A multiple case study

of parent involvement

with grade 8 learners

of mathematics

VASUTHAVAN GOPAUL GOVENDER
A MULTIPLE CASE STUDY OF PARENT INVOLVEMENT WITH GRADE 8 LEARNERS OF MATHEMATICS

by

VASUTHAVAN GOPAUL GOVENDER

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DEDICATION

I dedicate this thesis to my wife
Premela Govender for her encouragement, support and patience;
my children Kushantha and Sachen for their understanding and my
mother Kay Govender for always having faith in my ability
DECLARATION

I declare that this study is my own work and that it has not been previously submitted for assessment to another University or for another qualification.

SIGNATURE:______________________

DATE:          _____________________
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ABSTRACT

The learning of mathematics is a worldwide concern. International studies over the last decade place South African learners amongst the lowest achievers. Although various initiatives have been tried there does not seem to be any improvement. In the USA and UK initiatives include the involvement of parents and these have been implemented with great success. One of the parent involvement programmes from the USA, the Family Maths Programme has been in South Africa since 1996. This programme has been successful in South Africa but is confined to parents of grades 4-7 children. However, there is no programme for parents of high school learners.

As grade 8 is usually the first high school year in South Africa, this study focuses on parents of grade 8 children and their involvement in their children’s mathematics learning. It consists of an initial survey of grade 8 parents’ (from an urban school) mathematical backgrounds and experiences and their involvement in their children’s education. Using key points from the survey and elements from the literature review and other sources, the researcher designed a parent assistance programme for mathematics which was conducted with three groups of parents of grade 8 children from the same high school. Each group of parents was exclusive and the same set of procedures was applied to each group, making this study a qualitative multiple case study, within the interpretive research paradigm.

The parent-assistance programme consists of a parents’ workshop and completion of journals over a 7-week period. Parents documented their interactions with their children in structured journals, a process known as participant journaling. After this journaling period, parents and children were surveyed on this interaction by means of follow-up questionnaires. This was followed later in interviews with the parents and mathematics teachers, separately. After the completion of all three case studies parents and children participated in focus group discussions to discuss and share experiences of the programme.

The interrogation of the data, on two levels, suggests parents’ and children’s perceptions of mathematics were likely to be positively influenced. The data also suggest that children were likely to become more confident and to improve in mathematics.
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CHAPTER 1
OVERVIEW OF THE STUDY

1.1 Introduction

The learning of mathematics is a national and international problem (de Lange 1981; Howie 2001, Centre for Development and Enterprise (CDE) report 2004) and a number of approaches have been taken to remedy the problem, including in-service training conducted by higher education institutions and education departments (Taylor and Vinjevold 1999). Alternatively, in countries such as the USA and the UK, parental involvement has also been used as a strategy to meet the challenges presented by mathematics education.

Parental involvement programmes that have aided mathematics learning in the UK include the “IMPACT programme” (Merttens and Vass 1990) and the “Maths Year 2000 Scotland” programme (Ritchie 2000). Some programmes in the USA include the “Back-to-School nights” (Huetinck and Munshin 2000), “Mathematics Month” in Cape May County in New Jersey (Szemcsak and West 2002) and the Family Maths Programme (Weisbaum 1990). The latter programme was introduced to South Africa in 1996 but was confined to the primary school (Austin and Webb 1998).

Although the Family Maths Programme was largely successful in the schools in which it was implemented, there have been, as with any programme, some negatives. According to Pam Austin, coordinator of the Family Maths Programme at the Nelson Mandela Metropolitan University in Port Elizabeth, some parents lacked confidence in their own mathematics ability and sent other family members to accompany their children to Family Maths activities. Furthermore, some school principals were reluctant to support staff members who were enthusiastic about implementing the programme at their schools (personal communication).

Previously, parents were perceived as clients and they did not have any say in the school and the management of the school. However, it is now expected that
parents be partners, in the decision-making process and in its implementation in schools. The relationship between parents and schools is changing from a client type of relationship to a partnership relationship (Heystek and Louw 1999).

One of the problems facing schools is how to involve parents in school activities. Legislation like the South African Schools Act of 1996 compels parents to participate in school governance, but other activities like participation in fund raising, assisting teachers with academic or extramural activities are voluntary and parents must be motivated and trained to participate actively. The motivation of parents depends on the teachers and principals, which suggests that schools need to come up with proper plans to involve parents in education (Heystek and Louw 1999).

1.2 The literature surveyed

One of the key subjects in the school curriculum is mathematics. Mathematics is viewed as a subject that is needed for everyday life and is thus an essential part of the curriculum. This assertion that mathematics is essential for everyday life puts a greater pressure on pupils to succeed at mathematics than in many other subjects (Jennings and Dunne 1997). This is evidenced by the fact that the new curriculum for the further education and training phase (grades 10 – 12) in South Africa has mathematics or mathematics literacy as a compulsory subject (Department of Education 2003). In addition, school mathematics is a prerequisite for many higher education courses.

Parents may assist their children with mathematics in their primary school years but tend to shy away from assisting them in the high school (Shinn 2002). It is claimed that many adults have developed negative attitudes towards mathematics (Jennings and Dunne 1997). The subject is perceived as being both difficult to teach and learn. Although some parents are able to pay mathematics tutors to help their children, for the vast majority of children the only source of help in mathematics is their teacher.
Parental involvement programmes have had varying degrees of success. One of these programmes is the “back-to-school nights” for parents (Huetinck and Munshin 2000). This programme usually occurs at high schools in the United States and is ongoing. During ‘back-to-school nights’, teachers also discuss with parents typical homework assignments that are given to their children to work through. Parents with weak backgrounds in mathematics are also given support during these sessions. They are asked to help their children by providing a home environment in which homework is a priority and in which their children are encouraged to use the educational resources available for them in the community.

In Cape May County, New Jersey there was a successful high school involvement programme for parents (Szemcsak and West 1996). It started as a Family Math Night where parents and children could learn together. Parents and teachers demonstrated a high level of excitement, as well as energy and team spirit during this occasion and the programme was extended to a month to accommodate additional activities. The activities were wide and varied and parental involvement was the key factor in all the activities (Szemcsak and West 1996).

Another successful parental involvement programme was the IMPACT programme in the UK. This programme had the empowerment of parents and the transformation of the practices of schooling as some of its key foci (Mertens and Vass 1990). The programme involved primary school children taking home mathematics activities to do with their parents. These activities were chosen by the teacher to fit in with the work being done in the classroom. The products of the activity would then be returned to the school together with an evaluation of the activity and the process of doing it, filled in by both the parent and the child.

It would appear that there are only a few successful parental involvement programmes for mathematics and these have usually taken place either in the USA or the UK. The one successful South African programme is the Family Maths programme which originated in the USA. This programme is based in Port Elizabeth (Austin and Webb 1998). Some of the activities that take place in the Family Maths programme
are problem-solving activities, cooperative learning skills developments, where learners, parents and community members work together in a relaxed, non-threatening environment (University of Port Elizabeth Pamphlet). However, this programme is confined to the primary school. It would appear that there are no high school parental involvement programmes for mathematics in South Africa.

This study has been undertaken within the framework of the developing social, political and educational contexts of South Africa and is aimed at contributing new knowledge on parental involvement that may be used within the national context.

1.3 Context of the problem

In the late 1970s and early 1980s the Human Sciences Research Council (HSRC) of South Africa published a number of reports on the teaching of physical science and mathematics in South Africa. However, the focus at that time was only on “white” education (Khuzwayo 2005). The deficiencies in science and mathematics education in South Africa in general were highlighted by the de Lange commission in 1981 (Human Sciences Research Council 1981), but it was when the results of the Third International Mathematics and Science Study (TIMSS) were released nationally at a press conference in 1996 that the shock of South African learners’ low performance reverberated around the country. South Africa was ranked 45th out of 46 participating countries and, although many in education were not surprised, this fact generated intense debates in the media and in educational and political circles (Howie 2001).


The period between the two TIMSS projects in South Africa was a dynamic time in education (Taylor and Vinjevold 1999). In 1995, the first White Paper on Education and Training was published (Department of Education 1995).
This paper, being the first important policy paper providing a framework for a new system of education, highlighted the importance of science and mathematics education and the need for integrating education and training.

Revise of curricula took place in 1996 and Curriculum 2005 was introduced soon thereafter. Simultaneously, the White Paper on the Organisation, Governance and Funding of Education (Department of Education 1996) was passed, as were a number of Acts such as the South African Schools Act of 1996. An audit report on teacher education was released (Hofmeyer and Hall 1996) and the South African Qualifications Authority (SAQA) was established in 1997 to implement the National Qualifications Framework (NQF); this was an ambitious undertaking intended to transform education. Finally, the President’s Education Initiative (PEI) was established and commissioned 35 research projects to investigate and address the problems associated with the new system of education (Taylor and Vinjevold 1999).

Expectations in South Africa in the second half of the 1990s, in terms of education, were high. However, the key findings from the TIMSS-R were that there was no improvement in South African learners’ performance between 1995 and 1999. South African school children were outperformed on average by participants from all other 37 countries in the study and were 200 points below the international average on an 800-point scale. This result is particularly significant as South African pupils were not only competing with pupils from developed countries, but also from Morocco, Tunisia, Chile and a number of South East Asian countries such as Indonesia and the Philippines (Howie 2001).

It would appear from South Africa’s performance in TIMSS and TIMSS-R, that mathematics is a problem in South Africa. However, there are structural and social problems as well. This problem is exacerbated in the South African context because of social conditions such as poverty and cultural mores.

One of the most significant pieces of education legislation in democratic South Africa was the South African Schools Act of 1996 (DoE 1996a). This act envisaged a partnership between parents and schools in school governance to
ensure quality education. It was hoped that involving parents in education would give them insight into their children’s progress, encourage them to participate in decisions involving schools and make them critical of information on educational issues. This involvement would also influence communities to support their schools. The introduction of Outcomes-Based Education (OBE) in South Africa has also paved the way for greater parental involvement in education. Parents were required to share the responsibility of education with the state and use the knowledge gained to build their communities. For OBE to be successful, parents and teachers had to be thoroughly prepared as implementers (Mbokodi, Singh and Msila 2003).

However, in a study by Mbokodi et al (2003) it was found that 90% of parents did not know much about OBE. The study found there had been little emphasis and focus on parent empowerment and attributed the limited success of OBE in South Africa at that time, in part, to the lack of parental involvement. It was also found that black parental involvement in education at historically disadvantaged schools had been beset with problems that undermined initiatives to promote involvement.

Parental involvement in school-governing bodies in South Africa varies from area to area. Attendance at school-governing body meetings in affluent areas is usually high while there is poor attendance in less affluent areas. Parents in affluent areas employed shared, consultative and participatory decision-making strategies. At the same time, parents in less affluent areas tended to be passive when it came to decision-making (Magabane 2001).

Yet, despite the problems involved in getting parental involvement in education, when parents get regular and effective communication from teachers, they became much more likely to be active participants in their children’s education (Shinn 2002). Heystek and Louw (1999) refer to research conducted by Martins which found that principals of South African schools prefer parents to participate more actively in school activities with the aim of improving the standard of education. Reference is also made to Gene and Stoneman’s research in Heystek and Louw (1999), which found that the participation of
parents in schools has a positive influence on the academic achievement of children.

There are many obstacles to parental involvement in education in South Africa (Mbokodi, et al 2003). Schools and education departments need to create an environment where parental involvement in education is encouraged, nurtured and structured (Heystek and Louw 1999). The South African Schools Act allows for parents’ participation in education mainly through representation in School Governing Bodies. But Rambiyana and Kok (2002) argue that much more is required. Parents need to involve themselves in their children’s home learning and seek the assistance of teachers should their children have learning difficulties. Mbokodi et al (2003) argue for parents to be at the forefront of education dialogue with teachers and learners. Although this may be a bit more difficult in lower socioeconomic areas (Magabane 2001), attempts need to be made to get all parents involved.

This study attempts to find a way in which parents could get involved in the mathematics learning of their children. However, parents’ views of mathematics are shaped by their own experiences of mathematics and their attitudes towards mathematics have an impact on their children’s attitudes. Children whose parents show an interest in and enthusiasm for mathematics around the home will be more likely to develop that enthusiasm themselves (Hartog and Brosnan 2002). At the same time, it is possible that parents with negative experiences of mathematics may pass these attitudes on to their children (de Kock 1999).

1.4. The research question

One possible solution to change negative perceptions that parents may have of mathematics is for schools to implement a parent-assistance programme. In this regard the following research question is posed:

*Does a parent-assistance programme for mathematics affect children’s and parents’ perceptions of mathematics?*
To address the research question, this study attempted to answer the following subsidiary questions:

- What effect does the parent-assistance programme have on children’s perceptions of mathematics?
- What effect does the parent-assistance programme have on parents’ perceptions of mathematics?
- What is the perceived effect of the parent-assistance programme on children’s achievement in mathematics?

1.5 Research methods and procedures

The literature review undertaken was to examine what was happening in the field and to find a strategy applicable to the South African context. In the United States and United Kingdom, education districts encourage parental involvement in education. Many strategies are used to ensure that parents actively support their children’s education, in general, and mathematics in particular. Some of the strategies could be applicable in a South African context.

The principal and governing body chairperson of a local high school indicated, in conversation with the researcher, that they wanted to be part of a parental involvement initiative. It was agreed that the grade 8 parents of this school would be part of an initial survey which was conducted using questionnaires. Grade 8 parents were chosen, as it was the first year in high school for their children. These parents would comprise the population for this study (Cohen, Manion and Morrison 2000: 92). Only one parent per family had to complete the questionnaire. The purpose of the survey was to establish a profile of a grade 8 parent at the school. The questionnaires were analysed within the qualitative paradigm.

The main part of the research took the form of a multiple case study. In a case study, the researcher typically observes the characteristics of an individual unit: a child, a class, a school or a community. The purpose of such observation is to probe deeply and analyse
the various phenomena that constitute the life cycle of the unit with a view to establishing trends and patterns of coherence (Cohen and Manion 1994:106). In this study, the interaction between parent and child was observed and documented by the parent. Journals were then analysed and interpreted by the researcher. The parent assistance programme, used in this study, was conducted with three groups of parents, at different times during the school year. A total of 18 parents participated in the programme. These parents were volunteers, thus, making this sample of parents a convenience sample (Cohen and Manion 1994:88). Since the same procedures were followed with each group, each group of parents constituted a case study. Thus, the three groups of parents made this study a multiple-case study.

Each case study consisted of a parent workshop, the completion of participant journals and telephonic interviews. After each case, parents and children were given questionnaires to complete in which they were able to relate their experiences in the parent-assistance programme. Telephonic interviews were conducted with parents during each case to find out how parents and children were interacting during the programme and to motivate parents.

