Developing Early Algebraic Understanding in an Inquiry Classroom

A thesis presented in partial fulfilment of the
requirements for the degree of
Master of Education
at Massey University, Palmerston North, New Zealand

Jodie Margaret Roberta Hunter

2007

ABSTRACT

This study explores Year 5 and 6 students' construction of early algebraic concepts within an inquiry classroom context. Also under consideration are the tools—the instructional tasks and models, the forms of notation and symbolisation, the discourse and interaction, and the teacher's pedagogical actions—which mediate student development of early algebraic reasoning.

An emergent theoretical perspective which brings together social and constructivist theories of learning underpins the focus of the study. Relevant literature is drawn on to illustrate the need for student focus to shift from a procedural perspective of number operations and relations to understanding their structural aspects. Comprehensive evidence in the literature is provided of the significant role of the teacher in developing the students' early algebraic reasoning through facilitating their participation in making conjectures, generalising, justifying and formalising.

A classroom-based qualitative research approach—teaching experiment—matched the emergent theoretical frame taken in the study. The teaching experiment approach supported a collaborative teacher-researcher partnership. Student interviews, participant and video recorded observations, and classroom artefacts formed the data collection. On-going and retrospective data analysis was used to develop the findings as one classroom case study.

Important changes in student reasoning were revealed in the findings as the teacher guided development of productive discourse and facilitated extended time and space for student discussion and exploration within an inquiry context. Students were provided with many rich opportunities to engage with tasks and models which explicitly focused on developing relational thinking, understanding of algebraic notation, the exploration of the properties and relationships of numbers, and functional patterns. Evidence is provided that through engaging with the tasks and models, the students learnt to make conjectures, represent, justify, generalise and formalise their observations. Of significance in deepening student understanding of early algebraic concepts were the repeated challenges to their partial understandings.

The research findings provide insights into ways teachers can assist students to use their implicit understanding of number relations and properties as a foundation for the construction of early algebraic reasoning. The results of this study suggest that student participation in mathematical activity which included explanation, argumentation and justification supported their development of rich algebraic reasoning.

ACKNOWLEDGEMENTS

I would like to acknowledge and thank the many people who made this study possible. Most importantly I wish to thank the teacher who so willingly and enthusiastically gave of herself and her time. Her personal belief in this study and collaborative spirit contributed greatly to the project and was a source of strength for me. I would also like to thank the students in her classroom for their enthusiasm and keen participation in the mathematical activities which were undertaken.

I wish to acknowledge and thank my main supervisor, Dr Glenda Anthony who showed unstinting interest and offered invaluable support in the writing of this study. Glenda so willingly gave of her time and provided important professional suggestions and support. My thanks extend to Ngaire Davies, my second supervisor who aided the writing process through her supportive professional comments.

Finally, I must acknowledge members of my family, my mother Bobbie for her unwavering belief in me and perpetual support, my father Les for his unfailing confidence and my supportive, caring husband, Gavin who remained tolerant and positive throughout this research study. Their support enabled me to believe in my ability to complete this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES