MODELLING DIVERSITY IN ABSTRACT ALGEBRA TEXTBOOKS

HASSNAA HASAN SHAHEED

There is much existing research on the nature, purpose and use of textbooks but not much of it is applied to abstract algebra texts and their specific features. Rare exceptions are Capaldi [1] and Suominen [3].

This work is a proof of concept study of a model that I develop of abstract algebra textbooks. I look at a sample of abstract algebra textbooks – some classic, some more unusual – and use consideration of these books to build models of the diversity of abstract algebra texts. In doing so, it is necessary to come up with theory, language and models required to be able to see, analyse and (potentially in the future more effectively) utilise abstract algebra textbooks in all their diversity, in order to more effectively teach students in all their diversity.

Therefore, the task of this thesis is the theoretical work of model creation. In this work I utilise a combination of reader-oriented theory and content analysis. The former is a theoretical framework which emphasises the way that different readers may see different meanings in the same text. The latter is a widely used methodology for analysing texts. The two are at some tension with each other, because reader-oriented theory emphasises subjectivity and content analysis strives for objectivity. This tension has become a creative tension in my work which has influenced my conceptual framework. As a result, in the end, my models are not just models of books, but also of theoretical (that is, 'model') readers.

A key concept created within this work is the idea of the 'terrain' of a text. The word is intended to convey the idea that reading a book is a journey. Different readers can see different terrains in the same book. This has implications for teaching and learning, and how teachers may be able to help students see those aspects of the terrain of a text that will be most useful for them in their learning.

In this thesis, I have built two models called FENS and BAFENS. The first expresses terrain in terms of 'functionalities' called facts, explanation, notation, and signposting. The second prefaces the functionalities in the first with behaviour and affect, because those categories are so important to the teaching and learning of abstract algebra. These models allow visualisation of 'terrain'. Both models are challenged with data from abstract algebra textbooks and both models survive this challenge.

The FENS and BAFENS models have then been used in this work to create different 'prototype readers'. These models express different perspectives with which real readers might read abstract algebra texts. The models are then applied to eight abstract algebra textbooks, to see the diversity of the books in terms of the needs of these theoretical readers.

Some of this research has appeared in [2].

References

[1]   M. Capaldi, 'A study of abstract algebra textbooks', *Proc. 15th Annu. Conf. Res. Undergrad. Math. Educ.* (eds. S. Brown, S. Larsen, K. Marrongelle and M. Oehrtman) (Mathematical Association of America, Washington, DC, 2012), 364–368.

[2]   H. H. Shaheed, J.-A. Osborn and M. Roberts*, '*Modelling the diversity of tertiary abstract algebra textbooks*', Proc. Int. Conf. Res. Teach. Educ.*, Vienna, 2019 (Diamond Scientific Publishing, Vilnius, 2019), 71–82.

[3]   A. L. Suominen, *Abstract Algebra and Secondary School Mathematics: Identifying and Classifying Mathematical Connections*, PhD Thesis, University of Georgia, 2015.

HASSNAA HASAN SHAHEED, School of Information and Physical Sciences, University of Newcastle, Callahan, New South Wales 2308, Australia
e-mail: hassnaa23@live.com