Three months after cases 1 and 2 and two months after case 3, parents and teachers were interviewed individually. The teachers were asked about the children's attitude to mathematics, completion of homework, performance in assessments, and parental cooperation. They were also asked to give their views on the parent-assistance programme.

Immediately after the interviews with parents and teachers of case 3, parents and children from all three cases were invited to a focus group discussion (Hatch 2002:24), where their experiences in the parent-assistance programme were discussed and shared with others. The focus group discussion would also help to establish patterns of coherence (if any) and any challenges experienced in the implementation of the programme.

The data collection methods for this study consisted of participant journals,
questionnaires, interviews and focus group discussions (Hatch 2002:24). This allowed triangulation of data in order to improve the reliability and validity of conclusions arising out of the research conducted.

1.6 Definitions of concepts

The following concepts are now defined to give clarity to the context in which the concepts are used in the study.

**Perceptions of mathematics**: This refers to the way parents and their children see mathematics, their views of the subject and their attitudes toward the subject. For parents, this may come about from their own experiences of mathematics, their interaction with other adults and their interaction with their children. For children, this may come about from their experiences of mathematics at school, their interaction with their peers and their interaction with their parents or other adults.

**Parental involvement**: This refers to the way in which parents are involved in education. This may not be viewed in the same way by parents and teachers (Scribner, Young and Pedroza 1999: 36-40).

Squelch and Lemmer (1994: 93) define parent involvement as “the active and willing participation of parents in a wide range of school-based and home-based activities which may be educational or non-educational. It extends from supporting and upholding the school ethos to supervising children’s homework at home. Parental involvement implies mutual cooperation, sharing and support”.

**Parent-assistance programme for mathematics**: A programme outlining how parents could get involved in their children’s mathematics learning. Examples of such a programme include the Family Maths programme in the United States (Weisbaum, 1990) and South Africa (Austin and Webb 1998) and the IMPACT programme in England (Mertens and Vass 1990).
1.7 Relevance of the study

Mathematics is a key subject at schools. It is a fundamental requirement for many higher education courses. There are currently numerous initiatives to improve mathematics and science results at schools in the Nelson Mandela Metropole. These include programmes conducted by schools themselves, the matric improvement programme conducted by the Education Department, and the learner project organised by the Mathematics Department of the Nelson Mandela Metropolitan University. These programmes usually involve extra classes, in the afternoons and weekends, and focus on grade 10-12 learners. Teachers from within a school or other outside experts may teach these classes. There are usually no classes for grade 8 learners and parents are not involved in these programmes.

Parents are important stakeholders in education. They can and should play a significant role in the education of their children. They have their own perceptions of mathematics, which may be positive or negative. Notwithstanding their perceptions of mathematics, parents can become involved in their children’s mathematics and have fun at the same time. Unlike the other programmes, this study focuses on grade 8, which is usually the first high school year.

This study may benefit a wide range of stakeholders. Firstly, the learners may benefit by having parental support and developing their own confidence in the subject. This is likely to have an effect on their mathematics results. As a consequence, this programme could be replicated in some form to improve the mathematics results in similar groups of learners. The school may benefit by having supportive parents, who play an important role in the mathematical development of their children. This may raise the profile of the school and result in a demand for places at the school.

1.8 Limitations of the study

The research was conducted using parents of a particular school in a specific geographical area and it may not have relevance in another school with a different set of
parents and learners. However, the purpose of this study was not to generalise the results, but to determine the effect of the programme on parents and children and to elaborate on the field of research in parental involvement in mathematics in schools in the South African context.

This study is limited to the parents of grade 8 learners in an urban school. According to Shinn (2002) parents are usually very involved in their children’s early education but this involvement tends to decrease when their children are in high school. As there are no high school programmes involving parents in South Africa, grade 8 parents were chosen for this research to determine the effect of parental involvement in the high school.

The participation of parents in the programme was voluntary. The school sent out invitations. Although as many as 15 parents indicated that they would participate in each case, a total of only 18 parents participated in all three cases. This would seem to indicate that parents may have been reluctant to get involved in the programme or were busy when the programme took place. This may be regarded as a limitation as the 18 participants in the programme were not selected randomly.

1.9 Outline of the study

Chapter 1 is concerned with an introduction and the purpose of the research. It traces the problems of learning mathematics and refers to South Africa’s poor performance in the TIMSS and TIMSS-R. Reference is also made to some programmes in the USA and UK where parental involvement was the key. The South African Schools Act of 1996 (DoE 1996a) paved the way for more parental involvement in education but this involvement varied from area to area. The importance of mathematics as a school subject is discussed and the research question posed. A brief description of the research methods and procedures used for this study to answer the research question and subsidiary questions is provided. This is followed by the relevance of undertaking such research and the limitations of the study.
Chapter 2 deals with a literature review on parental involvement in education. There is discussion on guidelines which parents may find useful. This is followed by a description of parental involvement models which may be appropriate to this study. Other areas covered in the literature survey include parental education, the importance of mathematics as a school subject, the attitudes which parents have to mathematics, mathematics anxiety and the role of parents in promoting positive attitudes to mathematics in their children. It also examines initiatives taken by various countries or school districts to promote parental involvement in children’s mathematics learning.

There is a detailed description of the research methodology in Chapter 3. This includes a justification of the ontological and epistemological basis of this study, a description of the research paradigm and the theoretical framework in which this study is located. It also describes the processes involved in each case of this study and outlines the plan for the analysis of the data.

Chapter 4 carries out the plan stipulated in Chapter 3. From the results of the initial survey a profile of grade 8 parents of the school in this study is compiled. This is followed by a description of the data from the various components of the parents’ workshops. The data from the various data collection methods is then described. However, to avoid repetition, the results from only one data collection method are described and interpreted for each case. This is the first level of interrogation of the data. Chapter 5 deals with a second level of interrogation of the data. This interrogation of data uses the results from one data collection method as a nucleus and the results from the other methods as a means of triangulation. There is further triangulation across all three cases. The focus of Chapter 6 is to discuss the findings of the study and to bring the various elements of the study to their logical conclusion. This is followed by recommendations and suggestions for further research.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter looks at a number of issues, which are relevant to the study undertaken. To begin with there is a focus on the importance of parental involvement in education, with various writers cited in this regard. This is followed by a description of some parental involvement models and the relevance of these models to the South African context. One factor that may affect parental involvement, that of parental education, is discussed and its influence on parental involvement in education is elaborated upon.

Mathematics is considered to be a difficult subject and possible reasons for this are outlined. In bringing together parental involvement with mathematics learning it becomes necessary to also focus on the perceptions that adults have of mathematics. Some of these perceptions, as described in certain studies (Cockroft 1982; Fiore 1999), are also discussed in this chapter.

There are various roles that parents could play in promoting positive attitudes to mathematics and curriculum reform. Details of parental involvement programmes in the USA, UK and South Africa are described as a means of developing one for this study.

2.2 Parental involvement in education

Most parents would like to help their children succeed but usually possess little knowledge of how their children develop educationally. Parents also face confusion over allegations in various “stories and articles” (Wallen and Wallen 1978:116) that blame them for their children’s problems. The importance of parental involvement in education is emphasised in Oakes and Lipton (1990), who make extensive use of research on child development and parenting in making their claims.
Unger (1991) says that no school can educate children without the full co-operation of parents. He maintains that parents are important role models for their children. In this regard, he says that parents who do not read books cannot expect schools to make their children enthusiastic readers, and parents who watch television continuously in the evenings cannot expect their children to spend their own evenings doing homework. He goes further by saying that, regardless of children’s schools and teachers, the academic performance of children will ultimately reflect their intellectual life at home.

Although it is agreed that parents have an important role to play in education, there are different views on what this role should be. In a study undertaken by Scribner, Young and Pedroza (1999), it was found that the majority of teachers, of high performing Hispanic schools in the United States, believed that parental involvement meant participating in activities such as school events, meetings, workshops, and governance activities, and working as teacher aides, tutors, and school advocates within the larger school community.

This was different from the way parents viewed their involvement in the education process. They identified informal activities at home as the most important parent contributions to children’s success at school. Checking homework, reading and listening to children read, obtaining tutorial assistance, providing nurturance, instilling cultural values, talking with children, and sending them to school well fed, clean, and rested were the informal activities parents saw as involvement in the education process. Thus, for the most part, teachers defined parent involvement as a way of supporting the academic achievement of students while parents conceptualised involvement as a means of supporting the total well-being of children.

Parents’ concerns were not only with how well children performed academically, but also with teaching their children respect, honour, cooperation, good behaviour and responsibility at school. Although teachers and parents, in the study of Scribner et al (1999), had different views on what the role of the parent should be, parents saw themselves as playing more than just a supporting role.
Thus, it would appear that parental involvement in education is fundamental to the total educational development of children and there are a number of factors for parents to consider when contemplating their involvement in their children’s education.

2.2.1 Guidelines for parental involvement in education

Even though parents may be aware that their involvement in their children’s education is vital for their children’s educational success, how this involvement may occur is not clear to many parents. Over the years educationists have been trying to provide guidance in this respect.

The following parental involvement activities have been suggested:

- The parent should spend time talking with the child and sharing the child’s activities;
- the parent should read with the child in a pleasant atmosphere and the emphasis should be on reading for enjoyment; and
- the child should be a meaningful contributor to the home by having a reasonable set of work responsibilities (Wallen and Wallen 1978: 116).

A more comprehensive list of priorities for home support for learning is given in Oakes and Lipton (1990). These priorities, described below, offer parents a more practical way in which to get involved in their children’s education.

- **Developing language and ideas**

This is important as children learn to think and use language in order to communicate with their family and peers. Parents' everyday interaction with their children influences their children's thinking and language development. Certain kinds of interaction are helpful for children's intellectual development. Parents may ask for and listen to ideas that express relationships such as comparing, finding opposites, arranging items from highest to lowest, placing items in categories,
locating items in space and time and identifying directions. Questions such as “What’s happening?”, “What happened?”, “What will happen?” are important questions which parents may ask their children. In this way children may put their perceptions and experiences into words. This will ensure that children are engaged in mental processes such as abstracting, predicting, categorising and reflecting.

**Time out**

Children do important work when they take time out from structured activities and intensive interactions. When they are alone in quiet, safe places, they are able to pretend, reflect, imagine and solve problems. However, in this regard there must be a good balance between solitude and family interaction.

**Exploration, discovery and play**

Children’s best learning takes place when they act like scientists, examining the world around them and coming to conclusions about how things work and what things mean. Exploration, discovery and play are the work of these child scientists. Children are able to learn fundamental concepts such as light and heavy, big and small, floating and sinking, shades of colours and numbers of things. These things do not need the intervention of parents. Parents should make every effort to encourage their children and provide a safe environment and setting for such activities to prosper. Then, parents should step back and watch their children in action.

**Family routines that promote school success**

Families must have routines, which are firmly established. In this regard, they must ensure that schoolwork takes precedence over other activities such as watching television. While television may educate children, extensive television watching may diminish children’s ability to be active learners. Violence on television can consume
children and affect their learning in and out of school. Watching television can also fill up so much time that, other activities such as homework are neglected. Parents should monitor the television viewing habits of their children. Some television watching should be a family activity as this would make television a more analytical experience, rather than a passive one.

- **Keeping involved and enthusiastic**

Most new parents participate in their young children’s learning. However, once children go to school, they shift from following their own learning timetables to following a school’s rigid learning schedule. Parents of older children are very concerned about their youngster’s achievements but tend to have little knowledge about what the school expects. Some think that school learning is beyond their control or expertise. Older children tend to shy away from reaching out to their parents and discourage them from asking questions. However, parents must continue their involvement in their children’s education.

A review of the child’s day at school can help enhance the important connection between achievement and effort. Parents are there to support and encourage their children. While it is reasonable for parents to know about their children’s lessons and marks, there is much more that happens in school that children may want to talk about. Keeping track of the many details of the school day helps parents stay involved and children feel in charge. Further, enthusiasm, encouragement and praise are as necessary for older children as for younger children. Children also achieve more when parents expect more. High expectations are reinforced when parents take careful measures to be available to talk to their children.

Oakes and Lipton conclude by saying that when parents support learning at home, their children are almost certain to do well at school. Children from such families are likely to attend school regularly, respect school rules and routines, take class work seriously, and do their homework. Even more important, when parents encourage their children to learn at home, the children are more likely to be intellectually ready to learn in school (Oakes and Lipton 1990:233).
Unger (1991) makes a passionate plea for parents to be involved in their children’s education and lists a number of guidelines for parents, some of which may overlap with the above suggestions. These guidelines are:

- Parents should impose behavioural controls on their children at home;
- they should fill their homes with books and read with their children when they are young;
- they should monitor their homework;
- parents should support school and teacher demands for greater academic effort by their children;
- they should limit family and children television viewing;
- parents should ensure that their children get enough sleep and a proper diet; and
- they should monitor in and out of school activities.

Although the importance of home influences upon educational outcomes has been widely accepted for many years, its real significance has not always been taken into account, either in government policy or in the everyday life of many schools (Bastiani 2000). However, the following quotes, from Bastiani (2000), may enhance what has already been said thus far in this chapter about the importance of parental involvement in education.

“Where parents and teachers work together and education is made a priority at home, children develop beyond their peers and beyond expectations.” (Office for Standards in Education in England) (OFSTED)

“I have become even more convinced that parents and teachers working together in partnership are able to bring out the best in children.” (Teacher)

“When teachers, parents and children work together, everybody benefits - especially the kids!” (Parent) Bastiani (2000:19)
Using some of the guidelines above, the parent assistance programme in this study will require the parents to work with their children at home. This is likely to be the “safe environment” that Oakes and Lipton (1990) speak of. There will be much interaction between the parent and the child. The activities in the programme will also involve exploration and discovery.

2.2.2 Overcoming problems of parental involvement

While parents have every right to be involved in education, there are certain factors that discourage their involvement. A study by Mbokodi et al (2003) revealed some of the following factors that discourage parent involvement in education in South Africa:

- Unemployment, which leads to parent’s low socioeconomic status. Parents are unable to provide books and other relevant learning materials, which are necessary for successful study. Children have little access to privacy and comfort, which are likely to enhance serious study. At the end of the school day, children go home to parents who have no resources to enrich them educationally;
- Parent levels of education or low literacy levels discourage parents from helping their children with schoolwork;
- Lack of support programmes that empower black parents to participate fully and meaningfully in education;
- Lack of guidance teachers’ services that empower learners to enhance their skills;
- Lack of library facilities that would solve some of the black learners’ problems experienced at home; and
- Education that is made irrelevant to the community needs by ignoring cultural traditions and marginalising the learners by teaching them insensitive curricula while ignoring indigenous knowledge. (Mbokodi et al 2003:17)
Schools can play a role in combating some of these factors. Parents with low levels of education or low literacy levels could be given assistance at adult education centres. The school could have classes for these parents and work closely with local authorities in ensuring access to library facilities (Mbokodi et al 2003).

