Chapter 4   Methodology

In my research in Malawi I was seeking an overview of the factors affecting mathematics education in the primary schools. I chose a case-study method and used three types of data: surveys, observations and interviews, to provide cross-sections and help to explain the findings. I also analysed a vast number of Malawian policy documents: from official papers and curriculum statements to textbooks and examination papers.

4.1   Teasing out the variables

The research question has been presented in Chapter 3 as the climax of many questions arising from the literature review. It is repeated here for convenience.

- *How do policy and practice interact in Malawian primary education, in the case of mathematics teaching?*

There are many ways to organise the variables related to mathematics education in primary schools in Malawi. However, on the basis of the vast amount of literature read before making final research plans, I chose the list that appears below. The many questions that arose from the literature review in Chapters 2 and 3 have been summarised under nine headings, and these are the eight research variables relating to practice, and the questions relating policy to each of them.

In addition to the literature described above I read much more widely (see references below) about other countries in Africa, and the variables seemed to be the most important that met the following criteria:

- Policies exist in relation to them.

- They are areas that are recognised as significant to the primary education in many countries.

   See for example, Avenstrop & Swarts, undated; Chimombo et al, 2000; Dachs, 1998; Diphofa, 1997; Fasheh, 2000; FAWE, 2001; Hoffman-Barthes et al, 1999; Hulton and Furlong, 2001; Israel, 2001; Kaunda & Kendall, 2001; Lefoka et al, 2003; Malaney, 2000; Manyaga, 2001; Miller-Grandvaux & Yoder, 2002; Moulton, 1997a & b; Mulemwa, 1999a & b; Skovsmose, 1998; UNESCO, 2000; Wolf, 1995; Wolf & Odonkor, 1998; World Declaration on Education for All, 1990; World Education Forum, 2000.

- In relation to mathematics they are the major variables that are known to impinge on quality of learning in sub-Saharan Africa.

   See, for example, Atweh & Clarkson, 2002a & b; Bishop, 1988, 1990, 1991, 1998; Bopape, 1998; Chamdimba, 2002; Fasheh, 1997; FEMSA, 2003; Greer & Mukhopadhyay, 2003; Howie, 1999; Ivowi, 2001; Kellaghan & Greaney, 2003; Milner et al, 2001; Mukhopadhyay, 2000; Mwakapenda, 2000; Ottevanger et al, 2003; Setati, 2003; Setati & Adler, 2001; Vithal & Valero, 2002; Volmink, 1994; Woodhouse, 1973; Young, 2000.

These variables are, in summary:

From society:	• *Language*	• *Gender*
From primary schools:	• *Purpose of education*	• *Meeting the needs of all pupils*
From mathematics:	• *Purpose and relevance,*	• *Teachers' content knowledge*
	• *Teaching style*	• *Assessment*

4.1.1 Variables from society

I have chosen two major variables that arise from outside the school system, but impinge on it. They express an underlying tension between traditional African ideas of society embodied in the traditional culture and the western ideas embodied in the education system. These appear to surface in the critical areas of language and gender.

Language

In relation to language this appears in the issue of language of instruction: an African language in lower primary school and English in upper primary school. This reflects the nation's colonial past and the varying ideas about its future.

Gender

Again the tension between the traditional and the 'modern' appears in the area of gender equality. Modern ideas of development challenge traditional gender roles and views about the education of women, especially in mathematics and science. The greater school dropout rate of girls suggests that there are many factors at work.

4.1.2 Variables from primary schools

Purpose of primary education

The practice of primary education reflects the perceptions of its purpose. There is a strong belief in most literature that education contributes to development. It is expected that basic education will meet people's needs, making it easier for people to take part in the economy, improve their health, food security, care for children and also reduce the birth and death rates. Yet the kind of education that tends to take place is dominated by an academic curriculum leading to the opportunity for secondary school studies, and eventually paid employment.

Meeting the needs of all

Can the primary school meet the needs of all pupils? Certainly not, if many of them drop out of education, even before achieving basic competence in literacy. If so many pupils are having difficulty surviving in the system, what do teachers do to help them? What is being done about the drop out rates?

4.1.3 Variables from the mathematics classroom

The four variables chosen to represent mathematics education are: Purpose and relevance, Content knowledge, Teaching style and Assessment.

Purpose and relevance

Mathematics education can contribute to development, but only if the mathematics taught matches the needs of the students. School mathematics could include practical relevant numeracy that can assist the nations' development. In Malawi, what kinds of mathematics should be taught, for what purpose, and to whom? This is a significant cultural, social, economic and even political question, since issues of social class, gender, ethnicity, tradition, religion and language are involved. The cultural dimensions include the mathematics used in everyday life (ethnomathematics), and the influence of Britain, the former colonial power.

Content knowledge

When teachers have little understanding of mathematics themselves, they cannot move forward to better methods of teaching it (Beeby, 1966). The quality of primary mathematics education in any country is greatly dependent on the confidence and mathematical knowledge of its teachers. In this sense Malawi is also typical of most of the rest of the majority (developing) world, having many under-qualified or even unqualified primary teachers. If they are similar to their colleagues in many 'developed' countries, they will also have a significant level of mathematics anxiety (Frankenstein, 1989). In order to better understand

this situation, this research will try to locate and describe the teachers' developing understanding of both mathematics and how best to teach it.

Teaching style

One dominant feature of Malawian classrooms is the very large class sizes, particularly at lower levels. The style of teaching in many over-crowded classrooms is not friendly to girls or boys (FEMSA, 2000; Mulemwa, 1999). This makes teaching for understanding very difficult. What do teachers mean by 'understanding', and how might that relate to their own knowledge (and understanding) of the mathematics?

Assessment

In all competitive societies, mathematics has been used as a 'gatekeeper' subject through the competitive mechanism of the selection examination (Mwakapenda, 2000). There are reports that unfriendly styles of teaching are matched with very frequent testing, and pupils' progress through the system depends on their ability to survive in this competitive environment. Selection examinations act as a filter to determine who survives the race to obtain the limited number of employment opportunities available, and hence relative wealth amid desperate poverty.

4.1.4 Relationships between the variables

These variables are the basis of a survey and the observations of selected teachers. I used these variables to describe the practice as I saw it, and also the basis to analyse the policies. To help the reader keep track of these eight variables in the results and analysis chapters, the following graphic organiser has been devised. It reflects the fact that school is a microcosm of society and that mathematics education is a small part of that.

The Venn diagram shows mathematics teaching nested within the total program of a school, just as the school is nested within society. Variables such as *attitudes to gender* and *language of instruction* are derived from matters related to the whole of society, but they impinge on schools, and hence also on the teaching of mathematics. School variables, such as how they act in relation to the perceived overall *purpose of primary education* and how they attempt to *meet the needs of all pupils*, also impinge on the teaching of mathematics. Finally the listed variables under the heading of mathematics will be influenced by variables from outside the world of mathematics education. Such is the complexity of education, in Malawi as elsewhere.
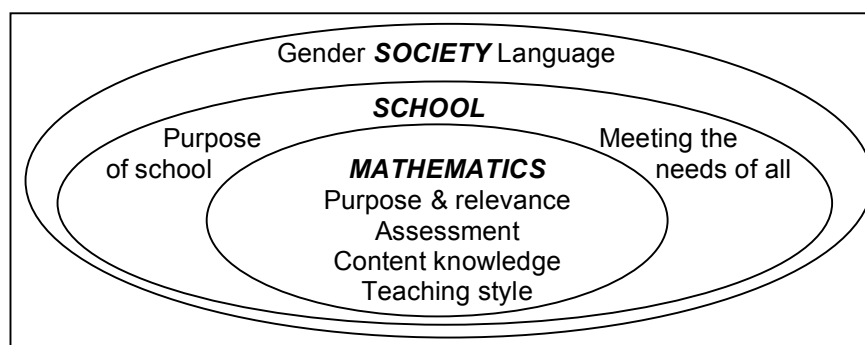
Fig 4.1

The methods I used to tease out some of the links between policies and practice are described in the next section.

4.2   Interactions between policy and practice

In a perfect world educational policies would be clearly written and available. There would be a consensus about its meaning, and the participants all share their values. Teachers in schools

would all understand and agree on each policy, and act consistently to achieve the results required. In any real educational system these conditions do not occur. In systems undergoing rapid change, or systems under great stress, the incongruities may be substantial. Malawian education is such a system, and some actions at the school level may bear little relationship to official policy (Wolf et al, 1999). This is not a criticism of the teachers or the policy makers, but simply recognises the stresses on the system.

4.2.1 The nature of the interactions

Of first concern are the policies. Are there written policies concerning each of the chosen variables?

Then, from the official side: How and when were the policies developed? How have they been communicated? Are they being promoted? Are there implementation plans, for example involving education and awareness-raising, or regulations and some form of policing?

From the point of view of the teachers: Are the policies known to the teachers? Do the teachers follow the policies? If not, do they disagree? If the teachers wish to follow the policies, but do not, are there constraints that make it impossible, or particularly difficult, to follow expectations?

In all cases, I try to develop both a clear picture of what is going on, and a sympathetic understanding of the reasons behind what happens.

4.2.2 The methodology chosen and its justification

I combined quantitative and qualitative methods. I chose a convenience sample for a questionnaire to canvas between 50 and 100 teachers, but I did not assume they were representative. The sample included teachers at all levels from 10 schools, to give me a range of explanatory variables that would help explain many of the relationships I expected to find. Linking policy and practice required in-depth explanations rather than statistical methods.

