Threshold concepts and a punctuated model of learning. (0045)

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Introduction

This conceptual paper builds on earlier empirical work that has considered the knowledge structures that are exchanged between students and teachers at university, and their impact upon the quality of learning (Kinchin, *et al*., 2008). This paper suggests a mechanism to address the problem recognised by Novak and Symington (1982: 8):

> *"Moving from a linear structure to a hierarchical structure and back again is in some ways the fundamental educational problem."*

The transformation of knowledge structures during the teaching-learning process has been described in detail elsewhere (Kinchin and Hay, 2007) and is seen as a prerequisite ability in the development of professional expertise (Norman, 2005; Kinchin and Cabot, 2010). However, the question that remains to be answered is 'why is the transformation between knowledge structures problematic?' One of the problems is that the linear and hierarchical components are often taught by different members of staff and in different situations (e.g. the practice of dentistry or medicine is taught by clinicians in a clinical setting whereas the underlying science is often taught by non-clinical scientists within the lecture theatre and laboratory). But even when the two components are not separated physically, there can still be a separation of the two in the mind of the student. Whilst this separation persists, the teacher may view this as a lack of progress as the student fails to grasp the nuances of the subject or to 'think like a biologist' or 'think like an historian', for example. Until the linear and the hierarchical can be integrated, the student appears to be in a period of 'conceptual stasis' that is characteristic of punctuated learning.

Punctuated learning

In his definitive work on the structure of evolutionary theory, Stephen Jay Gould (2002) gives a detailed account of the development of his model of punctuated equilibrium, in which evolutionary change is seen to occur in irregular bursts rather than as a gradual and even phenomenon. Gould then goes on to comment that: "*Only years later did I conceptualise the possibility that plateaus of stagnation and bursts of achievement might express a standard pattern of human learning*". This has been developed by Mintzes and Quinn (2007) into a punctuated model of conceptual change. The features of punctuated learning would be recognised by most teachers who observe students apparently making little progress for prolonged periods of time, until 'suddenly the penny drops' and everything becomes clear. Whilst the acquisition of facts may still be happening, the student is not necessarily making sense of them in the way that the curriculum intends.

Threshold concepts

The punctuated pattern of learning described above resonates with the work by Meyer and Land (2006), who attribute the 'ah-ha' moments in students' learning to the acquisition of threshold concepts; a transformed way of understanding that creates "*a portal, opening up a new and previously inaccessible way of thinking about something*". For threshold concepts to have a role in the development of professional expertise, their

integrative role should be involved in solving the fundamental educational problem identified by Novak and Symington (1982), and relate the linear (experiential) with the hierarchical (conceptual) – see Figure 1.

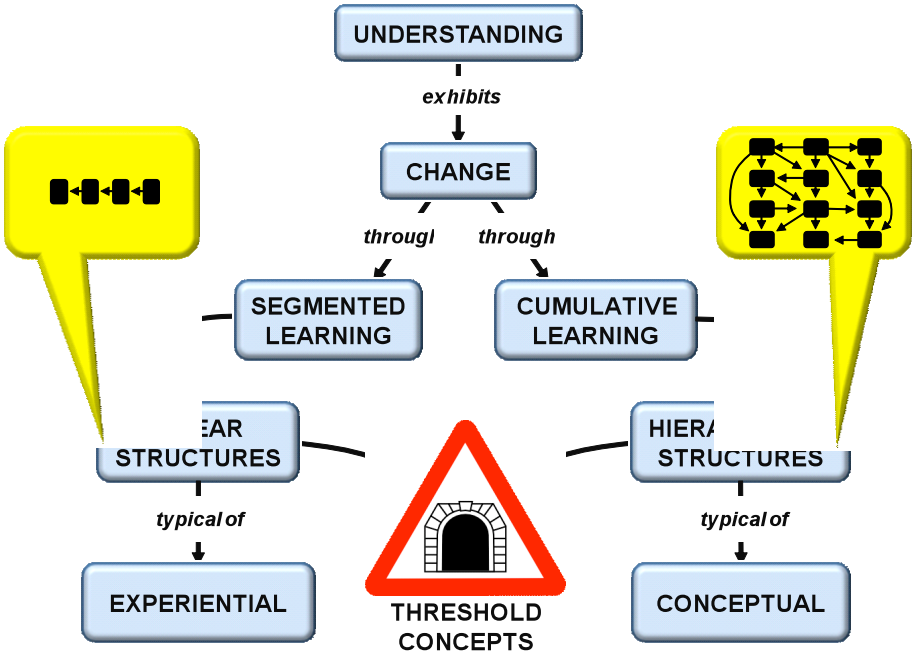

Figure 1:
Threshold concepts may link the hierarchical knowledge structures that are typical of conceptual learning with the linear knowledge structures typical of experiential learning.

Implications for teaching and learning

Whilst the threshold concepts model concentrates on the comparatively brief moments of change within a student's learning, the punctuated learning model offers greater consideration to the long periods between episodes of major change - periods of stasis. The two perspectives (threshold concepts and punctuated learning) are therefore complementary and mutually reinforcing. Mintzes and Quinn (2007: 301) make the comment that:

> "*all knowledge is not of equal value, that some propositions take precedence over others in the knowledge frameworks of experts, and that teachers and students should focus their efforts on those fundamental concepts that are critical to understanding*."

This is not often made explicit within curriculum documents which often comprise long lists of content in which '*knowledge structures tend to remain implicit to those working in the field*' and only become '*visible and explicit as deliberate attempts are made to reveal them*' (Luckett, 2009). This suggests an imperative to map the thresholds that exist within disciplines, to construct a web (Davies and Mangan, 2007) that can be used as a curriculum framework. The curriculum needs to acknowledge the development of linear and hierarchical components and identify key points where the two could be integrated through the

acquisition of a particular threshold concept. This would seem to address the paradox that arises in conversations between academic developers and disciplinary colleagues: when academic developers tend to encourage deep learning of overarching principles whilst colleagues often stress the need to give the students facts to populate the developing knowledge structure. The models presented above provide a rationale for each perspective.

Implications for professional development & academic practice.

Some of the challenges to competency-based models of professional training can be visualised and further explained by the framework depicted in Figure 1. For example, Wheelahan (2007) has concluded that competency-based training fundamentally transforms the nature of knowledge by *dislocating* the experiential knowledge from conceptual understanding. In the case of academic development, this dislocation may occur through the separation of teaching practice from pedagogic theory. The observation has been made by McLeod *et al.* (2003: 638) that good teachers usually possess an appreciation of the 'how' of teaching and employ a range of instructional techniques, but '*few understand the 'why' of pedagogic behaviours*'. Unless university teachers are granted access to the conceptual knowledge that underpins experience, they will be denied access to what Wheelahan (2007) has termed the 'yet-to-be-thought', and be constrained in the reproduction of conventional practice (eg. Reeves *et al.,* 2009) in which linear curriculum structures are sterile sequences that have been '*purified from networks of interdisciplinary connections*' (Matusov, 2009: 183). This will then continue to promote cycles of non-learning (Kinchin, *et al*., 2008).

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