

Title: Understanding why students find some concepts difficult to learn as the foundation of curriculum change: A case study from tertiary chemistry education.

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Session Learning Outcomes

By the end of this session, delegates will be able to:

- Understand the theoretical framework of conceptual change.
- Learn a novel approach to evaluate conceptual understanding for threshold concepts.
- Appreciate how prior conceptualisation, especially those developed in secondary education can be a barrier to learning concepts at higher education.
- How this evaluation can be applied to curriculum enhancement.

Session Outline

Many of us are aware from our teaching that there are some concepts that students find difficult to grasp. I am interested in developing approaches to enhance the teaching of such threshold concepts (Meyer and Land, 2005) in a manner that can be applied across different disciplines.

My method is to first identify what concepts students find difficult, how prior conceptual understanding affects students, and what misconceptions they might have, to then deal with these issues as the foundation for curriculum enhancement.

In this talk, I will discuss how we are applying this approach to the teaching of chemistry concepts at the tertiary level and the implications of this research in other subjects.

I will first introduce the importance of threshold concepts (Meyer and Land, 2006) and the conceptual change framework (Duit and Treagust, 2003) for teaching concepts in Higher Education.

I will then detail the methodology developed at Leeds for a practical method to identify threshold concepts which have been applied at three Russell group institutions, and could also be used in other disciplines.

Amongst our findings I will show that the threshold concepts we identified are linked to simpler models learnt in secondary education, leading to a discussion of how this aligns with the conceptual change model and its implications for school to university transition.

I will then show how we are implementing our findings alongside the conceptual change model to improve student understanding of these threshold concepts in our curriculum as well as how these could be applied in other disciplines.

This will be an interactive talk, where delegates will be invited to perform activities that align with discussion topics that will be presented.

Session Activities and Approximate Timings

The outline of the workshop is as follows;

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| 10 mins | Delegates will be introduced to theoretical frameworks for threshold concepts and conceptual change by performing practical activities (e.g. experiments, clickers). |
| 10 mins | Delegates will discuss different methods of measuring conceptual understanding leading onto our methodology development. |
| 10 mins | Overview of results and identification of threshold concepts. Delegates are invited to discuss their interpretation of the results. Activities introducing our approach will be showcases with practical activities using well-known threshold concepts. |
| 10 mins | Overview of how the research findings have been applied to teaching practice. Further discussion with delegates of broader implications for other subjects and how a greater understanding of threshold concepts could be developed. |

References

Duit, R., and Treagust, D. F., (2003) Conceptual change: A powerful framework for improving science teaching and learning, *International Journal of Science Education*, 25 6 671-688.

Meyer, J. H. F., and Land R., (2006) *Overcoming Barriers to Student Understanding: Threshold concepts and troublesome knowledge*. Routledge: Abingdon.