Although there are various factors that discourage parental involvement in education, the onus is on teachers to effectively engage parents. Effective teachers share the following four most important qualities (Canter and Canter 1996:10 -16):

- Effective teachers know that they must have the support of parents;
- in every interaction with parents, effective teachers demonstrate their concern for the child;
- in all situations, effective teachers treat parents the way they would want to be treated; and
- in every interaction with parents, effective teachers demonstrate professionalism and confidence.

These qualities should be emphasised to teachers in an effort to make them more effective in their interaction with parents.

Although many studies identify parental involvement as crucial to a child’s success in school, few describe effective means to increase parental involvement, and economic conditions often determine the level of parental support (Arcaro 1995). Magabane (2001) found that parental involvement in school governing bodies varies from area to area; the attendance at school governing body meetings by parents from middle and upper socioeconomic backgrounds was high while the attendance at school governing body meetings by parents from lower socioeconomic backgrounds was poor.

Schools need to devise ways of increasing parental involvement as this will be crucial to achievement levels of the learners. Ramirez (2006) refers to work done by Reynolds and Teddlie to suggest that schools with more parental involvement are in a better position to produce higher achievement levels than schools with less parental involvement.
One way in which parental involvement may be increased is through a well-designed parental involvement programme. A well-designed parental involvement programme can boost academic achievement and even raise low-income students' test scores to levels expected for middle-class children. However, quality teaching is still the most important factor in academic success and socioeconomic status does not have to control achievement in a good teacher's classroom (Jones 2001).

The most effective forms of parental involvement are those which engage parents in working directly with their children on learning activities in the home. Programmes which involve parents in reading with their children, supporting their homework assignments, or tutoring children using materials and instructions provided by teachers tend to be effective (Cotton and Wikelund 1989).

A study by Sanders, Epstein and Connors-Tadros (1999) of 423 parents from 6 high schools found that parental reports of involvement at home are encouraged and significantly influenced by school practices that assist parenting and facilitate parental involvement in education. The study also found high schools which develop strong programmes of partnership that include different types of parental involvement are likely to improve parental attitudes towards education and encourage greater family involvement at school and at home.

While it is important to acknowledge the role of the parent in education, how this role is encouraged and developed is dependent on what the school's policy is. Hence, the school plays a pivotal role in encouraging parental involvement. One factor that may hinder parental involvement is the educational level of the parent.
2.2.3 Parental education

Parental education is frequently a useful indicator of the level of support for academic endeavour, and is often associated with student achievement. South African students participating in the TIMMS study in 1995 were asked in a survey by the HSRC to indicate the highest level of education completed by their parents. The study revealed a clear positive correlation cross-nationally between parents’ education and students’ mathematics and science literacy. Students whose parents had had more education had higher mathematics and science literacy scores. The bulk of South African parents had either completed primary school or partly completed secondary school and it was possible that the level of parental education was one of the factors limiting academic performance (Howie and Hughes 1998).

The TIMMS study of 2003 also confirmed the association between higher educational levels of parents and the achievement scores of children, within a country. However, across countries, learners with the same background characteristics often attained different achievement scores, suggesting that there may be other factors, interacting with the issue of parents’ education, which produce the learner achievement scores (Reddy 2006).

In another study, undertaken by the UNESCO-UNICEF Monitoring Learning Achievement (MLA) project team in a number of African countries in 1999, it was found that most parents had education up to the end of primary school. Parents were very positive about the value of schooling for their children but the project team felt that household support for school activities could be improved. In this regard, the presence of someone at home to assist learners with schoolwork was identified as a key determinant of learner performance in many of the countries surveyed. This implied that greater attention needed to be allocated to improving adult and lifelong learning (Chinapah, H’ddigue, Kanjee, Falayajo, Famba, Hamissou, Rafalimanana, Byamugisha 2000).

Parental education is an important consideration when the issue of parental involvement in education is discussed, as low levels of parental education or low literacy levels may
discourage parents from helping their children with schoolwork (Mbokodi et al 2003). Various studies have shown that children like to feel supported in their education. For parents, supporting children’s efforts does not mean doing homework for them but leaving them to get on with their work and being available to assist them when needed (http://nrich.maths.org/prime/parents4/index.html). Such a role may be difficult in a subject like mathematics.

Parents with a low level of education may not know how to support their children’s mathematics learning. Huetinck and Munshin (2000) offer a solution to this problem by pointing out that older brothers and sisters or uncles and aunts can help and use the term “parent(s)” generically to refer to the adult(s) assuming responsibility for the education of children. The National Council of Teachers of Mathematics in the USA offers a similar solution. Each child can be assigned a “math helper”. Ideally, this could be one or both parents. However, should parents not have the necessary mathematical background to assist the children, then a relative, neighbour or older sibling could be identified as the “math helper” and almost all families can identify such a person (NCTM 1999).

2.3 Triangle of effective school design

It is evident from the previous section that parent involvement in education is highly valued by the different stakeholders. In this regard, the home, school and the learners are part of, what Bloomstran (2002) calls, the “triangle” of effective school design, with the three points of the triangle representing parents, teachers and learners. If one side of the triangle functions at less than maximum capacity, it may have a negative impact on the school environment. The groups that make up each side of the triangle must work together to keep a balance. This is usually true at the earlier grades at school, where parents may be involved in the library, assisting in the classroom or doing office duties.

However, as the children grow up and move to the higher grades, parents are less likely to take part in school activities. Rather, parents may sit on committees and participate in various forums and discussions. Bloomstran (2002) argues for parents to also play a role
in student activities and that the triangle philosophy can be beneficial to student activities and the overall design of the school. Although high schools in the United States usually ask for parental input on issues ranging from curriculum design, the choice of textbook adoption and safety and security, this could go much further as parents can also contribute to the development of student activities.

Parents of high school students often see the final product of their children’s work. If they get involved in the planning, implementation and evaluation of a project, a special bond between parents and their children can be created, allowing parents to see the entire process rather than just the final result (Bloomstran 2002).

The involvement of parents in education is drastically reduced when children reach high school and teachers often do nothing to encourage parental involvement. Teachers only tend to contact parents with foreboding news about their children or talk to parents during conferences (Shinn 2002). However, studies in parental involvement show that “when parents got regular and effective communications from teachers, they became much more likely to be active participants in their children’s education. It also showed that parents, recognising that adolescents need to assert their independence, tend to back away from their children too soon” (Shinn 2002:35).

This would imply that parent involvement in education decreases as the age of the child increases and is supported by statistics released by the United States Department of Education, which indicate that by the time children reach middle school only 8% of parents are involved as volunteers, compared to 33% in the first grade. The United States Department of Education data also show that parents find 52% of interactions with their child’s school positive in the first grade, but only 36% by the eighth grade (Shinn 2002:35). Although such statistics are not available for South Africa, it is likely that a similar situation exists.

In spite of the decreased involvement by parents as children move from primary school to high school, it is important for schools to work closely with parents. Whether a student
is disruptive or not, all parents have the right to be informed of their child’s school progress, both behaviourally and academically. In addition, parental support of school has a major impact on a child’s positive attitude towards school. When the student’s parents feel good about the teacher and the school, it is more likely that the student will receive encouragement and be reinforced for appropriate school behaviour (Jones in Levin and Nolan 1996:220). Parents can also be one of the teacher’s strongest allies (Brookover and Gigliotti in Levin and Nolan 1996:220).

Thus, teachers and other staff members should encourage parental support and cooperation. In this regard school districts in the United States have instituted school-wide programmes such as parent visitation, back-to-school nights, parent teacher organisations, parent advisory boards and volunteer programmes. Individual teachers complement these efforts by communicating positive aspects of children’s schooling to their parents through notes and phone calls, inviting parents to call when they have any questions, and requiring students to take home graded assignments and tests (Levin and Nolan 1996).

Some teachers feel uncomfortable about contacting parents and state that contacting parents is one of the least desirable and difficult aspects of their work and also a time-consuming process. They complain of intimidation by parents and the attitude of parents that teachers should be able to maintain control without parental input. At the same time, parents believe that since education is funded by their taxes, they should be able to “judge and monitor teacher performance” (Levin and Nolan 1996: 221). Even though teachers may feel intimidated by parents and have negative feelings about contacting them, teachers are professionals and these negative feelings should not get in the way of gaining the support and cooperation of parents (Levin and Nolan 1996).

Thus, it is important for teachers to keep the lines of communication open to parents if they want parents to support their children’s learning. The first contact that a teacher may have with families of learners is sending notes or letters to parents. Teachers would send a description of the course being taught, general expectations for the class, grading standards, and other details such as the use of the graphing calculator and
school supplies (Huetinck and Munshin 2000). Thus, parents and learners are made aware of the curricula and other needs of the subject being taught. This may contribute to effective functioning of the “triangle” described by Bloomstran (2002).

### 2.4 Models of parental involvement in education

Springdale and Stegelin (1999) describe three models of parental involvement in education. These are the protective model, the school-to-home model and the curriculum-enrichment model. Another parental involvement model is the Hoover-Dempsey and Sandler model or HDS model (Lanthier, Wright-Cunningham and Edmonds 1997)

#### 2.4.1 Protective Model

The protective model is designed to separate the functions of school and home. The assumptions that characterise this model are:

- Parents delegate to the school the responsibility of educating their children;
- parents hold school personnel accountable for results; and
- educators accept this delegation of responsibility (Swap in Springdale and Stegelin 1999:45).

Although this model has been characteristic of both public and private school situations, it eliminates the notion that parents are the children's first and most important teachers and that parents know their children better than anyone else does. Some parents willingly abdicate this aspect of their parenting duties. They may do so because their self-regard in terms of what they think they know about their children is very low, because this was the way of their own parents or they are afraid to deal with possible conflict.
2.4.2 School- to-Home Transition Model

In the school-to-home transition model, efforts of parents in supporting the objectives of the school are encouraged and sought. The assumptions that characterise this model are:

- Children’s achievement is fostered by continuity of expectations and values between home and school;
- school personnel should identify the values and practices outside school that contribute to school success; and
- parents should endorse the importance of schooling, reinforce school expectations at home, provide conditions at home that nurture development and support school success, and ensure that the children meet minimum academic and social requirements (Swap in Springdale and Stegelin 1999:46).

The role of parents in supporting the school in fund raising through cake sales, providing class materials and so on is typical of this model. Two-way communication is not actively sought or encouraged. This model does not reflect parents as being equal partners with school personnel in the care and education of children.

2.4.3 Curriculum-Enrichment Model

This model is representative of many early childhood programmes in the USA. Parents are viewed as the children’s first and most important teachers. The assumptions guiding this model are:

- Parents and educators should work together to enrich curriculum objectives and content; and
- relationships between home and school are based on mutual respect, and both parents and teachers are seen as experts and resources in the process of delivery (Swap in Sprindale and Stegelin 1999:47).
This model provides many opportunities for schools to function “without walls” as parents and other community leaders share their expertise with children and children are able to apply what they learn in school in the outside world. Parents can serve as volunteers within the classroom, reading to children and assisting children in work with manipulation and physical activities. Further, children are seen as part of a family system, with experiences at school affected by experiences at home and vice versa.

An example of the curriculum-enrichment model and its application to mathematics is the “back-to-school nights” for parents (Huetinck and Munshin 2000). This is an innovative practice that usually occurs at high schools in the United States. During such an occasion, parents follow their children’s timetable and move from class to class, each hearing from the teacher about the course, homework expectations and the materials used.

If an innovative curriculum is being introduced, some mathematics departments go beyond the time allocated and inform parents about the rationale for the selection of the curriculum and the mathematical content. Once parents are given an opportunity to work through a few of the activities, they realise that their children are not used as experimental subjects and can accept that the new curriculum was chosen to address the weakness of the previous system.

If innovative technology is used in the classroom, parents may be given a demonstration on how the technology will enhance and extend their children’s learning. They are asked to help their children by providing a home environment in which homework is a priority and in which their children are encouraged to use educational resources available to them in the community. They can also monitor homework, keep track of the various assessment dates and provide the means by which the children are able to visit the library to do research for class projects.

The “back-to-school nights” for parents in the USA has relevance for education in South Africa. Curriculum reform has been in the South African domain since 1998. Meetings with parents, in the evenings or on a Saturday, are a means to help them understand
the new mathematics curriculum, show them the kinds of activities their children are involved in class and guide them on how to support their children’s mathematics learning.

2.4.4 The Hoover-Dempsey and Sandler (HDS) Model

The Hoover-Dempsey and Sandler (HDS) model of parent involvement in education names three research-based factors as influencing levels of parental involvement. These are parent-role construction, self-efficacy and “school invitingness” (Lanthier et al 1997:3).

Role construction signifies how parents construct their roles as parents in general and in regard to their children’s education in particular. Some parents may adopt a passive view of their role, believing that their children’s education falls under the umbrella of the education department. Other parents view themselves as an integral part of their children’s education. Parental efficacy measures how effective parents believe they are in terms of helping their children succeed at school. The construct of “school invitingness” indexes the frequency that schools actually invite parents to be involved in their children’s schools. Some features of this model overlap with the previous three models.

The protection model or the school-to-home transition model of parent involvement tends to characterise parental involvement in South African schools (own experience). Only a few schools have the resources and know how to implement the curriculum-enrichment model. However, it is important that more schools should move towards this model and this study attempts to provide some insight on how this may be achieved at the school chosen for this study.

2.5 Mathematics as a school subject

The Department of Education in South Africa defines mathematics as follows:
“Mathematics is a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. Through this process, new mathematical ideas and insights are developed.” (DoE 2002).

Mathematics is needed for everyday life and forms an essential part of the curriculum. This point of view is supported in Mathematics Counts (Cockcroft 1982:1), which begins:

“There can be no doubt that there is general agreement that every child should study mathematics at school; indeed, the study of mathematics, together with that of English is regarded by most people as being essential …It would be very difficult—perhaps impossible—to live a normal life in many parts of the world in the twentieth century without making use of mathematics of some kind…”

Although mathematics is only one of many subjects in the school curriculum, there is a greater pressure for children to succeed in mathematics than in subjects such as history or geography even though it is generally accepted that these subjects should also be part of the curriculum.

