

Numeracy as an obstacle to learning for students entering the discipline domains of science and medicine

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We have been exploring the extent of '*the maths problem*' in science teaching and learning at tertiary level. It has been useful for us to refer to the discipline matrix of Biglan¹ where science is defined as a "hard discipline", where "applied" disciplines (e.g. Medicine) are distinguished from "pure" (e.g. Physics and Biology) and where disciplines focused on "life" (e.g. Biology and Medicine) can be distinguished from "non-life" (Physics). Our investigations into the extent of '*the maths problem*' have crossed the pure and applied boundary and the 'life'-'non-life' boundary. It is of interest to us to see how closely correlated thresholds concepts are to discipline boundaries.

Regardless of subject, students saw numeracy as a problem in Physics, Medicine and Biology, with specific issues being: i) maths anxiety ii) difficulty with interpreting data iii) reconciling observations and experimental data with theory². There are striking parallels in how students in each of the sub-disciplines have responded to question: "*what was it about learning in this course did you find to be problematic?*" and the characteristics of practitioners on these same disciplines as described by Biglan¹. For example, students of Medicine focused on how relevant the content of their statistics course was to their overall study, whereas students in Biology were grappling with the complexity of understanding a living system. The Higher Education sector has undergone changes over the past few decades³: There is now a greater number of vocational degrees being offered where 'relevance' is almost pre-requisite to learning, and a more diverse student body with equally diverse experiences of mathematics prior to entry into university. These changes in the Higher Education sector highlight as concerns the issues of: i) 'relevance' in relation to how students in an applied discipline view numeracy, and ii) students using mathematics to understand concepts in sciences. One of the challenges we will need to address as we face this more diverse student body enrolled in vocationally-focused degree programs will be the increasing number of students for whom numeracy is a threshold.

By examining numeracy across science sub-disciplines we are identifying places where students are getting stuck as they begin to practice science. We have a view that by examining our practices within our discipline territories³, we will be able to map where the learning thresholds of our students are occurring. We think that our work may provide some necessary clues to devise teaching approaches to better connect students with the discipline by addressing issues with academic numeracy.

References:

1. Biglan, A. 1973. *Relationships between subject matter characteristics and the structure & output of university departments*. Journal of Applied Psychology, 57: 204-213.
2. LeBard, R, Micolich, A, Thompson, R & Quinnell, R. 2009. *Identifying common thresholds in learning for students working in the 'hard' discipline of Science*. Proceedings of the 2009 Uniserve Science conference Motivating Science Undergraduates: Ideas and Interventions: 72 - 77.
http://science.uniserve.edu.au/images/content/2009_papers/LeBard.pdf
3. Becher, T and Trowler, P. (2001). *Academic Tribes and Territories: intellectual enquiry and the cultures of disciplines* (2nd edition). Buckingham: Open University Press/SRHE.