However even the questsionnaire aimed at deep comparisons. I devised a procedure for creating three forms of the questionnaire with three alternative responses to each question. These were:

- what do you actually do in the classroom?
- what would you like to be able to do? and
- what do you think the Ministry of Education wants you to do?

This made it feasible to quickly locate mismatches between teachers' responses in relation to what they do, what they would like to do and what they believe is expected of them by policy. (See Appendix 2.) I also compared policies and teaching resources to the teachers' responses.

I would use the data from the questionnaire responses to select 6 to 8 teachers to observe over a number of days and then interview them. The major purposes of this were to aid in interpretation of the questionnaire data. I expected the interviews to help me understand some of the reasons for the actions that I observed and for some of the responses from the survey. The observed lessons would be photographed (with permission). The lessons and the interviews would be digitally recorded and translated where needed, so that I had a permanent aural and visual record of the events to supplement my notebook.

I would also interview as many relevant educators (academics, administrators and policy makers) as possible on matters relevant to the research. In the process I would search out relevant documentation about policies, curriculum, textbooks, history of education, etc. to support the research. Combined with this was extensive analysis of policy documents.

The process involved a large amount of natural triangulation, as various opinions would be sought on significant variables from different teachers and policy makers. The observations of mathematics teaching at most Standards of the Malawian primary school were expected to provide a rich source of insight into the quality of teaching and the level of involvement of

pupils in the learning process. I was hopeful of being able to compare the teaching with the suggestions in the Teacher's Guides for the different levels, and obtain some feedback about their usefulness.

4.3   Components of the data gathering

For each of the eight variables I needed five types of data, listed in the sections below. These would enable me to take the journey from the policy itself, through some background about its creation and implementation, past the views of teachers on the matter (what they do, what they would like to do and what they think policy asks of them), to my classroom observations and the interviews of the teachers to try to make sense of it all.

4.3.1 Policy in relation to the variables

I started with almost nothing official in writing about Malawian education. Locating copies of policy documents, analyses of them, syllabuses, textbooks, Teacher's Guides, books on educational history, etc. became of great importance. I am most grateful for the support of many people in obtaining everything needed for this study.

4.3.2 Educators' views on the policies most related to their interests

The context of educators (academics or policy makers) in Sub-Saharan Africa is very different from that of countries in the 'west'. The African situation involves, among many other things, poverty, lack of resources, competition between government departments for funds, many international aid donors (national governments and NGOs) each with their own agendas, traditional African attitudes in villages, lack of infrastructure or economic traditions, and lack of employment opportunities for graduates (Wolf, et al, 1999).

I planned to meet and interview (and record with permission) as many educators as possible. In the event I received an amazing level of cooperation, and am most grateful for this.

4.3.3 Three related sets of opinions of teachers

Many teachers might prefer to teach in other ways than they do, but are not in a position to do so because of strongly felt constraints on their actions. For example, teachers might *prefer* to teach in the local language and offer local examples, but they might *feel compelled* to train students to learn by rote in English in order to try to pass examinations. In this situation, offering child-centred alternative teaching methods may only serve to increase the tension in the minds of teachers, and is therefore unlikely to result in improvements in their teaching. This position is supported by much other research. See for example, DFID (2001b).

In the survey the questions were asked three times, once asking the teacher to say what they do, once asking what they would prefer to do, and finally asking what they thought the Ministry of Education wanted them to do. In choosing this approach I hoped for evidence of agreement or clashes in opinions between what teachers do, what they would like to do and what they think the Ministry wants. This would reveal underlying misunderstandings of policy, and the outcomes of constraints on teachers' actions. Also, if teachers thought the Ministry wanted something different from what either the Ministry officials or the printed policies said, this tells us about the teachers' knowledge of the policies. Disagreements between what they do and what they think is wanted registers non-compliance with policy.

4.3.4 Observations of teachers in classrooms

The classroom observations of a number of chosen teachers would be recorded, with permission, through photographs, digital recording (translated where needed), and notebook jottings. The choice of teachers was to be made based on the questionnaire responses, so the survey would have to be completed first.

4.3.5 Interviews with observed teachers

Associated with the classroom observations, was one final interview, recorded with permission, and translated as needed. I could have wished for a situation in which I could interview the teachers after each lesson, and so recall of events for explanation might be fresher in our minds; however teachers were all busy people, and could not be replaced for so many interviews. The purpose of the interviews would relate to the variables to which their opinions or classroom behaviours were most pertinent. There would not be time to ask each teacher to explain everything.

4.4   Procedures

I will describe the process undertaken as a series of forward steps. The actual road was not so straight, involving backtracking and rethinking.

