

How NOT to identify threshold concepts.

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Devising a methodology for identifying threshold concepts would represent an important milestone in the evolution of threshold concept scholarship. For the most part the strategies deployed by researchers to date have yielded tentative proposals only and the uncertain nature of the outcomes has been a frustrating experience for investigators. It is sometimes asserted that perceived difficulties with the threshold concept definition impede the accumulation of empirical evidence that can be used for identification purposes. However, we believe many of the problems experienced thus far are associated with the approaches used to gather the empirical data. In this paper we identify some of the shortcomings inherent in the commonly-used approaches. Exposing them will assist investigators in the formulation of their research strategies and avoid the continued sense of uncertainty within the threshold concept community.

A number of attempts at concept classification have been documented in the literature. These attempts have had as their goal the classification of concepts based on empirical evidence as opposed to subjective decisions. Typically, the source of the evidence has been discipline experts and would-be discipline experts in the guise of learners. The belief is that experts can validate the inclusion of concepts in a classification because they "know" their discipline and this knowledge provides them with the tools to dissect and analyse the body of knowledge to identify the appropriate concepts. A variant of this approach seeks empirical data gathered from partial or would-be experts in the guise of students at various stages of completion of their programmes of study at university or other places of learning. In this scenario the subjects' lack of competence or gaps in their knowledge are viewed as sources of evidence to support or confirm the assignment of a particular status to a given concept.

The shortcomings identified represent a small but significant collection of issues that highlight the difficulties associated with acquiring the necessary empirical data for identification. The collection includes the effects of basic level concepts, expert blind spot, hindsight bias and the curse of knowledge, the illusion of memory, the influence of language and the effects of emotion. The analysis shows how these issues actually mitigate against the discovery of the type of data that is sought by investigators.

Classifying concepts using categories as *core*, *fundamental*, *central*, *key*, *important* can provide useful insights into the form and substance of a discipline or body of knowledge but they are indifferent to the learner's experiences and the difficulties encountered with the acquisition of conceptual understanding. In the case of threshold concepts the anatomy of the conceptual space and the physiology of the conceptual elements provide the distinguishing insights that characterise a threshold concept and are pivotal for realising the integrative and transformational properties. From the analysis provided in the paper it is apparent that the approaches used have not facilitated any sort of fine-grained consideration of the conceptual space and the features that distinguish concepts and allow them to be classified in a purposeful way.