Unlocking the Problem Solving Threshold by Promoting Enhanced Thinking and Discourse

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Much of the focus of the threshold concepts framework has been on the identification of threshold concepts and threshold functions, such as problem solving, and on developing an understanding of the nature of the troublesome attribute and the associated liminal state. A major challenge remains on the determination of appropriate curriculum measures to address troublesomeness and to expedite attaining the threshold transformation. This contribution seeks to further examine the issue of determining such appropriate curriculum measures and, in the context of engineering problem solving, proposes a novel approach to the design of problems.

Previous work (Foley, 2012) on engineering problem solving, viewed as threshold function, has identified the main threshold attributes as a growing sense of empowerment on the part of the student and a significant advance in their way of thinking and in the discourse they employ. The enhanced way of thinking and the associated sophisticated discourse are normally regarded as manifestations or consequences of achieving the threshold transformation. But perhaps the question could be proposed in reverse: are there specific language or discourse measures which could be taken and which are targetted more directly at enhancing the student's way of thinking and use of discourse so as assist in attaining the threshold goal? In other words, rather than viewing a way of thinking and a level of discourse as outputs of the threshold process, could we also avail of thinking and discourse as more direct inputs to the process?

Engineering problems, whether of the narrow, closed type or of the broad, open type, tend to present the greatest difficulty to the student at the problem formulation stage, ie converting a largely verbal problem statement into a more mathematical specification. Once a student engineer is faced with a tightly specified, well-formulated problem, they will usually have enough analytic capabilities to determine or generate a solution. The task of progressing from the problem statement to tight formulation may constitute the most challenging part of the process because it depends more on a characteristic disciplinary way of qualitative thinking than does the analytical stage.

From the teaching perspective then, the task is to devise some form of exercise that focuses explicitly on the sort thinking, reasoning, and discourse that are characteristic or representative of the problem formulation stage. Such an exercise might, for example, pitch the student into a technically unusual scenario and invite them to reason their way to the more familiar. This contribution will present examples – understandable to the layperson – of this type of engineering problem and report on preliminary student experience of the approach.

Reference

Foley, B. (2012). Engineering problem solving: triggering a metalearning response to a threshold experience. Seed paper presented at the Fourth Biennial Threshold Concepts Conference: from personal practice to communities of practice, 28-29 June, in Trinity College, Dublin.