4.4.1 Literature review

I undertook a very substantial literature review before collecting data, mainly to get a good understanding of the African background – the society, politics, economics and as far as possible, the education. Because I had previously worked in the majority world country of Samoa, I was able to visualize a lot of the situations I was reading about. I used mind maps and other graphics to assist me to establish the major issues, and these became the basis organizers for the questionnaire and the research.

4.4.2 Plans

The basic plans for the research have been described in section 4.4. They evolved through several manifestations.

4.4.3 Questionnaire – preparation and trialling

The variables for the questionnaire were selected on the basis of reading as described above. I was keen to look for evidence of clashes (disagreements) within teachers' responses. For this reason I chose to present the same questions on the questionnaire in three different forms:

• In relation to the variable, what do you actually do in the classroom?

• In relation to the variable, what would you like to be able to do?

• In relation to the variable, what do you think the Ministry of Education wants you to do?

The questionnaire is found in Appendix 2.

The variables and question numbers were:

    Q1, 10, 19:   Language (when teaching mathematics)

    Q2, 11, 20:   Gender preferences (when teaching mathematics)

    Q3. 12. 21:   The role of primary schools

    Q4, 13, 22:   The locale of examples used in teaching (when teaching mathematics)

    Q5, 14, 23:   How they manage classes (when teaching mathematics)

    Q6, 15, 24:   The purpose of mathematics teaching

    Q7, 16, 25:   How they help weaker pupils (when teaching mathematics)

    Q8, 17, 26:   Their teaching method (when teaching mathematics)

    Q9, 18, 27:   How they assess pupils' learning (when teaching mathematics)

In addition there were questions asking about the topics hardest to understanding and to teach.

For each question there were three alternative responses, randomly ordered. These were composed on the basis of three possible orientations that I had determined were likely from the reading.

- *African*: an orientation towards traditional African values and approaches to the question.

- *Development-oriented*: a 'Western' approach to the question, following the recommendations of international bodies, such as the United Nations.

- *Examination-orientation*: an approach to the question that is oriented to getting as many pupils through the selection examination as possible.

For the details on how these were worded, please see the questionnaire, in Appendix 2. Anticipating that teachers often have mixed motives, I offered the opportunity for teachers to choose one, two or all three of these alternatives. (Fractions were used to share each teacher's response across the categories, in order that fairness was maintained.)

The trial version of the questionnaire was sent to the person with whom I had arranged to stay, Mr Grames Chirwa, who lives and works at the Malawi Institute of Education (MIE). He took it to three nearby schools and arranged for 18 responses to be posted back to me in Australia. I analysed these, was satisfied with the outcomes and decided to make no changes. (In fact some of the teachers in the trial were also involved in the final responses; this served as a useful check on the reliability of the data – there were very few disagreements, and where these existed I used the later responses.)

I used the trial responses to design a spreadsheet template to obtain a rapid analysis of the data once it was entered. This was most helpful in the field, particularly in enabling me to choose teachers for observation and interview, partway through my four weeks in Malawi. It was also most helpful in later data analysis.

4.4.4 Ethics permissions

I complied with all the ethics processes required by Monash University. Signatures were obtained on the required permission forms etc. I obtained a letter of permission and authorisation to use with any other Ministry officials and teachers from Dr Simeon Hau, the Principal Secretary for Education, before I bought a plane ticket. In practice, this letter was never required as all Malawians I approached were very willing to cooperate with my research. In 2005 Dr Hau was chief administrator (Principal Secretary) of the education sector in Malawi. He had previously been a mathematics teacher and lecturer at MIE (and even the past-president of the Mathematics Teachers Association of Malawi) and hence I was pleased to be able to visit and interview him as soon as possible once I arrived in Malawi.

The 83 teachers from 10 schools who filled out the questionnaire all signed forms showing their understanding of the process and their willingness to have their responses used in my research.

The six teachers chosen for observation and interview also signed permission forms allowing me to observe, digitally record and photograph them, and to use any of this material in my research. Some months after my visit to Malawi, through Grames Chirwa – the able research assistant for the project – I sent them copies of all that I had written about them. I offered them a chance to make clarifying comments or to refute what they had said. Most did this and their additional comments area quoted in the results (Chapter 6). I requested permission to use their names and gave them the opportunity to be represented by a pseudonym. All were very willing to have their real names used.

The questionnaire is found in Appendix 2 and the data from the questionnaire is tabulated in Appendix 3. In Appendix 4 is a sample lesson observation, illustrated by my notes taken at the time, with explanations. Appendix 5 contains a transcript of one interview with one teacher: Patricia Fundi, a teacher of Standard 1 and 2. Appendix 6 gives a list of the educators I interviewed, and Appendix 7 is the transcript of an interview with the Vice Chancellor of the University of Malawi in 2005, Dr Francis Moto.