In South Africa, the UK and other countries, mathematics is considered to be a gatekeeper into higher education courses. Until 2004 in South Africa, a large number of learners did not pursue mathematics after grade 9 and this proved to be a stumbling block for their career aspirations. An attempt was made to address this situation in the new curriculum which was introduced in South Africa at the beginning of 2006. This new curriculum, introduced in the further education and training band (grades 10–12), has mathematics or mathematics literacy as a compulsory subject (DoE 2003).

One of the reasons that mathematics has had a special place in the school curriculum over the last two centuries is the way it has been used as a screening device for entry into numerous professions. However, the service role of mathematics has also been increasing in importance. This is separate from the “filter” role of the subject, where many professions that require evidence of mathematical attainment for entry do not make use of the mathematical skills and knowledge demanded in the qualifying process.
The service role is becoming important in subjects such as biology and geography which have become more quantitative and are providing new opportunities for coordinating schoolwork and for displaying mathematical applications (Howson and Wilson 1986)

The introduction of outcomes-based education in South Africa has resulted in teachers using a variety of themes and contexts in their teaching. In mathematics, teachers have to ensure that there is meaning and relevance in what they teach. Arising out of this is the need to show that mathematics can be found in many different contexts. Galpin and Haines (1994) suggest that opportunities should be created for the integration of mathematics into other teaching subjects. This may prepare the student teacher to understand the key role of mathematics in the school curriculum and its applications in many other subjects. If mathematics teachers refer to other subject areas when suggesting applications of mathematical ideas, this can be important in influencing learners’ perceptions of mathematics and its place in the curriculum.

Although education in South Africa is a provincial competence, the National Department of Education in South Africa, has identified key subjects that have been examined nationally since 2001. Mathematics and Physical Science are two of these key subjects. All provinces write the same Mathematics and Physical Science examination papers. This has been done to ensure that standards are the same throughout the country. The National Department of Education in South Africa is always concerned about overall grade 12 pass rates, as well as pass rates in mathematics and science.

Schools that have a less than 50% overall pass rate belong to what is termed the “Matric Improvement Programme” or MIP. Provinces make provision for subject advisors to work closely with subject teachers at these schools with a view to improving results. Provision is also made for Saturday and holiday classes for learners at these schools. Study materials and tutors for these classes are paid for by the provincial departments of education. However, these processes take place with no parental input or involvement.

Parental involvement in a subject like mathematics may have far-reaching consequences. The mathematics syllabus, approaches to teaching and the assessment
of mathematics have changed over the years. However, what has not changed for parents is their desire for their children to be successful in mathematics. At the same time, what has not changed for learners, are the periodic lapses in their performance (Cline 2002).

The Cockcroft Report (1982) enhanced the importance and status of mathematics in the school curriculum. This resulted in many parents encouraging their children in mathematics as they see it to be a stepping stone to many influential careers. However, mathematics is perceived by many to be a difficult subject.

2.6 Perceptions of mathematics

People generally regard mathematics as a difficult subject. For many, it is associated with a strong sense of failure and their memories of school mathematics are of tests and examinations, of crosses, of the fear of getting incorrect answers. It was the subject, which sorted out the academically bright from the dull (Howson and Wilson 1986).

It is also acknowledged in the Cockcroft Report (1982) that mathematics is a difficult subject, both to teach and learn. Mathematics is a hierarchical subject which means that the ability to proceed to new work is often dependent on a sufficient understanding of work that has been covered before. Individual children learn at different speeds. Some may be able to grasp a mathematical concept in a single lesson while others may take longer than a week to grasp the same concept. There are very great differences in attainment between children of the same age.

Mathematics is also a subject that requires hard work and much practice, whatever one’s level of attainment may be. The Cockcroft Report, further, states that since the attainment and rate of learning differ so greatly from learner to learner, mathematics is a difficult subject to teach. In this regard, if learners are taught at a fast pace, they may not be able to develop an understanding of the subject matter. If the pace is slow, learners can become bored and lose interest. It is important that the needs and ability levels of learners be taken into account when teachers plan their mathematics lessons.
as learners should not be allowed to experience repeated failure in mathematics (Cockcroft Report 1982).

2.6.1 Parents’ perceptions

The importance of mathematics and parental involvement in education featured strongly in the “Goals 2000: Educate America Act of 1994”. This act had eight goals, which were to be achieved by the year 2000. Two of the goals focused on mathematics and parental involvement. These were:

- The United States students will be the first in the world in mathematics and science achievement; and
- every school and home will engage in partnerships that will increase parental involvement and participation in promoting the social, emotional, and academic growth of children (Morrison in Springdale and Stegelin 1999 p. 44).

The inclusion of these two goals in the Act suggests that mathematics and science are viewed as important subjects and that parents have a role to play in their children’s learning of these and other subjects. However, for these and other goals of the Act to be achieved, school districts had to offer their full cooperation and support (Boaz 1997).

When parents work with their children, it is important for them to separate their own histories and experiences of mathematics from their children’s experiences. Parents should not assume that their child should be duplicating their own successes or failures and need to look at ways to motivate and encourage their child through those occasional times of difficulty. Parents may find the following ideas (Cline 2002) useful in their attempts to motivate their children in mathematics.

- Mathematics concepts permeate every part of life; they appear on news broadcasts, in the newspaper and in connection with driving a car; they are among the building blocks of economics, sports, politics, surveys, medicine,
science, weather, banking and so on; by drawing attention to the ways mathematics helps describe and explain our world, parents may be able to help their children understand how important mathematics is;

- once mathematics concepts have been "discovered" in everyday life, parents should assist their children to find ways to apply them; examples are analysing nutritional information on a cereal box, ratios and fractions after stock market news, ratios and percentages in baseball statistics, political polls and weather reports;

- parents should remind their children that time and effort, are key components in understanding mathematical concepts; practice, repetition and review are what help these concepts and problem-solving skills stick. sometimes a child's difficulty in mathematics does not indicate inability, but that extra time, practice and instruction are required to master the subject matter; and

- parents need to learn how mathematics is taught today. Teachers understand that children do not all need the same pace or approach to learning mathematics; they use more resources in the classroom: these include objects that can be handled, counted and arranged to help students grasp abstract concepts; calculators and computers may also be used.

These ideas give parents definite guidelines on how to promote the mathematical development of their children and some were included in the researcher’s parent-assistance programme. Examples of these were:

*Parents were alerted to the applications of mathematics in the parents’ workshop; they were required to discuss mathematical topics with their children and note these in the journals; children had to describe how they used mathematics in their homes and environment and children had to complete certain mathematical tasks (under parental supervision) using the newspaper or television news as a resource.*
The role that parents may play in the mathematics learning of their children is also highlighted in a comparative study by Wang and Lin (2005). This study suggests that Chinese students’ success in mathematics, when compared to US students, is, in part, likely to stem from family values and processes. Their analysis of research in that area demonstrates the importance of parental expectations and parental support in the mathematics performance of Chinese students.

The research also suggests that Chinese parents set higher expectations for their children’s mathematics achievement, engaged their children in working more on mathematics at home, and used formal and systematic instructional approaches at home. Similar family values and processes were found in Chinese- American families.

Thus far, this literature review has emphasized that parents have an important role to play in their children’s learning in general and mathematics learning in particular. However, there are parents with negative perceptions of mathematics and it is likely that these negative perceptions may be passed on to their children.

Various studies have shown that many adults have negative attitudes to mathematics. Mathematics is perceived as being both difficult to teach and to learn. Unlike reading, there are adults who appear not to be embarrassed in their inability to do mathematics. There are some university professors who willingly admit to their failure to do mathematics and do not consider that this in any way detracts from their academic status. Some parents do not support their children when they do badly in mathematics but share with them their own lack of success. Those who achieve in mathematics are called “boffins” and when asked to draw a picture of a mathematician, young children frequently draw someone with spots, glasses and even aerials coming out of their heads (Jennings and Dunne 1997).

These insights are captured in the following quotes from Sewell’s study:

"The extent to which the need to undertake even an apparently simple and straightforward piece of mathematics could induce feelings of anxiety, helplessness, fear and even guilt in some of those interviewed was, perhaps, the most striking feature of the study."

"Failure and consequent dislike of mathematics was often ascribed to a specific cause when young. Such causes included change of teacher or of school, absence through illness, being promoted to a higher class and becoming left behind, having an irascible or unsympathetic teacher who failed to resolve difficulties or even over-expectation on the part of parents, usually fathers."

Sewell’s study also refers to:

"those who dreaded what they saw as the innate characteristics of learning mathematics such as accuracy and speed, as well as the traditional requirements to show all working neatly. This recalled the long buried anxieties by the pupil's arriving at an answer by a mental method and being required to produce a written solution demonstrating a method which had not been used".

Another feature revealed by Sewell’s study was a widespread inability to understand percentages. Many of those interviewed said that they did not understand them or had never used them and comments such as “I’m hopeless at percentages really” surfaced. Many adults interviewed for Sewell’s study had access to a calculator but a third of them said they had never used them. Some of them admitted that they did not know how to use a calculator and others expressed doubt and distrust. Comments such as “I never use it because of the risk of major mistakes”, “brains are better”, “they make you lazy” surfaced. For some, the use of a calculator made all the difference; “I know the theory but without the calculator I couldn’t do it.”

While the views expressed in the quotes come from a study conducted in the United Kingdom, it is possible that such quotes may have relevance in a South African context. The possibility also exists that many of the adults, whose views were expressed in Sewell’s study, had children who may have been influenced by their views. These quotes from the study show that adults have fairly distinctive perceptions of mathematics. These perceptions have been shaped by their own school experiences and in their association with other adults.
A similar result surfaced in a study conducted in the USA which found that public attitudes about mathematics are shaped primarily by adults’ childhood experiences where, mathematics is seen not as something that people actually use but as a best-forgotten and often painful requirement of school. For most members of the public, their lasting memories of school mathematics are unpleasant (Everybody Counts 1989).

While there may be many reasons why adults have negative attitudes towards mathematics a case study on mathematics anxiety by Fiore (1999) may shed some light on this issue.

2.6.2 Mathematics anxiety

Norwood, cited in Fiore (1999), states that mathematics anxiety does not appear to have a single cause. It results from parents’ and teachers’ attitudes toward mathematics, poor self-concept, the inability to handle frustration, and emphasis on mathematics through drill without understanding. Fiore (1999) also cites Tobias and Weissbrod’s definition of mathematics anxiety as the panic, helplessness, paralysis, and mental disorganisation that people experience when they are required to solve a mathematical problem.

Mathematics anxiety is also described as an illness that is an emotional as well as a cognitive dread of mathematics and studies have shown that parents who have mathematics anxiety can pass it on to their children and teachers who have mathematics anxiety can pass it on to their students. A high percentage of elementary school teachers tend to avoid mathematics and are mathematics anxious (Fiore 1999).

Mathematics abuse is defined as any negative experience related to an individual’s doing mathematics. It could be verbal, where the students are called "stupid" if they cannot solve a problem, or physical, where a student is struck for giving the wrong answer (Fiore 1999). In his study, Fiore describes two cases of mathematics abuse, the resulting mathematics anxiety and how he dealt with the situation.

In the first case, a forty-year old woman was returning to college to become a teacher.
She was in Fiore’s developmental algebra class. In the first class session, a short assessment test was administered and during the test the student was tense and clearly disturbed. After class, she explained to Fiore that she was afraid of mathematics and that she performed well in all her classes except mathematics. She asked Fiore to be patient with her and that she would work very hard.

In the second case another woman, who was forty-three years old, and in the same class, was studying to be a nurse. She was quiet in class and to encourage her participation she was asked a straight-forward question. However, she panicked and said nothing. After class she explained that she had taken the class once before and had failed. She said that each time she was called to answer a question in class she would "panic and freeze". She requested that she not be asked any questions in class. She had difficulty learning mathematics and despite lectures being crafted specifically for her, her results remained the same.

Both these cases were investigated. All students were asked to write a one-page paper entitled “Math and Me” in which they had to describe their mathematical history. The responses of the two women were examined in detail.

The first woman recalled very negative experiences with mathematics as early as the third grade. Her teacher asked her to go to the chalkboard to solve a long division problem. She had no clue about the solution and she was not allowed to return to her seat until she solved the problem. She stood there while the rest of the class "ate lunch and laughed at me." She was still standing there at 15:30 when school was dismissed. The exercise was repeated the next day. This routine continued on and off for an entire school year. During that time her teacher did not give her any help and she was too terrified to ask for it. She remarked that her "mathematics demons" were created in the third grade.
The other woman’s responses comprised eleven pages. Her worst mathematics experiences involved her father. She, too, was in the third grade and needed help with her mathematics homework so she asked her father for help. Although her father helped her, he was very impatient with her and he slapped her when she did not understand. He screamed at her and told her that she was stupid. He tore the page out of her notebook and threw it at her. She remarked that when she was in the mathematics class, she sometimes felt like that little girl again, shaky and stupid (Fiore 1999).

Although Fiore believed that he had entered unfamiliar territory, he decided not to ignore their mathematics anxiety but rather "deal with it". Knowing their mathematical pasts helped Fiore deal more effectively with the students in class, he attempted to make their learning environments more comfortable. The first woman was given the opportunity to take her tests outside the classroom while the second woman was not called upon to answer questions in class.

Lecturers or teachers sometimes say that their students have or lack the ability to learn mathematics. A student who has had a painfully negative experience in mathematics often has the ability but this ability is simply masked by anxiety. These students can be taught by encouraging them and their ability to learn mathematics through support, positive talk, and accommodation. Had these two adult students’ histories not been discovered by Fiore, they may have been viewed as slow mathematics learners who just had to work harder to pass the course (Fiore 1999).

Adults have a wide range of mathematics experiences; some positive and some negative. These experiences shape the way these adults view mathematics. Fiore’s study shows that negative mathematics experiences at school tend to leave an indelible mark on the adults and may affect the way in which they interact mathematically with their children.

Teachers need to be aware of parents’ attitudes to mathematics. This could be achieved by interacting with them and explaining the various roles they could play in their
children's mathematics learning. In this study, parents were made aware of these roles in the parents' workshops. These workshops also attempted to help those parents with negative experiences of mathematics overcome these experiences and ensure that they play a positive role in their children's mathematical learning.

2.7 The role of parents in developing positive attitudes to mathematics

Various studies have shown that different treatment of males and females begins at an early age, starting with parents. Astin, Suniewick and Dweck (1974) discovered that parents of female children generally do not buy as many mathematics-related toys and games as do parents of males, thus putting their female children at a distinct disadvantage when they enter the classroom. Parsons, Adler and Kaczala (1982) refer to studies which show that parents of female children are more likely to downplay the importance of mathematics. Jacobs and Weisz's (1994) study of sixth to eleventh grade children and their parents showed that females hold more negative beliefs about their abilities in mathematics even when they performed consistently better than males; this pointed to the possibility that parents can influence their children's perceptions of ability.

