

Exploring learning strategies to address threshold concepts using an example from biology

Workshop

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A threshold concept can be considered as a conceptual gateway or portal. Passing through it is transformative and frequently leads to an increased self-esteem. The learner feels different. This is significant since the liminal space leading up to the conceptual portal can be a place of confusion and anxiety (Meyer and Land, 2006) (Perkins, 2006).

Within a number of disciplines threshold concepts have been recognized and strategies for teaching and learning explored (biology, Taylor and Cope, 2007 and Ross and Tronson, 2007), (geosciences, Drennan 2008), (economics, Davies and Mangan, 2007), (engineering, Flanagan, Taylor and Meyer, 2010), (mathematics, Nesbit and Adescope, 2006). A threshold concept in Biology has been identified in the UNSW Foundation course that has not been specifically encountered in the literature. This is the distinction between the existence of chromosomes in pairs in cells and the strands within chromosomes. We have found that learners frequently think that they understand this distinction but the teacher does not often use a strategy to explore these alleged understandings.

One key insight in my approach, as a teacher, to this conflict in understanding is that the use of experiential learning using collaborative and inclusive techniques, the use of a simple model and **verbal interaction** is effective. It has helped students to recognize misunderstandings and use an iterative process to progress (using the model) in the light of their new understandings. It has also assisted me, as facilitator, to receive feedback on students' thinking. Hence it is diagnostic and also remedial and recursive (Land et al, 2006). The learners have been placed at the centre of the process of discovery. I have employed a conversational method to enable students to produce the model and then question their understanding of the concepts represented by the model. Then I can guide the learners through an iterative cycle of learning through modeling.

In this workshop, a short presentation will be followed by a "classroom experience" of the use of the model. Students, who have been involved in teaching and learning using this approach, will be present for a discussion. This will enable a second key insight to be examined by illustrating **students' own reflections on their thinking within the liminal space**. Participants will also be given the opportunity to work in small groups to suggest the development of models or other experiential classroom strategies that can be used to clarify threshold concepts and to further consider the two insights raised by the presenter.

References

- Davies, P. & Mangan, J. (2007) Threshold concepts and the integration of understanding in economics. *Studies in Higher Education* 32(4) pp 711-726.
- Drennan G. (2008) Interactive approaches to teaching First Year Geology Mapwork: 2-d, 3-D and 4-D visualisation. Presentation at Second International Threshold Concepts Conference, June 2008. <http://thresholdconcepts.appsci.queensu.ca/schedule.php>
- Flanagan, M. T., Taylor, P. & Meyer, J.H.F. (2010), Compounded Thresholds in Electrical Engineering, in *Threshold Concepts and Transformational Learning*, Land, R., Meyer, J.H.F. and Baillie, C., (eds), [Sense Publishers](#), Rotterdam, *in press*.
- Land, R., Meyer, J.H..F & Smith, J. (Eds) (2006 – 2008) *Threshold concepts within the Disciplines*. Rotterdam; Sense Publishers.

Meyer, J.H.F. and Land, R. (2006), Threshold concepts and troublesome knowledge: Issues of liminality, In Meyer, J.H.F. and Land, R. (eds.), *Overcoming Barriers to Student Understanding: threshold concepts and troublesome knowledge*, London and New York: Routledge, pp 19–32.

Nesbit, J.C. & Adescope, O.O. (2006) Learning with concept and Knowledge Maps: a Meta-analysis *Review of Educational Research* 76 (3) pp 413 – 448.

David Perkins (2006): Beyond Understanding. Presentation at the Threshold Concepts within the Disciplines Symposium, Glasgow, September, 2006; <http://video.strath.ac.uk/06/140-06-01>

Taylor, C. E. and Cope, C. (2007) *Are there educationally critical aspects in the concept of evolution?*, UniServe Science, Proceedings of the Assessment in Science Teaching and Learning Symposium, University of Sydney, September 28–29, 2007, pp 101–106.

Ross, P. M. and Tronson, D. A. (2007) *Intervening to create conceptual change*, UniServe Science, Proceedings of the Assessment in Science Teaching and Learning Symposium, University of Sydney, September 28–29, 2007, pp 89–94.