DEVELOPING CRITICAL NUMERACY AT THE TERTIARY LEVEL

by

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DECLARATION

I declare that this thesis is my own account of my own research and has not previously been submitted, in whole, or part, for assessment at any tertiary institution.

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DECLARATION

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PREFACE

During the course of my career as a teacher at secondary and tertiary levels it has become increasingly apparent to me that many students, from all kinds of backgrounds, tend to skim over those aspects of information that are quantitative. It seems that many lack the confidence to engage with the quantitative material, be it in the form of tables, graphs charts, embedded in the text or written in prose, while others may not be aware of the importance of dealing with this kind of information themselves.

This is of concern for several reasons. In the context of education, students need to be able to research information about their chosen area of study. They need to be able to engage with available data and be able to understand what it represents and some of the implications. They also need to be aware that there is a range of interpretations that can be made based on the same data. Interpretations are always influenced by the perspective of the person interpreting the data and when these are reported in print or other forms of media, they may reflect some element of bias. Without the confidence and ability to engage with the reported information the reader may be misinformed, or mislead by the author’s own viewpoint.

An awareness of the need to encourage and enable students to engage with the quantitative material led to the study on developing students’ numeracy to be reported on in this thesis.
ABSTRACT

Students at university encounter quantitative information in tables and graphs or through prose in textbooks, journals, electronic sources and in lectures. The degree to which students are able to engage with this kind of information and draw their own conclusions, influences the extent to which they need to rely on the interpretation of others. In particular, students who are studying in non-mathematical disciplines often fail to seriously engage with such material for a number of reasons. These may include a lack of confidence in their ability to do mathematics, a lack of mathematical skills required to understand the data, or a lack of an awareness of the importance to able to read and interpret the data themselves. In this dissertation, the successful choice and use of skills to interpret quantitative information is referred to as numeracy.

The level of numeracy exhibited by a student can vary depending on the social or cultural context, his/her confidence to engage with the quantitative information, the sophistication of the mathematics required, and his/her ability to evaluate the findings. The first part of the dissertation is devoted to the conceptualisation of numeracy and its relationship to mathematics.

The empirical study that follows this is focused on an aspect of numeracy of importance to university students: the reading and interpreting of tables of data in a range of non-mathematical contexts. The students who participated in this study were enrolled in degree programs in the social sciences. The
study was designed to measure the effectiveness of a one-hour intervention workshop aimed at improving the levels of the students’ numeracy. This workshop involved reading and interpreting a table of data using strategies based on the SOLO taxonomy (Biggs & Collis, 1982).

The SOLO taxonomy was developed mainly as a means of classifying the quality of responses across both arts and science disciplines rather than classifying the students. The categorisation uses five levels: prestructural, unistructural, multistructural, relational and extended abstract. It can be used as a diagnostic tool at all levels of education as it can be seen as a spiral learning structure repeating itself with increasing levels of abstraction. It can also be used as a teaching tool because it is based on an analysis of responses, rather than of individual students.

A measuring instrument, also based on the SOLO taxonomy, was designed to gauge the levels of the students’ responses to these tasks. Each response was allocated a level that was subsequently coded as a number from zero to seven. Because the responses were in distinct ordered categories, it was possible to analyse the scores using the Rasch Model (Rasch 1960/80) for polytomous responses, placing both the difficulty of the tasks and the ability of the students on an equal interval scale. The Rasch Model was also used to evaluate the measuring instrument itself. Some adjustments were made to the instrument in the light of this analysis. It was found that it is possible to
construct an instrument to distinguish between levels of students’ written responses for each of the chosen table interpretation tasks.

The workshop was evaluated through a comparison of the levels achieved on the scale by individual students before and after the workshop. T-tests for dependent samples indicated a significant improvement (p < 0.01) in student performance for the majority of students. In addition the positive change in overall means for the table interpretations tasks indicates that the workshop using the Five Step Framework was effective overall. The Five Step Framework and the measuring instrument are appropriate for teaching and learning at a range of educational levels, and they will be used to contribute to further research in the area.
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