

CHAPTER 3

METHODOLOGY

3.1 Introduction

This study is an exploratory study using a qualitative approach and intends to explore the students' understanding of quadratic equations, based on their written responses. Firstly, writing tasks were given to the students to provide familiarization with writing in mathematics. This was followed by a set of writing tasks. The written responses to these writing tasks were then analyzed. Secondly, individual interviews were conducted to seek clarifications of the written responses. Finally, the data collected was then further analyzed to determine the students' understanding of quadratic equations.

3.2 The Sample

Five students were selected from a group of twelve volunteers from two Form Four Science classes in a school in the Klang Valley. The gender variable was confined to girls only as this is a girls' school. The science students were chosen because they took Additional Mathematics, which included quadratic equations and quadratic functions. In addition, the senior mathematics teacher recommended the selection, as these students would demonstrate a better ability in expressing themselves in mathematics.

3.3 The Instrument

The instrument for data collection consists of five writing tasks to explore the students' understanding of quadratic equations (Appendix 1). These tasks were validated by a senior Additional Mathematics teacher in the school on the suitability and relevancy to the syllabus. The criterion was that the students had been taught the topic quadratic equations. They had also learnt the roots of quadratic equations and the methods of obtaining the roots of quadratic equations.

Task 1 was designed to answer the first and second research question in this study, which is to explore students' understanding of quadratic equations and roots of quadratic equations. In this task, the student had to explain in a letter to a friend, who was absent from class for a week attending athletic practice, on the topic of quadratic equations and roots of quadratic equations focusing on the meaning, applications and other important aspects on these two areas.

The response from Task 2 and Task 3 were for the third research question for exploring students' understanding on the methods of obtaining the roots of quadratic equations. Task 2 requires the student to explain to a friend on how the factorization of $x^2 - 4x - 5 = (x - 5)(x + 1)$ is done and how a quadratic equation can be solved using factorization. In Task 3, the student needs to explain one of the methods of obtaining the solution to quadratic equations and later to use it to solve $x^2 - 2x - 1 = 0$.

3.4 Design of the Study

The study was divided into five phases. The first phase was to familiarize the students with writing while the second phase was the actual writing and data collection process. The next phase was the analysis of written responses and to determine points that need to be clarified. A general structured interview was planned from this analysis. In the next phase, the interview was conducted. The final phase was the analysis of the written and oral data that have been collected.

In the first phase of the study, the students were given writing tasks as a preliminary practice in writing in mathematics (Appendix 4). The tasks were given to familiarize the subjects with writing tasks. A maximum of two writing tasks was given over a period of 5 weeks. The writing tasks focused on content as the students had to explain mathematical concepts. They were of an informal nature such as writing a letter to friend to explain certain mathematical concepts that had been learnt, or explaining a mathematical idea that a friend had difficulties with.

Feedback on the written responses was given to the subjects. The feedback included comments on whether the writings were sufficient or needed to be improved upon. In this way, the subjects would be familiar with writing tasks in the data collection phase.

The tasks from Appendix 1 were then given to the students after the topic had been taught in class. The tasks were given after school hours at the convenience of the student. Only one task was given at a time and the students

could take as long as they wished to write their response. However, the students could not make any references nor consult anyone. Furthermore, the tasks were completed in the presence of the researcher.

The students' written responses were then analyzed to determine the understanding of the underlying concept. Any ambiguities were noted so that further clarification could be sought during the interview in the next phase.

The fourth phase of the research was the interview. A structured interview was planned based on the students' written responses. Examples of the interviews were transcribed in Appendix 2. The interview questions were different for each subject as each student wrote in her own individual way. The aim of these interviews was to obtain clarifications on the students' understanding of quadratic equations.

3. 5 Pilot Study

A pilot study was carried on a separate sample of two Form Four Science students. The subjects in this sample had also been exposed to the same writing tasks designed in the familiarity phase of the study. They were then given the tasks in the Instrument (Appendix 1). The students' written responses were analyzed and questions for the interview were formulated.

As a result of the pilot study, the instrument was accepted to be appropriate. The students had no difficulties in writing their responses to each task. Though the time taken in answering each task differed for each student, they managed to complete each task in an hour's time. The researcher also

noted that the interview schedule could only be planned after analyzing the students' written responses.