

# THRESHOLD CONCEPTS: CHALLENGING THE WAY WE THINK, TEACH AND LEARN IN BIOLOGY AND SCIENCE

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## ABSTRACT

Meyer and Land (2003, 2005) proposed the notion of 'threshold concepts', which are central to the mastery of a specific discipline due to their transformative, irreversible and integrative nature. Using the methodology of Davies and Mangan (2007) we interviewed novice students (58) and expert academic staff (11) from three Australian universities and conducted an international survey of academics (55) to identify differences in novice and expert conceptions. We matched these data with understandings from the 'misconceptions' literature to create the 'biology thresholds matrix'. The matrix demonstrates that threshold concepts in biology are not necessarily the troublesome content, but rather the tacit understandings of the discipline (Taylor, 2006, 2008; Ross & Tronson, 2007, Ross, Taylor, Hughes, Kofod, Whitaker, Lutze-Mann & Tzioumis, 2010). These are often not explicitly taught (Perkins, 2006) yet underpin difficult content areas including: energy and energy transformation, variation, probability and randomness, proportionality and surface area to volume ratio, dynamic equilibrium, linking the subcellular (submicroscopic) with the macroscopic, temporal and spatial scales (Ross et al., 2010), and the formulation and testing of hypotheses (Taylor & Meyer, 2010). These threshold concepts are not hierarchical in nature, but form a web of epistemes which has commonalities with tacit understandings in other science disciplines.

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