

**An examination into the effects of incorporating
collaborative learning methods in a core
first-year mathematics subject**

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Certificate of authorship

I, Sabita Maria D'Souza, hereby certify that the work presented in this thesis has not been previously submitted for a degree, nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

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(Sabita D'Souza)

Dedication

I dedicate this thesis to my loving family:

To my beloved parents-

Dr. Peter Joseph Francis D'Souza
&
Mrs. Maria dos Anjos D'Souza

and my sister -

Nisha Maria D'Souza

My source of strength, courage and love

Preface

The following are refereed research publications relating to this thesis:

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Abstract

This project aims to examine the effects of incorporating collaborative learning methods extensively in a core first-year mathematics subject and to investigate students' individual learning style preferences, their attitudes towards group-work in mathematics and the objectives for setting group work, their attitudes towards using computers, in particular, *Mathematica* and their concerns regarding the assessment of group-based work.

Following the rapid increase in the use of technology in education over the last decade, one would perhaps expect to find an overabundance of literature regarding the effects of its use. However, the number of technology related research studies has been surprisingly low, especially those pertaining to the curriculum area of Mathematics at the tertiary level. The availability of quality software, the need for curriculum redesign, and limited research on the effectiveness of computers as a teaching tool, are factors to have hindered the rate of implementation and of subsequent research.

Also, despite the rapid growth in the use of collaborative methods of learning, and widespread belief in the importance of such methods, there have been calls for increased research especially at the tertiary level, and particularly in engineering education – looking at students who have to study mathematics because it is a requirement and not because they are majoring in mathematics, therefore needing to determine how best to make their learning a meaningful and enjoyable experience.

This project aims to investigate the effects of incorporating a rich collaborative learning based curriculum in either face-to-face or computer-supported environments in the subject *Mathematical Modelling* 1. The carrying out of this project is a response to the lack of research in a curriculum area of tertiary mathematics. Within the context of mathematics, issues of attitude, gender differences, motivation and achievement are considered. The chief purpose of this investigation is to explore the effectiveness of collaborative learning in mathematics at university, and to provide some insight as to what degree, if any, the use of such methods enhance mathematics learning.

The research uses an experimental methodology, an attitudinal questionnaire and in-depth interviews to elicit students' feelings and/or opinions toward the incorporation of collaborative learning. The questionnaire sought demographic information from the students, namely, name, age, gender, length of stay in Australia and language spoken at home, and investigates the role of these factors in the effectiveness of, and interest during the tutorial and laboratory sessions – a time when students were working on collaborative-based activities.

This project maintains interest in the use of collaborative problem solving, and the belief that the findings could be of international significance if the effectiveness of this style of learning can be finally established. It is also hoped that grounding the collaborative activities in the literature, and providing statistical and theoretical support for their use might promote them more widely in mathematics in particular and more generally, across universities in Australia.

The broad issue of whether the use of collaborative learning enhances mathematics learning can be broken down into a number of specific inquiries. The key research questions may thus be expressed as follows:

1. What are tertiary students' preferred learning styles?
2. What are students' opinions about group work in mathematics?
3. Does collaborative group work foster a deep, meaningful understanding of mathematics?
4. What are students' attitudes about using CAS such as *Mathematica*?
5. What are students' attitudes about the assessment of group-based work?
6. Are there any differences in students' learning style preferences across the various demographics?
7. Are there any differences in students' attitudes towards collaborative learning methods across the various demographics?
8. Are there any differences in students' attitudes towards the use of *Mathematica* across the various demographics?
9. Are there any variations in students' attitudes towards the assessment of group work in mathematics across the various demographics?

This study does not claim to fill the void into the effectiveness of computers or collaborative learning methods, but should provide greater insight and support to future research.

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