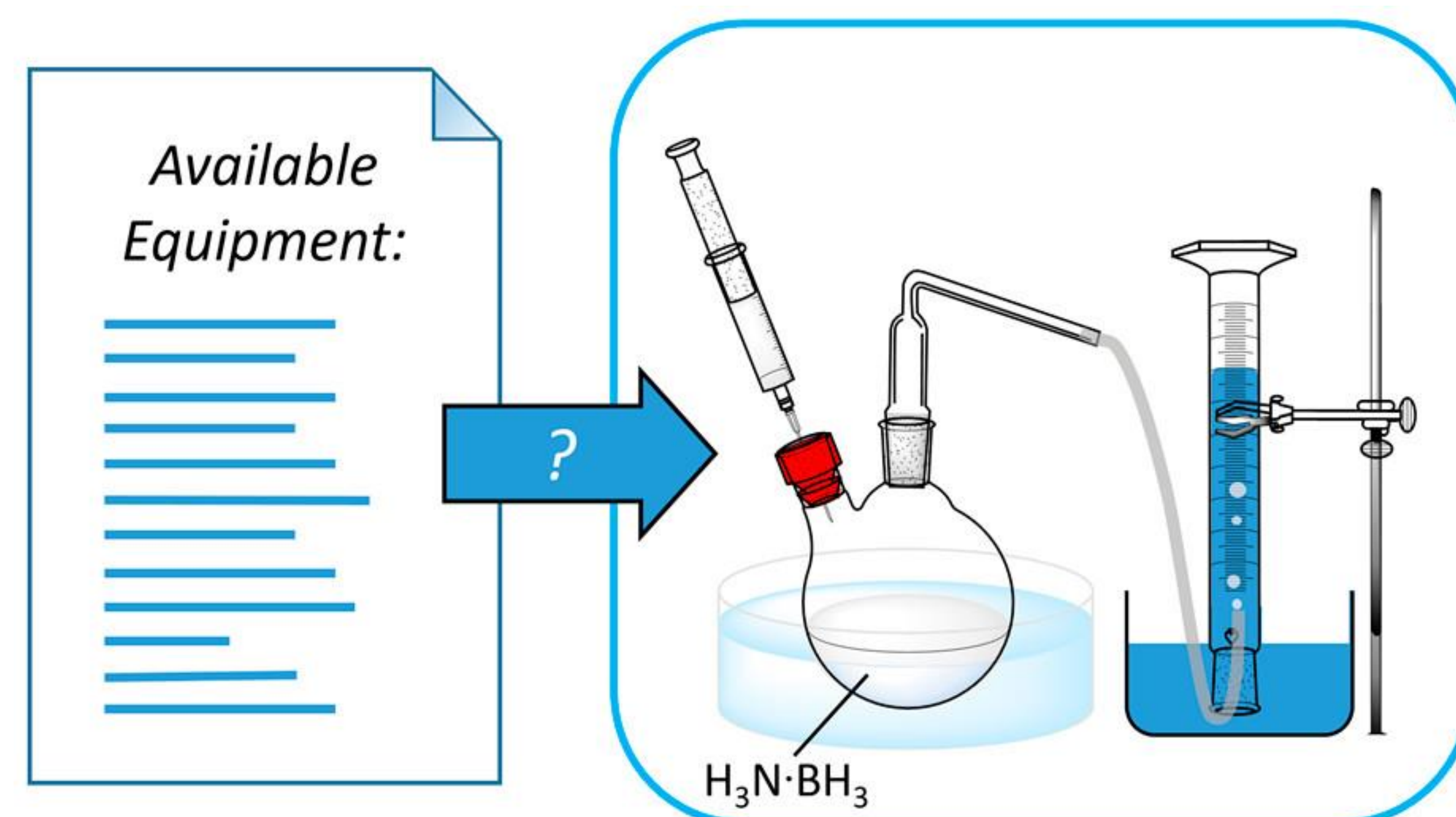
Educational literature maintains that expository 'recipe-style' activities in first-year practical teaching prevents cognitive overload. However, our students say this rigid format reduces engagement, and limits both ownership of their learning and development of scientific and transferrable problem-solving skills needed for their final year research project and their future careers.

Novel 'spiral curriculum'

This features an innovative decision-making framework which introduces five distinct decision types ranging from simple apparatus or analytical technique selection through to full experimental design, progressively increasing in complexity over the first six months of study.¹



Initial **decisions** focus on core considerations of the scientific method, such as equipment calibration and standardisation, or what analytical evidence is needed for a reaction to be considered complete.²



Student feedback confirms increased understanding and engagement through this 'spiral' approach.

The second part of the practical, where we had to design our own experiment to investigate the various hypotheses and work as a team.

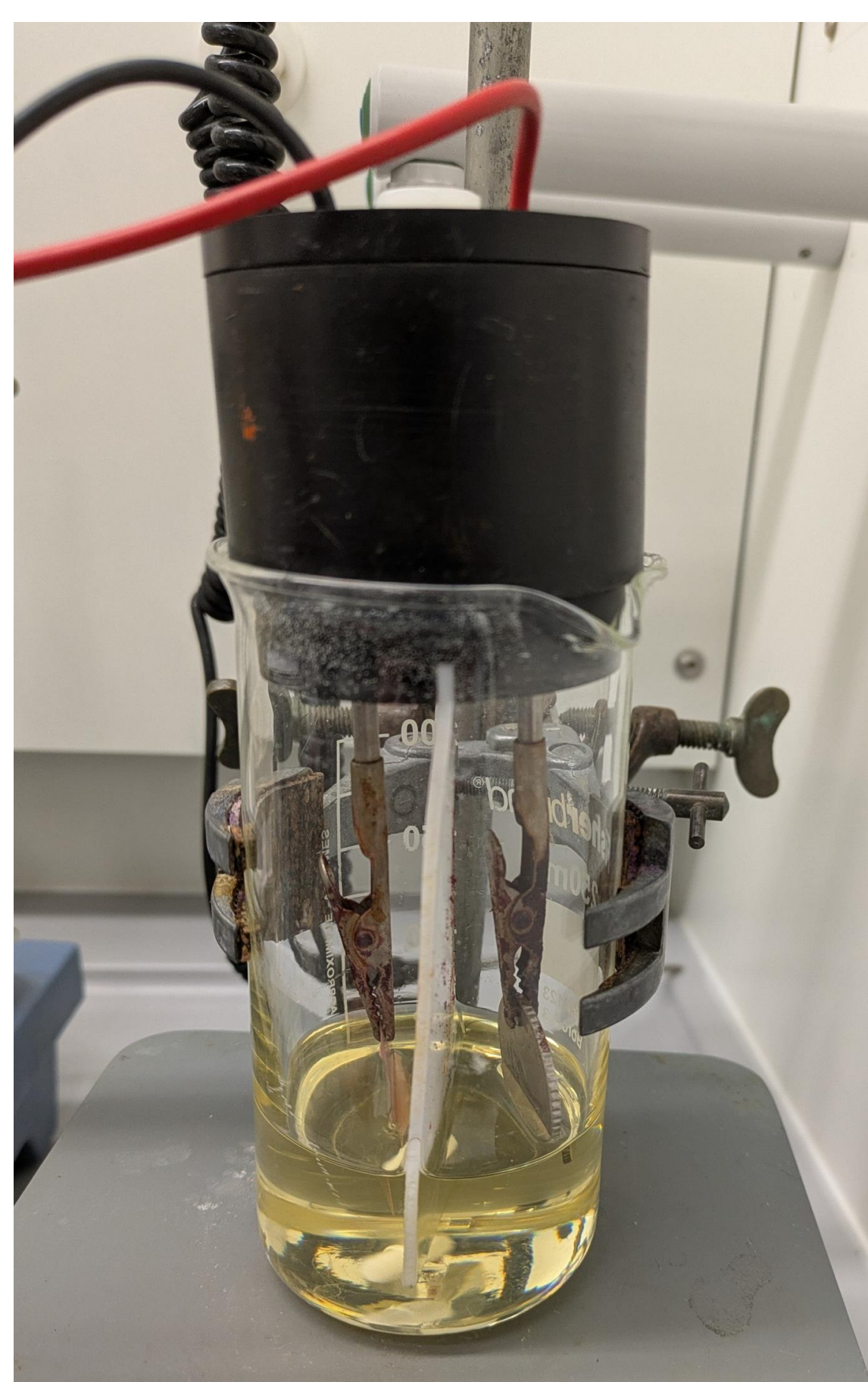
I liked having to try to justify each decision we were making and also try to reason when the data didn't turn out the way we expected.

Working in a larger group was new and a challenge, but good to do.

This challenges the prevailing dogma against introducing problem-solving at an early stage in practical curricula.

After some ushering in the right direction from our instructor, we devised a pretty effective method that obtained valid results which aligned with our expectations from the theory.

