

Spaces of variation in understanding uncertainty and legal reasoning: extending understandings of transformation, irreversibility and liminality in coming to understand threshold concepts

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As students begin to engage with threshold concepts in their discipline, they enter liminal spaces where they may be uncertain, confused and show understandings that can vary at different times and in different contexts (Meyer & Land, 2005; 2006). Once students have passed through conceptual 'portals', their understandings have been transformed in ways that are typically irreversible. This paper will illustrate ways in which phenomenography and variation theory might extend understandings of the transformations and liminal spaces that students experience as they move towards understanding threshold concepts.

In a current ALTC project, we have been working on the threshold concepts of 'uncertainty' in Physics and 'legal reasoning' in Law with groups of disciplinary academics from four universities. Although the concepts come from different disciplines, the academic groups identified that, among other features, both concepts require an epistemological transformation from seeking 'truths' to focusing on contextual interpretation, and both have procedural aspects, requiring a transformation in focus from procedures alone to an integration of procedures with their meanings. Unsurprisingly, both concepts are troublesome, with many students developing understandings slowly if at all.

To identify students' understandings of these threshold concepts, first-year Physics and Law students were interviewed using trigger examples and open questions, with the transcripts analysed phenomenographically (Marton & Booth, 1997). Phenomenography is a useful way of investigating students' understandings of threshold concepts, as it focuses on identifying variation in understandings and the critical features that distinguish more from less complex understandings (see for example Taylor & Cope, 2007). Our paper will describe the outcomes of our phenomenographic analyses, focusing on the critical features of professional or disciplinary ways of understanding uncertainty and legal reasoning. We will also provide examples of the transformations, both ontological and epistemological, that are related to coming to experience these critical features.

We have also built further on the phenomenographic analysis, using the variation theory of learning (Marton & Booth, 1997; Marton & Tsui, 2004; Marton & Pang, 2006) to redesign curriculum experiences to assist students to experience these critical features and cross through the threshold to professional or disciplinary understandings. Variation theory maintains that in order for students to learn to experience a concept in a particular way, it is necessary for them to experience a pattern of variation related to the critical features. Each feature must be *contrasted* with what it isn't, *separated* from other features of the experienced world by varying it while holding other features invariant, and *generalised* by remaining constant across varying situations. All of the features that correspond to a way of experiencing must then be varied together to become *fused* as features of the same thing.

Drawing further on the examples of uncertainty and legal reasoning, we will illustrate what it might take for students to experience these patterns of variation, and how variation theory and the range of critical features might help to explain why students often spend considerable time in a liminal space before irreversibly crossing the threshold. We will also describe how these patterns of variation intersect with but differ from the modes of variation described by Meyer, Land & Davies (2008).

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