Parents are thus identified as a key factor in the social determinants of mathematics attitudes and performance as they exert a more powerful and more direct effect on children's attitudes towards mathematics than teachers. Parents' gender stereotype beliefs are the key cause of sex differences in attitudes toward mathematics (Eccles and Jackson in Leder 1992).

The role of parents and teachers in the development of attitudes to mathematics is outlined in Southwood and Spannenburg (1996). They say children's attitudes towards mathematics and expectations of their mathematical abilities are shaped by:

- the views which adults hold of mathematics;
- the attitudes of other children; and
- the images and attitudes presented to them.
They also say that teachers’ attitudes and expectations as well as those of others need to be examined and challenged, and suggest the following ways in which this could be achieved:

- Sharing and discussing feelings such as a lack of self-confidence and fear;
- considering ways of identifying unconscious attitudes such as administering questionnaires to learners to find out any perceived differences between boys and girls;
- discussing and challenging such attitudes;
- devising strategies to compensate for attitudes such as paying more attention to the girls and giving them more encouragement; and
- ensuring the suitability of materials (Southwood and Spannenburg 1996).

Although these statements concern the effectiveness of the teacher in the classroom, the statements also have relevance for parents. Underachievement in mathematics can often be attributed to preconceived expectations and attitudes, not only of teachers, but of parents and the children themselves. Strategies need to be devised to promote greater achievement in mathematics, especially among children who are currently underachieving (Southwood and Spannenburg 1996).

The role of parents in promoting positive attitudes toward mathematics is also endorsed by de Kock (1999). Parents should not be negative about mathematics and should avoid comments such as:

“I have failed mathematics in Grade 5 and ever since – so will you! The possibility for you to succeed in mathematics is less than the possibility of you lending your Billabong T-shirt to your younger brother, i.e. less than 0%” (de Kock 1999:1).

Many parents have the perception that:

“because I was at school such a long time ago and because I had a problem with mathematics myself, I dare not help my child for he/she may fail because of me. I understand nothing of the modern mathematics anyway and therefore I am not able to assist my child” (de Kock 1999:1).
To counter such negative perceptions, positive intervention (with positive results) is what children ask from parents in respect of mathematics. If a parent had problems with mathematics while at school, his/her child may find the following statement reassuring:

“I might have failed maths, but now I know, now I understand, that with some common sense and hard work you will be able to attain what I have failed – you will become a maths winner, and I will help you. Let’s win together!” (de Kock 1999:1-2)

One of the questions in the TIMSS students’ questionnaire was “My mother thinks it is important for me to do well in mathematics at school”. Children had to reply with one of the following responses: Strongly agree, agree, disagree or strongly disagree. Without taking any of the other factors into account, there was a positive correlation of 0.4 between the responses of the learners whose mothers thought that is important for their children to do well in mathematics and the learners’ mathematical achievement. This further confirms the view that parents were in a position to influence their children’s mathematical performance and achievement whether they knew mathematics or not (de Kock 1999:2).

In the past, parents were regarded as consumers of services, both on their own behalf and that of their children. The parent-teacher relationship was presented in the form of a consumer-provider relationship and there was a clear distance between parents and teachers. Teachers were presented as providers of specialised services, which through the increased flow of information and through involvement in the governance of schooling, parents evaluated. Thus, parents were active as consumers but were not directly involved in the provision of the service.

This situation has changed in recent times. There has been increasing interest in countries such as the United Kingdom and United States in fostering the participation of parents in schooling in different ways. Thus, parents have now become partners in education. In South Africa, parental involvement in education usually occurs through school governing bodies and the extent of parental involvement depends on the socioeconomic status of the parent (Magabane 2001). However, children whose parents
show an interest in and enthusiasm for mathematics around the home will be more likely to develop that enthusiasm themselves (Hartog and Brosnan 2002).

Parents have the opportunity of using the everyday contact between them and their children as a means of communication as well as for teaching mathematics. They can help their children to succeed in mathematics with positive motivation and should be able to help them develop positive feelings towards the subject. If the child loves mathematics, s/he will enjoy the subject and therefore work harder and strive for more accuracy. This could only lead to success, which in turn could spiral into total success, achievement and satisfaction in mathematics. At the same time parents should avoid criticizing the mathematics teacher or speaking negatively of mathematics as this could result in a dislike of mathematics (de Kock 1999).

2.8 Studies on the role of parents in the reform of mathematics education

One area where parental involvement is vital is when there is a change to the existing curriculum or a new curriculum is being implemented. Parents should be kept informed of changes in education and the implementation of a new curriculum because they have a vested interest in the process. It is their children who will be affected by the changes.

2.8.1 The Wisconsin Study

A study on the involvement of parents in a mathematics reform programme in Wisconsin from 1991 to 1993 is discussed by Peressini (1997). In this study, parents found that the mathematics their children were doing was different to what they did. Their children were doing more and different kinds of mathematics. Although many parents were supportive of the changes, they were unsure of the rationale, content and expected outcomes of this “reformed” mathematics instruction and some parents found the everyday activities in a “reformed” mathematics class to be unsettling. The children were observed
completing various authentic mathematical tasks, often without the direct assistance of the teacher, using an assortment of resources and technological tools; and engaging in small-group debate.

The classrooms were centres of bustling activity in which children appeared to have taken over the class as their teachers encouraged them to arrive at their own mathematically sound conclusions. In contrast, the parents of these children had experienced mathematics learning in a much more traditional manner. At first glance, some parents concluded that their children’s classroom activities had no apparent structure and that the teacher did not have proper control of the class. The tension that parents experienced in watching their children learn mathematics in reformed classes was often recognised by classroom teachers.

One teacher who was hesitant about informing parents about their children’s success in group work said that parents would be amazed at how bright the students were when they work in groups but that some parents would complain about the situation. Although parents believed that these different classroom activities might offer a more exciting environment for their children to learn mathematics, many parents found these “new” classroom environments unsettling.

Parents also had difficulty making sense of the new mathematics content that their children were receiving. As teachers attempted to teach problem solving and to focus on algebra, geometry, pre-calculus, discrete mathematics, and statistics concepts, in addition to a variety of other content areas, some parents expressed concern about the diminished focus on basic number facts and algorithmic processes. Often parents who attempted to become involved with their children’s homework assignments found themselves on unfamiliar ground as many parents did not recognise the mathematics that their children were learning.

Some parents felt that the absence of a mathematics textbook or a traditional textbook eliminated possibilities for them to help their children with mathematics homework and,
as a result, increased the distance between them and their children’s mathematics education. They also voiced concern that the unfamiliar mathematics content and instruction would affect their children’s opportunities later in life; especially those whose children were completing their secondary school education.

The mathematics teachers, at all the schools participating in the study, relied on communication as the primary means to involve parents in their children’s mathematics learning. The communication was initiated to inform parents about changes in the schools’ mathematics programmes. In particular, schools sponsored “parent mathematics evenings” at which teachers explained their mathematics programmes, their goals and the changes in content and pedagogy. The ensuing activities included children working on mathematical programmes, teachers demonstrating classroom practices, children and teachers engaging in computer and calculator demonstrations and parents going to their children’s classrooms to participate in actual mathematics lessons. These evenings allowed parents to gain first-hand knowledge and experience of the children’s mathematics education.

Mathematics departments also developed newsletters to inform parents about the new programmes. These newsletters were delivered by students or mailed with the hope that a large number of parents would be reached, as some of these parents would not be able to attend parents’ mathematics nights. Mathematics departments also turned to the larger community in an attempt to build support for their efforts to enhance their programmes.

High school mathematics teachers noted that parents rarely came to schools to observe mathematics classes. Instead, parents relied on their children and their children’s homework as the primary sources of information regarding their school’s mathematics programmes. Despite all the efforts to inform and convince parents about the need for reform in mathematics education, some parents remained unconvinced about the merits of the evolving mathematics programmes. This situation arose typically from a situation when a child scored lower than siblings or some other children on the computational part of a standardised test or when the school’s overall test results, which fell below that of other schools, were published in the newspaper.
As parents became more involved in their children’s mathematics education, their understanding of changes occurring in school mathematics increased. As a result they began to support and enhance the schools’ efforts to reform their mathematics programmes. Schools that put parental involvement and support at the top of their priorities successfully implemented the “reformed” mathematics curriculum (Peressini 1997).

This study highlights the need for parents to be kept informed about curriculum changes and also shows how parental support for curriculum changes could be achieved as a result of keeping parents informed. If parents are informed about changes to the mathematics curriculum, it is likely that they would find it easier to get involved in their children’s mathematics learning.

2.8.2 A UK experience

In a UK study, undertaken by de Abreu and Cline (2005), on parent involvement in children’s mathematics learning, parents of Pakistani high-achieving children held distinct representations of their own mathematics and the school mathematics of their children. Some of them made sure that these representations were passed on to their children. An example of this was learning the multiplication tables by heart. At the same time, some parents of high-achieving children were prepared to have their children as co-teachers so that they could help them acquire the mathematical meanings which were disguised by the use of different strategies or linguistic codes. This interaction was absent from the discourse of parents of low-achieving children.

The interviews with white British parents did not provide such clear examples of the differences between the accounts of high and low-achieving children. One issue clearly highlighted in the study by de Abreu and Cline is that parents do not find it easy to support their children’s mathematics learning at home. This difficulty arose as a result of changes to the school curriculum. Children were engaged in school mathematical practices that were quite different from the ones that the parents learned when they were
at school. These differences emerged because of changes within the education system or because parents were migrants and had been to school in another country. In this regard, parents needed support not just to learn about how mathematics is taught at school but on strategies for bridging any home-school gap.

2.8.2 The South African experience

In the South African context, education reform has been very much in the public domain since 1997, with the introduction of outcomes-based education and Curriculum 2005. This situation will continue with the revision of Curriculum 2005 and the implementation of the National Curriculum Statement (NCS), in the further education and training band. While some schools have been very proactive in keeping parents up to date about new developments in education, many schools have not done so. In the study conducted by Mbokodi, et al (2003), it was found that 90% of parents did not know about outcomes-based education. This prevented parents from giving their input and becoming involved in curriculum reform in South Africa.

The lack of parental awareness about outcomes-based education and Curriculum 2005 may have contributed to the problems associated with its implementation at schools. Taylor and Vinjevold (1999) used the results of the President’s Education Initiative studies to conclude that, while there may have been support for Curriculum 2005 amongst teachers, few teachers were able to translate the very complex logic of Curriculum 2005 and its vaguely stated outcomes into appropriate learning programmes, and to effectively mobilise student-centred learning.

Bennie and Newstead (1999) illustrated the range of practical demands placed on teachers and the challenges to their basic beliefs when they attempted to translate the very complex logic of Curriculum 2005 into suitable learning programmes for mathematics. This became evident when Curriculum 2005 reached the high school and the teaching of mathematics in grade 8 and grade 9 was adversely affected.
It is the researcher’s experience that as a result of the lack of proper support, direction and monitoring, many teachers tended to focus on the OBE (outcomes-based education) terminology without teaching an adequate quantity of mathematical content in these grades. When these learners reached grade 10 in 2003, it was discovered that they were ill-prepared for grade 10 mathematics. This resulted in grade 10 mathematics teachers teaching key mathematical content from grade 9 to their classes, before commencing with grade 10 mathematics. Further, it would appear that there was little or no consultation between grade 9 and 10 mathematics teachers, in the same school, on what mathematics should have been taught in grade 9 to adequately prepare their learners for grade 10. It is likely that had parents been actively involved in their children’s learning, they may have identified this problem and asked that it be addressed by the Department of Education.

In this chapter much has been stated about the importance of parent involvement in education, in general, and mathematics education, in particular. In the light of what has been stated, it is now opportune to examine examples of parent-assistance or involvement programmes for mathematics. Although these programmes may have different emphases, the common feature is parental involvement in their children’s mathematics learning. One of the programmes, with United States origins, has been implemented with some success in South Africa.

2.9 Some examples of parent-assistance/involvement programmes

In this section some examples of parent assistance or involvement programmes for mathematics are discussed and their purposes outlined. These programmes are relevant to the study undertaken by the researcher as ideas from these programmes were used in the development of the researcher’s parent assistance programme.
2.9.1 Maths Year 2000 Scotland

The “Maths Year 2000 Scotland” programme was a government sponsored programme to improve numeracy skills in Scottish schools and help everyone do basic arithmetic calculations (Ritchie 2000).

There was a general feeling that negative attitudes towards mathematics had held people back. The word "maths" tended to bring panic in people or people admitted they were "just hopeless" with numbers. This affected their work performance as many jobs required basic mathematics skills. “Maths Year 2000 Scotland” tried to reverse this trend and create a positive attitude towards mathematics and to dispel the myth that it is too difficult (Ritchie 2000).

To promote mathematics the "Maths Year 2000 Scotland" committee organised well-attended, creative events throughout the country focusing on educational activities which emphasised the practical value and fun of numeracy. A booklet, “It All Adds Up”, was issued to parents, relatives, carers and childminders who wanted to help primary school children to get better at mathematics. It included simple games to play at home, some of which were adding the digits on a phone number, and how many scoops of ice-cream can be bought for a specific amount.

The initiative supported the view that parents are partners in their children's education, and that “Maths Year 2000 Scotland” could help them increase their own mathematical abilities. The programme offered a more investigative approach to mathematics in schools. Teachers commented that the children responded enthusiastically to the activities in the programme. One of these was the Grand Prix on-line challenge in Birmingham. This competition involved virtual races to find the fastest car. The participants in the Grand Prix had to carry out various calculations if they wanted their car to compete in each race. This included measuring the length of the track, the angle of the bends and the fuel consumption. Another competition was a fantasy football competition for schools.
The activities in the “Maths Year 2000 Scotland” provided an opportunity for children to explore mathematics in a fun way. Mathematics became a favourite subject for the children and they asked for extra mathematics tasks. Thus, one of the main outcomes of the programme, that of making children aware of the fun nature of mathematics while improving numeracy skills was achieved (Ritchie 2000).

2.9.2 Mathematics month in Cape May County, New Jersey

The lower township elementary schools of Cape May County, New Jersey participated in a parental involvement programme for mathematics. In the beginning, a group of interested parents, teachers, and administrators organised a family mathematics night so that children and parents could learn mathematics together. The high level of excitement, energy and team spirit demonstrated by parents and teachers during the first meeting was evidence that more time was needed to accomplish group plans. As the activities for the proposed family-mathematics night were explored, additional activities began to surface.