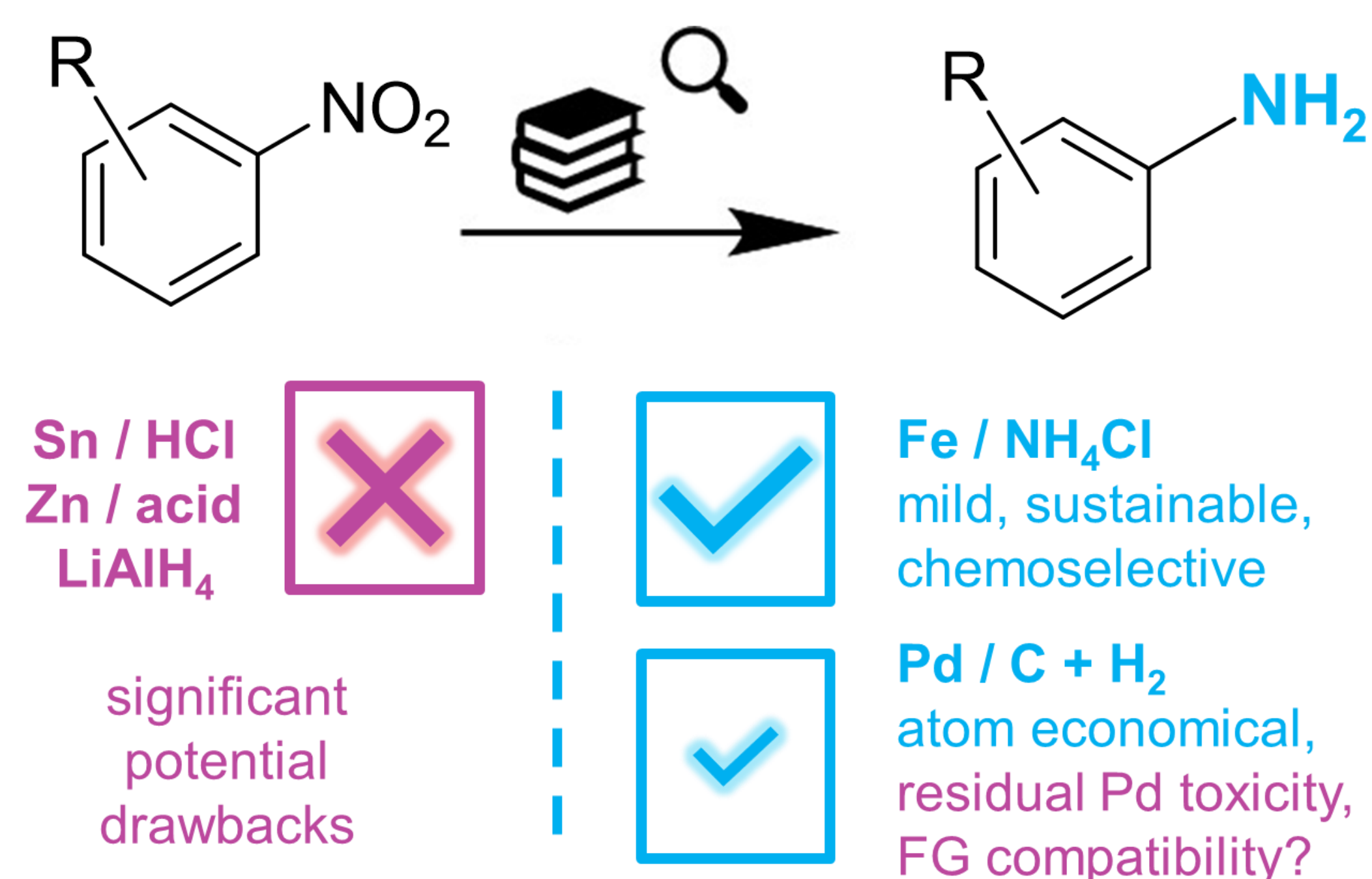
I thought our experimental design was very effective, as it allowed us to do only what we needed to gather the necessary information, as we weren't spending time completing unnecessary tasks that we could've been using to think about the rest of the practical.



Scaffolding **decision-making** in this way, students develop a deeper understanding of scientific principles, the rationale behind laboratory techniques, and essential problem-solving skills.

Over time broader factors such as **sustainability, cost** and **safety** are incorporated.

By embedding these elements, students develop a more comprehensive understanding of the wider context of the task at hand.³



References

1. Campbell, C., Midson, M. *et al.*, *Chem. Teach. Int.*, 2022, 4, 3, 243-257.
2. Smallwood, Z. *et al.*, *J. Chem. Educ.* 2021, 98, 11, 3514-3523.
3. Campbell, C., Birkett, T., Stewart, M., *J. Chem. Educ.* 2023, 100, 9, 3171-3178.



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