

The advantages of a discipline “tour guide” approach to teaching statistics in medicine and biology

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Statistics is taught in undergraduate science and medicine courses as an essential research subject. For many science students there is a program requirement to include a first year mathematics and/or statistics course taught by mathematicians and/or statisticians with the topic revisited later within the discipline by academics who are not statisticians. Statistics are taught by a medically trained public health academic within evidence-based medicine in the undergraduate medicine program at University of NSW and taught as laboratory and field research skills by biology academics in the biology courses at University of Sydney.

Seeing our students fail to comprehend the basics of the statistics taught using a more traditional ‘statistics-centric’ method we independently reviewed our courses. We detected particular areas of difficulty in our student’s learning, including numeracy issues and threshold concepts. We will argue that the unpicking of threshold concepts and focusing on the applied relevance of the concepts greatly assisted in improving our students’ understanding. Further, this paper explores how disciplinary factors may assist our students to cross the various thresholds that they encounter, be they generic or applied. This ‘tour-guide’ approach will be illustrated by showing how we use a network of three overarching threshold concepts delineated for medical statistics that link together multiple threshold concepts of generic and applied theory with other key concepts.

An intriguing finding of this review of our statistics teaching was a recognition that as non-statisticians teaching statistics we have a unique view of how our students are learning statistics as we experienced this same process as non-statistician undergraduates. We were not very “statistically minded”, we found it hard to think in a statistical manner and we both struggled initially with statistical concepts. Students of statistics and medicine/biology may both encounter similar obstacles when learning statistics as they manipulate datasets, calculate probability and make statistical inferences, however, our students do not stop when they have made the statistical inferences as it is at this point that we require our students to extend beyond the statistical meaning of their analyses to the meaning that is coherent with the discipline, including critiquing experimental design. Hence, notably, it is the *application* of statistics that distinguishes our students’ learning. Consequently, students of mathematics appear to find interest and relevance in the statistics themselves; whereas we see that those from medicine/biology find understanding and relevance in the medical or biological explanatory narratives used in explanations of the theory as well as the applied inferences that follow from their statistical findings.

We have found stumbling points in learning both pure and applied statistical concepts which statisticians may not perceive for our students. As discipline experts teaching statistics to our students we are able to identify the threshold concepts and troublesome language that our students have difficulty with and have enhanced the teaching of applied elements to increase the relevance and clarify the key concepts. We view ourselves akin to “tour guides” assisting students as they traverse the statistics landscape on route to destination back in their home disciplines, thus making this troublesome subject more accessible, more acceptable and more easily understood by the discipline based student.

Reference:

Quinnell R. & Thompson R. 2010. Re-viewing academic numeracy in the tertiary education sector as a threshold concept. In Land, Meyer, & Baillie (Eds) *Threshold Concepts within the Disciplines*. Sense Publishers. In press.