One of the activities was a newsletter called "Math Madness" which was prepared by parent volunteers on a biweekly basis and sent home with each child every Tuesday and Thursday. It contained news of school mathematics activities, mind-bending puzzles and suggestions to parents on how to help their children enjoy and understand mathematics. To ensure that the newsletter reached its destination a family activity page was attached to the newsletter to be completed and returned to a "math box" located in the cafeteria. At the end of the week a random draw was held to determine the student who would win an ice-cream party for his or her class. The purpose of the activity sheet was not to ask for right or wrong answers but rather to present a non-traditional mathematical challenge that would foster questioning, exploring, conjecturing and thinking. The activity was also structured to encourage family involvement.

Another activity involved getting community members to meet with students to speak about the importance of mathematics in their jobs and, relate to children their own experiences as school children in learning mathematics. The intended message was that
not all adults who are proficient users of mathematics were necessarily gifted mathematics students. It was pointed out to students that although mathematics may not be easy at times, the extra work and effort that is needed to master mathematics is likely to pay dividends in the future.

An activity called "Bubble Day" was coordinated entirely by parents. Each child was given the chance to explore bubble blowing in a mathematics lesson. Questions such as why bubbles are spherical, if one dimension of a bubble changes by a certain amount does the other dimension change proportionally, and what happens when four bubble walls come together, were investigated by the students.

A family mathematics night was held at the end of the mathematics month. Parental involvement was the key factor in planning all the events for the night and the programme coordinator was a parent. Workshops were held in different classrooms. The workshop sessions were on using calculators in the classroom, resources to solve problems, and computer-assisted instruction to solve multi-step problems. A session titled "But Who's Counting?" allowed parents, teachers, administrators, and board members to participate in a game show involving estimation and hypothesis building. At the end of the evening parents had to complete evaluation sheets and the comments were all positive. Some of the comments were:

“Great! Must do it again!"; “Wish it could be longer!"; “My family and I had a great time!" and “Math is fun!"

These comments implied that “Math Month" was a successful programme and served to promote and activate creative thinking about the need to focus and upgrade mathematics instruction. As a community effort, the planning implementation and evaluation of all mathematics activities brought parents, teachers, administrators, and students together to experiment with and enhance mathematics as both an intellectual activity and a creative adventure. The outcomes of the programme, using real-life applications when teaching and learning mathematics and encouraging thinking that
uses imagination while exploring mathematics, were achieved (Szemcsak and West 2002).

2.9.3 Massachusetts Parent Involvement Project (Mass PIP)

The Massachusetts Parent Involvement Project is based on numerous research studies, which show that a child's educational achievement increases when parents and caregivers get involved in school and schoolwork. The team that is in charge of the programme believes that for Massachusetts children to attain higher achievement levels in mathematics, science and technology/engineering, it is essential that parents increase their involvement. They also believed that educating children in mathematics, science and technology/engineering education is a community responsibility.

The mission statement of the project is “to increase involvement of families in their children's mathematics, science and technology/engineering (MST/E) education by creating partnerships and supporting parents in communities where students are underachieving in MST/E education” (www.alfored.org/Mass%20Pip/Pip%20Web%20Page/about_pip.htm).

The project supports local community coalitions, which are composed of parents, leaders from community organisations, businesses, school personnel, and representatives from Partnerships Advancing the Learning of Mathematics and Science (PALMS). Each coalition plans and implements outreach programmes and other activities to help increase parents' awareness of and involvement in their children's mathematics, science and technology/engineering learning. The local community targets three areas of parent involvement:

- Helping parents engage with their children;
- helping parents become advocates for high quality science, mathematics and technology education for their children; and
- helping parents become leaders in their community with regard to advancing science, mathematics and technology/engineering education in the schools and community.
Decision making is in the hands of Local Community Coalitions and provides three key areas of support which are:

Training to build the capacity of the coalitions to work together productively, to experience and spread involvement in MST/E education and to reach parents in their communities; hands-on MST/E activities developed by the coalitions and collected by educators of the Museum Institute for Teaching Science to engage children and their parents/families in public community sites and at home; and ongoing technical assistance to ensure successful outreach efforts to parents and the community, and to develop activities, services and products to enhance mathematics, science and technology/engineering.

The Massachusetts Parent Involvement Project (Mass PIP) is especially relevant to this study as it shows what can be achieved if different stakeholders in education get together and pursue a common goal.

2.9.4 The IMPACT Programme in the United Kingdom

The educational benefit of actively involving parents in the process of teaching their children to read has been widely celebrated in the United Kingdom and other countries. The PACT (Parents and Teachers and Children Together) initiative of 1984 (Merttens and Vass 1990) was the best known and most widely practised intervention of this kind in the UK. PACT developed a dialogue between teacher and parent about a child's reading by involving both the teacher, within the school, and the parent within the home, in listening to the child read and making written comments about the child's performance. The perceived success of PACT together with other factors, generated considerable interest in developing ways in which parents could be actively engaged in the mathematical education of their children and through which a dialogue between the parent and teacher can develop.

This led to the implementation of a programme called IMPACT, which had the empowerment of parents and the transformation of the practices of schooling as some of
its key foci. The programme involved primary school children taking home mathematics activities, which were chosen or designed by the teacher to fit into the work being done in the classroom, to do with their parents at home. The products of the activity are then returned to the school together with an evaluation of the activity and the process of doing it filled in by both the parent and the child.

The following features were part of the IMPACT programme. Schools that implemented IMPACT had to stick closely to these features (Merttens and Vass 1990: 140).

Each IMPACT teacher was asked to plan the mathematics curriculum at least a few weeks ahead. IMPACT had to be introduced to all the parents whose children would be taking part. Any activity to be done at home should have some connection with current on-going class-work, and the children had to be explicitly introduced to some aspect of the activity. There were a variety of activities.

Mathematics games were sent home to practise skills. There was also investigative and problem-solving work done at home and gathering data for class work. Opportunity had to exist for both parent and child to report back on how the activity went and what they thought about the activity. Class work following a home activity had to incorporate and develop what had been done at home.

At least twice-yearly parent meetings were to be held to discuss progress. The bulk of IMPACT work at primary level had to be designed in preparation for the home activity so that the child became initiator and tutor in the home. Activities were to be sent regularly and in an organized manner. Sending activities haphazardly de-motivates both children and parents and lowers the responsiveness of the home, which in turn disappoints teachers.

IMPACT was a well-structured programme, which ensured that the school, parents and children worked very closely together.
2.9.5 The Family Maths programme

This programme has its origins in the USA. It is designed to give parents, teachers and children the opportunity to develop a better understanding of, and improve attitudes to, mathematics at a primary school level. The focus of Family Maths is on families learning together and aims at changing the attitudes of parents and children to mathematics through enjoyable, everyday activities. The programme uses a problem-solving approach and “hands-on” materials in order to develop conceptual understandings, logical and spatial skills (Kreinberg 1989; Weisbaum 1990).

The Family Maths programme was introduced in South Africa in 1996 and targets parents of learners in grades 4-7. A University of Port Elizabeth (now Nelson Mandela Metropolitan University) pamphlet about the Family Maths programme listed the following activities that take place in the programme.

- Problem-solving activities;
- cooperative learning skills development; and
- learners, parents and community members working together in a relaxed, non-threatening environment. (Unknown author: UPE Pamphlet 2003)

Family Maths activities have occurred regularly in the Eastern Cape and a cooperative attitudinal study on Family Maths was conducted in Port Elizabeth. This involved ten Afrikaans speaking grade 5 learners and their parents. Although it was a limited study, parents and children found the process enjoyable and felt the exercise was worthwhile. The programme increased family involvement in children’s learning of mathematics, not only during Family Maths sessions but also at home.

The data from the study, although limited, appeared to support the contribution of Family Maths to education in the following manner:

- It involves parents in their children’s schooling;
- it impacts positively on both parents and children’s attitudes; and
it could possibly accelerate the development of certain cognitive planning and processing skills in children. (Austin and Webb 1998)

The results of this study show that the Family Maths programme in South Africa has had a positive impact on both parents and children who were involved. The programme is ongoing and, according to Pam Austin, Family Maths coordinator, based at the Nelson Mandela Metropolitan University, has already achieved the following benefits:

- Children and parents have developed positive attitudes towards mathematics;
- there are positive links between school and community members;
- there is extension of family maths activities in classrooms; and
- outcomes-based education has been reinforced in learners, teachers and parents. (personal communication)

However, there have been some negatives. Some parents were unwilling to participate and sent other family members to accompany their children to Family Maths activities. Some school principals refused to allow interested teachers to implement the programme at their schools (personal communication).

2.10 Summary

The literature review in this chapter is comprehensive and offers some insight into the roles that parents can play in the education of their children. The information presented in this chapter can be summarized as follows:

Parents have an important role to play in the education of their children. There are different parental involvement models and the model which best promotes active parental participation in education is the curriculum-enrichment model. Mathematics is a key subject in the school curriculum but is viewed as difficult to teach and learn. Parents perceive mathematics in different ways. Many parents would like to support their children’s mathematics learning but require guidance on how to do so. Parental level of
education is a crucial factor when it comes to supporting children’s mathematics learning.

Mathematics-anxious students have to be treated with sensitivity and utmost care by their teachers. Parents should be guided on how they can help in the process and must not to contribute to the anxiety of their children. They are also in a position to promote positive attitudes toward mathematics in their children. Parents should have a role to play during the curriculum reform. This does not appear to have been the case during curriculum reform in South Africa.

Various successful parent involvement programmes for mathematics have been implemented in the USA and the UK. One of the programmes, the Family Maths programme has been introduced in South Africa and it operates in primary schools.

In a subject like mathematics, parental involvement may have an impact on children’s attitudes to mathematics and influence their achievement in the subject. However, some parents are reluctant to get involved in their children’s mathematics learning because of their own fears and insecurities about mathematics. At the same time, mathematics is viewed as an important subject and most parents would like their children to do well in mathematics.

Parent involvement programmes in countries such as the United Kingdom and United States are ongoing and have involved parents very significantly in their children’s mathematics learning. The Family Maths programme has been introduced to South Africa but focuses on parents of children in grades 4 to 7. This creates a vacuum when children move to high school. It is possible that an assistance programme for high school parents may fill this vacuum. This programme could guide parental involvement in children’s mathematics learning and influence the way parents and children perceive mathematics. The proposed programme needs to be embedded within a precise methodology and this is addressed in the next chapter.
CHAPTER 3
DESCRIPTION AND JUSTIFICATION OF THE RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an insight into the research methodology used in this study. Firstly, there is a brief description of research paradigms and approaches and a rationale for using a qualitative approach. As this study involved parent-child interaction in the home environment with parents documenting this interaction in journals, a brief description of participant journaling is given and a description of the interpretive research paradigm and its appropriateness to the study is also explained. This study was conducted with different sets of parents at different times of the school year and fitted the mould of multiple case studies. Thus, a brief description of case studies and the role they play in this research is provided.

The research procedures that were used to answer the research question are sketched and an explanation is given on how the participants were selected and prepared for the research. This is followed by a description of the operational strategy applied during the course of the research.

The data collection techniques and instruments are introduced and described in detail. This is followed by a brief discussion on the data analysis of this study and a description on how the data are written up. Some ethical issues regarding the research are also explained.

3.2 Research paradigm and approach

There are various definitions and descriptions of a research paradigm. Guba (1990) defines a paradigm as a basic set of beliefs that guide action. Denzin and Lincoln (1998) believe that the notion of a paradigm encompasses epistemology, i.e., how we know the world, and ontology, the raising of basic questions about the nature of reality and methodology, thus focusing on how we gain knowledge about the world.
Usher (1996) states that, ontological and epistemological questions are related since claims about what exists in the world imply claims about how what exists may be known. Patton (2001) describes paradigms as being normative, informing practitioners of what to do without the necessity for long existential or epistemological considerations. Thus, from the preceding discussion, any research undertaken should be located in the appropriate paradigm, as the paradigm should guide the researcher's actions. The paradigm should also encompass ontology and epistemology.

This study takes into account both ontological and epistemological perspectives as it is vitally important to examine what is already known about parental involvement in education and how this study fits in with the current knowledge base of this involvement.

Burrel and Morgan (1979) claim that, because of the commonality of purpose that binds the work of a group of theorists together, sociological paradigms can be divided into four quadrants.

\[
\begin{array}{c|c}
\text{CRITICAL THEORY} & \text{STRUCTURALISTIC} \\
\text{Subjective} & \text{Objective} \\
\text{INTERPRETIVE} & \text{POSITIVISM} \\
\text{Order} & \\
\end{array}
\]

Figure 3.1 Sociological Paradigms (Burrel and Morgan 1979)

These four quadrants do not only harbour particular thoughts of understanding and of seeing the world, but also define the world differently to such an extent that they become mutually exclusive. The research paradigm therefore determines the method of research and dictates the research techniques adopted (Mouton 2001). However, Lather (1991) argues that real scholars work within an untidy reality that does not fit into neatly segregated paradigms, and that paradigms must not be treated as clearly defined, real entities, but as loose frameworks for dividing research.
De Landsheere, cited in Keeves (1988), expands the argument, reflecting that no single paradigm can answer all the questions arising from educational research. McFarlane (2000) agrees with this view and warns that because researchers tend to work in more than one paradigm, researchers need to be consistent in terms of keeping their various decisions in line with their stated assumptions.

As a result of what has been stated about research paradigms in this section, it is important to examine more closely the ontology and epistemology of this study.

3.2.1 The ontology

The ontological basis of this study is primarily about the involvement of parents in the education of their children. Parents play a very significant role in their children’s early learning of mathematics and there is no reason why this should not continue throughout their children’s schooling careers.

Education is a complex undertaking involving various role-players. For the first six or seven years of a child’s life, before the child goes into formal schooling, most of what the child learns is via interaction with parents. This occurs in different stages of abstraction.

The child’s mathematics experience, like all the child’s experiences, progresses through this sequence of abstraction. Liebeck (1984) categorizes this sequence as follows:

| E | experience with physical objects, |
| L | spoken language that describes that experience, |
| P | pictures that represent the experience, |
| S | written symbols that generalise the experience. |

Figure 3.2: Mathematics learning sequence of a child

This sequence of abstraction characterizes the progress of the child through the stages in attaining mathematical understanding and competence. In the child’s earlier years, the
parent is the key facilitator or teacher. As the child moves through the grades, the role of the parent diminishes and the role of the teacher increases. However, with increasing class sizes at school, the mathematics teachers are unable to give children individual attention and some children fall behind. It, thus, becomes of paramount importance for parents to get involved.

This study argues for parents to continue with the role that they so successfully carried out in their children’s earlier years. They may believe that they are unable to play a role in their children’s mathematics learning as their children get older and move into high school but there is overwhelming evidence to suggest that they can play a role. Many parents, without realizing it, provide situations in the home whereby they are involved in mathematical practices and their children can learn from them. The parent who says that she/he is not good at mathematics is usually very capable of balancing the weekly budget. When baking, she/he is able to measure and mix the different ingredients quite successfully to bake a cake. When cooking various meals she/he is also very good at adjusting quantities proportionately, depending on how many people are being catered for. The last two examples just described involve fractions and ratio and proportion. These concepts feature in mathematics curricula throughout their children’s schooling careers.

There are various other ways in which parents may involve themselves in their children’s mathematics learning. These roles should not be difficult for parents to play. This study attempts to make parents aware of these roles so that they could support their children’s mathematics learning from an informed and knowledgeable position.

3.2.2 The epistemology

The epistemology of this study focuses on where this study fits in with the current knowledge base about parental involvement in education. Much has been written about parental involvement in education (Wallen and Wallen 1978; Oakes and Lipton 1990; Unger 1991; Cline 2002). The overriding comment of these authors is that parental
involvement in education is bound to have a positive impact on the children’s confidence and their results at school.

The South African Schools Act of 1996 (DoE 1996a) has made it possible for elected school governing bodies to play a leading role in education. While this has happened in the majority of the schools, the involvement of parents in curriculum matters has been lacking. The introduction of outcomes-based education in South Africa in 1998 has made parental involvement in education more vital than ever before. With the focus being the acquisition of skills as well as knowledge, varied assessment tasks are set for learners. Parents should monitor their children’s performance in these tasks and liaise regularly with their children’s teachers to make sure their children are making good progress (DoE 2004). Some tasks may involve research and parents could make provision for their children to go to the library or have internet access to facilitate the research process.

Parents get involved in their children’s education with different levels of commitment and there are various parental involvement models (Springdale and Stegelin 1999) that describe this level of commitment. Although all parents would like to support their children’s education, there are various factors that affect such involvement. Some of these factors are: work commitments, level of education and socioeconomic conditions (Mbokodi et al 2003). With respect to the latter, it depends on where the school is situated. Schools in the more affluent areas are likely to have a higher level of commitment from parents than schools in less affluent areas (Magabane 2001).

The involvement of parents in their children’s learning could have implications for their performance in the different learning areas or subjects. One such learning area in grade 8 is mathematics. Mathematics has been perceived to be a difficult subject to teach and learn. Parents have their own experiences of mathematics, some positive and some negative. If parents are negative about mathematics, they may pass this negativity on to their children. Negative experiences of mathematics often lead to mathematics anxiety. According to Thomas (1992) the foundation of mathematics anxiety begins in junior school with a simple but incorrect assumption that the most important thing in mathematics is to get the right answer. Various cases of mathematics anxiety in adults
have been described in the Cockroft Report (1982) and by Fiore (1999). It is more than likely that mathematics anxiety in adults could rub off onto their children. To counter any mathematics anxiety in parents and ensure that they were adequately prepared for participation in this study, parents were provided with different forms of support.

3.2.3 Qualitative research

Hatch (2002) explains that in qualitative work, it is understood that the act of studying a social phenomenon influences the enactment of that phenomenon. Researchers are part of the world they study; the knower and the known are taken to be inseparable. Being reflexive places qualitative researchers in a distinctly different position to that of the objective scientist, i.e., one who is usually proscribed in more traditional or positivistic research activities. The capacities to be reflexive, to keep track of one's influence on a setting, to bracket one's biases, and to monitor one's emotional responses are the same capacities that allow researchers to get close enough to human action to understand what is going on. Goodall, cited in Hatch (2002:11), defines reflexivity as "the process of personally and academically reflecting on lived experiences in ways that reveal deep connections between the writer and his or her subject". This, according to Hatch (2002), is essential for the integrity of qualitative research.

In this study an attempt is made to draw deep connections from the revealed interactions between parents and children by means of journals, interviews, questionnaires and focus group discussions, all of which provide qualitative data which can only be meaningful if the researcher identifies closely with the participants in order to understand their world. In the context of this study, the researcher had a close relationship with the parents. This relationship was established during the parents' workshops and continued during the parent assistance programme, and concluded at the focus group discussions. The data generated were qualitative in nature. Since such data were collected by both the parents and the children, there was a need for interpretation by the researcher. Thus, relevant to this level of the study would be the interpretive research paradigm.
3.2.4 The interpretive paradigm

Hatch (2002) reports that for qualitative researchers the lived experiences of real people in real settings are the objects of study. This type of inquiry is concerned with understanding how individuals make sense of their everyday lives. Qualitative research also seeks to understand the world from the perspectives of those living in it. In this regard, individuals act on the world based on their perceptions of the realities that surround them. This approach is in line with the interpretive research paradigm, as described by Bassey (1999). As the research questions in this study require understanding of the problem from the perspective of those involved, the study is located in the interpretive paradigm.

The interpretive researcher cannot accept the idea of there being a reality "out there" which exists irrespective of people (Bassey 1999). Reality is seen as a construct of the human mind. People may perceive and understand the world in ways which are often similar, but not necessarily the same. There can be different understandings of what is real and concepts of reality can vary from person to person. Observers are part of the world, which they are observing and may change what they are trying to observe.

The interpretive researcher considers that the rationality of one observer may not be the same as the rationality of another, and so accepts that when these two observers talk to each other the world may not seem "rational" or "make sense". The interpretive researcher sees language as a more or less agreed upon symbolic system, in which different people may have some differences in their meanings. As a consequence the sharing of accounts of what has been observed is to some extent problematic. Because of differences in perceptions, in interpretation and in language it is not surprising that people have different views of what is real.

This study is concerned with parent-child interaction and the documentation thereof. It is likely there would be differences in perceptions and interpretation of this interaction.
Thus, to ensure the validity of the data emerging in this study, a multi-method approach is used (Cohen and Manion 1994:233). The data were generated by means of a number of different instruments, e.g., journals, follow-up questionnaires, interviews, and focus group discussions. The data were then triangulated in an attempt to get a better understanding of the participants’ reality.

Berry (1998) lists characteristics of interpretive research as identified by Sherman and Webb (1988). These characteristics confirm that interpretive research is qualitative in nature and a summary of these characteristics follows.

Events can be understood adequately only if they are seen in context. Therefore, a qualitative researcher immerses her/himself in the setting. The contexts of inquiry are not contrived; they are natural. Nothing is predefined or taken for granted. Qualitative researchers want those that are studied to speak for themselves, to provide their perspectives in words and other actions. Therefore, qualitative research is an interactive process in which the persons studied tell the researcher about their lives. Qualitative researchers attend to the experience as a whole, not as separate variables. The aim of qualitative research is to understand experience as being unified. The methods used in qualitative research are those that are most appropriate to the aims of such research. There is no single general method of inquiry.

In the context of this study, although guidelines were given to the parents on what type of mathematical interaction to have with their children, each parent-child interaction would have its own unique configuration. Each parent came from a different background with different educational experiences and qualifications. Their own experiences of mathematics at school as well as the level of mathematical knowledge attained would come to the fore during the interactions with their children. The children would also bring their own experiences to the fore during their interaction with their parents.

To interpretive researchers the descriptions of human actions are based on social meanings; people living together interpret the meanings of each other and these meanings change through social interaction. Interpretive researchers recognise that by asking questions, or simply by observing, they may change the situation which they are
studying (Bassey 1999). As one of the key features of this study involved the interaction between parent and child, the field research technique of participant journaling was used to in an attempt to document this interaction.

3.2.5 Participant journaling

Smith (2006) speaks of the physical characteristics of a journal as being a bound notebook or a ring binder full of papers and says that a journal is a day book, which according to Klug, cited in Smith (2006), is “a place to record daily happenings”. Klug goes further by giving the following description of a journal.

A journal is also a tool for self-discovery, an aid to concentration, a mirror for the soul, a place to generate and capture ideas, a safety valve for the emotions, a training ground for the writer, and a good friend and confidant (Klug in Smith 2006).

Journals share some qualities with logs and diaries such as recording experiences and events over a period of time. However, writing and keeping journals also entails conscious reflection and commentary and must involve learning at some level (Smith 2006). It was expected that the journals used in this study would enable parents and children to reflect on, and learn from, their interactions.

The process of gathering data from journals is described by Hatch (2002) as participant journaling. According to Hatch (2002) participant journaling is a strategic data collection procedure that researchers build into their studies. Participants agree to keep some kind of written record of their experiences and reflections during the research process. These records are shared with researchers and become data for their studies. Journals can, thus, provide a direct path into the insights of participants.

Some participants are comfortable expressing their feelings, ideas, and insights in writing and these can be powerful data that reveal how they understand the phenomenon under investigation. These data have a slightly different nature to data collected directly by a researcher. This is so because the data are not processed through a researcher but come directly from the participant. However, researchers still have to interpret these as analyses are made and participants are aware that they write entries that will be read by the researcher.
To ensure that the journals were completed in a systematic and structured manner, the parents were guided on how to record their interactions with their children. Three groups of parents participated in the parent assistance programme, with each group working independently of the other groups. As the same procedures were followed with each group of parents, each group constituted a case study.

3.2.6 Case studies

Cohen and Manion (1994:106) note that “the case study researcher typically observes the characteristics of an individual unit – a child, a clique, a school or a community.” In this research, the units that were investigated were groups of parents and children in situations that would create opportunities for educational discussion, especially in mathematics. The purpose of the investigation would be to probe deeply and to analyse intensively the various phenomena that would surface during the parent-child interaction.

The parent-assistance programme used in this study was implemented with three different groups of parents at different times of the school year. Exactly the same procedures were followed with each set of parents. This made this research a multiple case study (Yin 1984:47).

3.2.7 Socio-cultural approach to learning

It was expected that the parent-child interaction in this study would differ from household to household, with each interaction being unique to a specific grouping. Although, parents were given guidelines on what to do, each parent-child interaction would have its own unique set of experiences. As such, in each interaction the search for understanding focuses on different issues and is approached in different ways. Thus, the socio-cultural approach (Brodie and Pournara 2005) to learning also plays a role in this study. In this approach, learning occurs through social interaction and is the internalisation and construction of the social and cultural means for understanding the world (Brodie and Pournara 2005). This study focused on parent-child interaction in a natural setting.
In trying to consolidate the preceding sub-sections, the theoretical framework of this qualitative study is created. This study may, therefore, be classified as a multiple case study research, with socio-cultural influences, within the interpretive research paradigm.

3.3 Research question

The research question, which follows, was developed in the context of the afore-mentioned.

Does a parent-assistance programme for mathematics affect children’s and parents’ perceptions of mathematics?

Three subsidiary questions were also developed. These were:

- What effect does the parent-assistance programme have on children’s perceptions of mathematics?
- What effect does the parent-assistance programme have on parents’ perceptions of mathematics?
- What is the perceived effect of the parent-assistance programme on children’s achievement in mathematics?

To answer the subsidiary questions, and in so doing, the research question workshops were held for three groups of parents. Each group of parents was considered to be part of a distinct case study. Thereafter, the parents had to complete participant journals and follow-up questionnaires. They were also interviewed later. Focus group discussions were then held with all the groups, together with the children.
3.4 Selection of participants

US statistics about parental involvement in education show that parents tend to be more involved when their children are in the earlier grades (Shinn 2002:35). Although such statistics are not readily available in South Africa, it is the researcher’s experience that parents in South Africa tend to be more involved when their children are in primary school than when their children are in high school.

Parents of grade 8 children were chosen to participate in this study as it was the first year in high school for their children and it was assumed that at high school level they form the group most likely to become involved in their children’s education.

The background to the selection of participants in this study is sketched in Chapter 1. At the time when the initial survey was conducted, there were 180 grade 8 learners at the school. Thus, 180 questionnaires were handed out to parents to complete. Of these, 148 questionnaires were returned. This survey was used to generate a profile of the parents involved. The data generated by the questionnaires revealed that most parents were eager to participate in the parent workshop and the assistance programme. This initial availability of the parents allowed the full study to be carried out at this individual school.

Thus, the parents were invited to participate in the workshops. These workshops were held at the beginning of each case study. Prior to each parent workshop the grade 8 head of the school briefed children about what would happen during the workshops and asked them to inform their parents. Based on verbal responses from the children, invitations containing a brief description of the activities were sent to 25 parents for each workshop.

The dispatch of invitations was coordinated by the grade head. Parent participation was voluntary, with five parents participating in the first case, eight parents participating in case two and five parents participating in case three. Since the participation of parents was voluntary, the sampling used in this study would be what Cohen and Manion
(1994:88) calls “convenience sampling.” Different parents participated in each case and there was a great deal of diversity between the parents in terms of their mathematics backgrounds.

3.5 The parent-assistance programme

Of the population of 180 sets of parents, 18 parents participated in the parent-assistance programme as part of this research study. They firstly attended a workshop and then interacted with their children according to set guidelines for a period of seven weeks. This was recorded in a journal. The journals were then interpreted by the researcher. The parent-assistance programme was designed to highlight the role of parents in children's mathematics learning. Its influence on perceptions of mathematics would also be investigated.

3.6 The initial parent survey

The initial parent survey was done using a questionnaire (Appendix 1). The following key issues were considered when the questionnaire for the initial parent survey was designed:

Parents’ education level is a key determinant of learner performance (Chinapah et al 2000); parents should be encouraged to get involved in school activities (Bloomstran 2002); homework is a great opportunity for getting parents involved in their children’s educational experiences (Canter and Canter 1996); learners, parents and teachers all have different attitudes which affect their perceptions of learning (Gibney 2002) and parents have their own perceptions of mathematics (Cockcroft 1982).

With these key issues in mind, the purpose of the initial parent survey was to investigate:

- Background information of the grade eight parents at the school;
- the involvement of the parents in school matters;
- the role played by parents in their children’s homework; and
- their perceptions of mathematics
The survey, thus, enabled the researcher to establish a profile of the population of grade eight parents at the school. There were 180 children in grade eight at the school and all of their parents were surveyed. The grade 8 class teachers facilitated this process. In each home, one parent had to complete the questionnaire. Since all parents were given questionnaires to complete, this ensured that all of the parents from different ethnic, cultural, religious and socioeconomic backgrounds, at the participating school, were surveyed.

On the cover of the questionnaire parents were given reasons why the survey was being done. They were also informed that their responses would be used in the development of a parent-assistance programme for mathematics. The questionnaire was divided into four sections. In section A routine information on gender, home language and information such as the parent’s education level, highest mathematics qualification, and a description of the parent’s mathematics experience was requested. This information was important as parents at the school where the study was undertaken came from diverse backgrounds and may have had different mathematics experiences at school.

Section B requested information on the parent’s involvement in school matters. This was to ascertain whether the parents were actively involved in school matters. Section C was about assisting with homework and being part of a parent-assistance programme for mathematics. Section D examined the parents’ perceptions of mathematics.

Key points from the survey, together with relevant sections of the literature review in Chapter 2 and other sources, indicated in this chapter, were used to design a parent assistance programme for mathematics. This parent-assistance programme was conducted with sets of parents as three different case studies.
3.7 The parents’ workshop

At the beginning of each case study, parents participated in a workshop. They were assured that despite what they perceived about mathematics, the workshop could help them to support their children as the main task of the workshop was to provide information to parents about current trends in education and to outline the role that they could play in the mathematics learning of their children. Each workshop was attended by the grade head, one mathematics teacher, the researcher and a group of parents. A description of the workshops follows.

Firstly, the grade 8 head welcomed the parents and outlined the purpose of the workshop. She told parents that they were to be part of a programme which would help them monitor, support and assist their children in mathematics. As part of the introduction to the workshop, the grade head gave parents an overview of outcomes-based education. She then introduced the researcher to the parents and informed them about the role of the researcher in the above programme.

The grade 8 mathematics teacher was able to respond to queries of parents such as how their children were assessed and comments by parents about the lack of mathematics homework. She also contributed to the workshop by presenting a course outline (Appendix 6) for grade 8 mathematics. This outline informed parents about the topics that were to be covered in each term so as to help them when they monitored their children’s work. She related the topics to the 10 specific outcomes for mathematics (DoE 1997).

The teacher also notified parents about the different forms of assessment in mathematics, how these assessments were carried out and the weighting of these assessments. The parents were informed that they had a role to play in the mathematics education of their children and that, as assessment was on a continuous basis, it was important that they keep track of the assessment dates. She emphasised that parents had to ensure that their children did their homework regularly and prepared adequately for tests. In addition, they should make arrangements for their children to go to the local
and/or city libraries to do the necessary research that was required of them when doing projects.

The researcher then taught a lesson on the multiplication of two negative numbers to the parents (Appendix 2). The lesson, which was compiled using de Jager (1996) as a reference, was chosen for its simplicity and unique result and was used to build parents’ confidence and show them that they could also participate in a mathematics lesson. It was also used to motivate parents and inform them that grade 8 mathematics was not beyond them. It was pointed out to the parents that although assessment strategies and procedures had changed since they were at school, and that the methodology that is used in today's mathematics classroom is different from what they had been exposed to, the essence of the mathematics that their children were doing in class is not different to what they had done in school and that they need not fear mathematics. After the lesson had been completed, parents were asked to give their views on what they had experienced. These views were noted by the researcher and are discussed in Chapter 4.

The researcher then facilitated an informal discussion of a guideline document (Appendix 3) as part of the workshop. This document was compiled from various sources and the points that follow were noted in its design.

When parents are involved in their children’s education, both children and parents are likely to benefit (Brown 1989). Homework is a very important component of a child’s learning and parents should ensure that children bring homework home (Canter and Canter 1996), as parents who are more involved in their children’s education are able to get their children to do more homework (Edwards 2001). Children benefit greatly when parents take a keen interest in their mathematical learning (Puddick 2002). Mathematics is part of our everyday life and is found all around us (Kanter 1992; Haury and Milbourne 2001).

With these points in mind, the discussion of the guideline document focused on the following key elements:
• Tips for parents to show that they are interested in their children’s work;
• why homework is important and how parents can help their children with mathematics homework;
• what parents can do if the child does not do homework or does not bring homework home;
• how shopping can become an enriching mathematical experience;
• the mathematics that we come across in the newspapers;
• mathematics on television;
• mathematics in the home; and
• geometric shapes in the home or environment.

At the conclusion of the discussion parents were given journals (Appendix 4) to complete. This would ensure that the interaction between parent and child was carefully documented for the research being undertaken. There was close synergy between the discussion document mentioned above and the journal. The researcher went over the journal requirements with the parents and explained to them how the different sections should be completed.

Some sections required data to be collected weekly while other sections, such as the grocery shopping and the noting of temperatures, were to be a once-off activity. It was also stated that they should take full responsibility for the journal even though there were certain sections that had to be completed by their children, i.e., this had to be done under parental supervision. This process took place over a period of seven weeks.

3.8 Operational strategy

Parents had to complete the journals on a weekly basis. For sections that required weekly journaling, a maximum of seven entries was expected. To ensure that they followed the programme, the researcher kept in contact with parents by telephoning them twice during each session. The duration of the calls varied with some calls lasting about three minutes and others as long as 20 minutes. At the end of the programme both parents and children were surveyed on their participation in the programme by means of follow-up questionnaires (Appendices 5a and 5b).
To find out if parents were still following the programme after the 7 week period, they were interviewed some time later. These interviews were conducted three months after the completion of case 1 and case 2. The interviews with the parents of case 3 occurred about two months after its completion. The interviews were held to point out to parents that their involvement in their children's mathematics learning was not limited to the 7 week period of the parent-assistance programme and that their involvement should be ongoing. The mathematics teachers were also interviewed.

After the follow-up interviews were completed, all parents and children who had participated in the three case studies of the programme were invited to a focus group discussion session. The parents were divided into three groups, with each group comprising one case study. The researcher and two educators facilitated each of the focus group discussions with parents. The children were placed in one focus group and another educator facilitated the focus group discussions with the children. Each group had to share experiences on their participation in the programme. The purpose of the focus group discussions was to consolidate the experiences of the parents and children in the programme and to assist with the researcher’s interpretation of the data.

3.9 Data collection techniques and instruments

According to Cohen and Manion (1985:94) the survey is the most commonly used descriptive method in educational research. Surveys gather data at a particular point in time with the intention of describing existing conditions or identifying standards against which existing conditions can be compared, or for determining the relationships that exist between specific events. As stated earlier, there were 180 grade eight children at the school where the researcher wanted to establish a profile of the grade 8 parents.

As there was a large number of parents at the school, it appeared that the most appropriate method of gathering data to establish this profile was to survey them via questionnaires. Responses given by parents in the survey aided the researcher in the design of the parent-assistance programme. These details are given in chapter 4. The literature review of chapter 2 and other sources, stated in this chapter, also helped in the design of the programme.
The principal data for qualitative researchers are gathered directly by the researchers themselves; in this study the parents assisted the researcher with data collection. The methods used by qualitative researchers include field notes from participant observation, notes from or transcriptions of interviews with informants, diaries and transcripts and reports of conversations (Bassey 1999). Some of these methods were used in this study.

As noted earlier, this study included an initial survey of parents via a questionnaire. Other techniques employed were telephone interviews, journals, individual interviews and focus group interviews of parents and children. During each case, the parents were interviewed over the phone to find out about their progress on the programme and if they had encountered any problems. These interviews were largely unstructured but were conducted to show support for what the parents were doing. During these telephonic interviews, parents were also reminded about completing their journals. During preparation for using the journal technique the parents and children were given specific tasks which had to be completed and documented in the journals. Thus, these journals were different from individual diaries or personally initiated journals (Hatch 2002).

The journal was divided into three sections, two of which involved weekly journaling. Details of the journals that parents completed in this study are discussed in the next section.

3.9.1 The journal

Parents can help children to gain confidence and develop a positive attitude towards mathematics by talking about what has been taught at school (Puddick 2002). Parents should check the homework of children and provide guidance and encouragement (McEntire 2002). There should be regular contact between parents and teachers (Huetinck and Munshin 2002). These aspects were taken into consideration in designing the first section of the journal.
During each week of the parent-assistance programme, parents had to write down details about the following:

- Any discussion which the parent had with the child about school;
- how the parent was involved with the child’s mathematics homework; and
- whether the parent made any contact with the school or mathematics teacher.

This meant that the parent had to be in constant communication with the child about his or her schoolwork in general, and mathematics in particular.

Mathematics is not only confined to the school but is a part of life (Kanter 1992). In this regard, there should be regular communication between parents and children about the mathematics that is being learnt at school. To ensure that this communication took place at home, the child also had to do the following, under parental supervision, on a weekly basis:

- Write down two mathematical terms or words, as well as their meanings or descriptions, that the child learnt during that week; this would be discussed with the parent; and
- write down two mathematical experiences or encounters that the child had come across at home or in the environment; this would also be discussed with the parent.

The above two activities were intended to communicate to the parent the mathematics that the child was learning at school and the applied mathematical knowledge in the home and environment.

Another activity in the journal was grocery shopping. Grocery shopping is an ideal way to foster mathematical thinking in children (Bishop 2000; Mathematics-the simple way 2002). This had to be completed, once, during the programme. The child had to draw up a shopping list of 10 to 12 items. The child had to estimate the price of the items with parental input. Once the shopping had been completed, a comparison was made between the estimated price and the actual price. The parent had to answer some
questions about the shopping experience. This activity meant that the parent had to work closely with the child. It was expected that the child could learn about estimating and comparing prices of items as well as budgeting. The activity also encouraged close parent-child cooperation and socialising.

Parents can play a major role in helping their children notice and use mathematics in an everyday context (Puddick 2002). It is with this in mind that the next activities in the journal were planned. The first one involved children reading the predicted maximum and minimum temperatures for their city for a specific week. This could be obtained from the newspaper or television. They also had to answer some questions on the temperature readings. This activity showed parents and children that mathematics is not done only at school and that the newspaper provided opportunities for mathematical development. In this activity, children learnt about maximum and minimum and applying the concept of average to a set of real data.

The next one, which parents had to supervise, was the reading of the rand-dollar exchange in the newspaper or on television. The children then had to work out problems based on the rand–dollar exchange. It was expected that, by working through these calculations, children would better understand currency exchange and its effects on our economy.

The final section of the journal comprised questions relating to the parents’ and children’s views on the parent-assistance programme. Parents had to describe their interaction with their children during the session. They also had to indicate what they and their children had gained from the programme. The last journal question required parents to suggest any improvement/s to the programme.

At the conclusion of each case parents and children were given follow-up questionnaires to complete (Appendices 5a and 5b). Details of these questionnaires follow.
3.9.2 *Follow-up questionnaires*

The following details were sought from the parents, who participated in the programme, via the follow-up questionnaire:

- Highlights of the programme;
- difficulties experienced and how these were overcome;
- what the parent learnt from the programme;
- the parent’s perceptions of mathematics before and after the programme; and
- if the parent felt anything could be added or removed from the programme.

Children had to supply the following details.

- Highlights of the programme;
- a description of the interaction between parent and child;
- effect of the programme on the child’s attitude to mathematics;
- effect of the programme on the child’s understanding of mathematics, ability to complete homework effectively and on time and on the child’s performance in mathematics assessments;
- what the child learnt from the programme; and
- if the child felt that anything could be added or removed from the programme.

3.9.3 *Interviews*

Kerlinger, cited in Cohen and Manion (1985: 293), emphasises the importance of interviews as data-collecting instruments and suggests that “they might be used to follow up unexpected results, for example, or to validate other methods, or to go deeper into the motivations of respondents and their reasons for responding as they do”.

The interviews with parents were conducted at least two months after the programme. They were structured in nature, with the same set of generic questions being put to all parents. This was done in order to find out if parents were still following the programme and to determine the value of the assistance programme.
The following questions were put to parents:

- How did your child treat his/her mathematics homework before you participated in the programme?
- Was there any change as a result of your participation in the programme?
- How did your child do in his/her mathematics tests during this period?
- How does your child find mathematics now?
- Are you still involved in your son's/daughter's mathematics learning?
- How do you as a parent feel about mathematics now?
- Did you have any contact with the school, especially the mathematics teacher?
- Is it possible that your child will continue with mathematics in grade ten?
- What did you and your child learn during the programme that is still helping you?

After the interviews with parents were completed, the mathematics teachers were interviewed. The teachers were asked to comment on each child. This information would be used to validate or contradict some of the information volunteered by parents in the journals, follow-up questionnaires and the interviews. The teachers were asked to comment specifically on the following issues:

- The child’s attitude to mathematics;
- the child’s completion of homework and the accuracy thereof;
- performance in assessments;
- any specific incidents regarding the child in the mathematics class;
- parental cooperation; and
- the teachers’ views of the programme.

3.9.4 Focus group discussions

After the completion of all cases, a focus group discussion session was arranged for all parents and children that were involved in the programme. Hatch (2002:24) describes focus groups as “sets of individuals with similar characteristics or having shared
experiences (e.g. beginning teachers) who sit down with a moderator to discuss a topic”. Hatch (2002) also refers to comment by Kreuger that focus group discussion provides a different kind of information than that which can be generated from individual interviews and/or observations. In the context of the research undertaken, the focus group discussions supplemented the other qualitative data in this research.

Immediately after the interviews with parents from case 3, the parents and their children (from all three cases) were invited to a meeting to share their experiences of the programme. This took the form of four focus group discussions. 11 parents (out of 18) and their children attended the meeting. The parents were placed in groups according to the cases in which they were involved. All the children were placed in a single group.

Each group was asked to respond to the request: "Discuss your experiences during the parent-assistance programme"

3.10 Data analyses

When analysing the data generated in a study, issues of reliability and validity have to be taken into account. There are both external and internal reliability and external and internal validity. A well-organised, complete persuasive presentation of procedures and results enhances external reliability while internal reliability is described as consistency in the research process. This could be addressed through proper training of observers to enhance consistency in their observation (Wiersma 1995).

Internal validity relies on the logical analysis of the results and verifying results from two or more sources. External validity is concerned with the comparability and translatability of the research. Some qualitative researchers leave the issue of external validity to those that read the report of the study (Wiersma 1995).

In this study, the parents acted as initiators and collected data for the researcher by documenting their interactions with their children in structured journals. Thus, the researcher had to ensure that this data was both reliable and valid.
3.10.1 Reliability of data

The initial survey, where all grade 8 parents were surveyed by means of questionnaires, was used to establish a profile of the grade 8 parents at the school. This was done by a data reduction process (Cohen and Manion 1985:113) where the data were coded by hand. This was possible as 148 questionnaires (the number returned) proved to be a manageable number.

Prior to coding, the questionnaires were checked and edited. Moser and Kalton, cited in Cohen and Manion (1985) point to three central tasks in editing, namely, completeness, accuracy and uniformity. Completeness is done by checking that there is an answer to every question and missing answers may be cross-checked with other sections of the survey; accuracy is addressed by checking that all questions are answered accurately; and uniformity is addressed by checking that respondents have interpreted instructions and questions uniformly.

The editing process for the initial survey in this study was carried out with these three points in mind. Each response in the questionnaire was checked for completeness. Responses that were incomplete did not have a major impact on the profile of the grade 8 parent that was compiled.

The quantitative data were easy to code and record as the parents had to choose appropriate responses from given alternatives. Some responses could be checked for authenticity, as in section D of the questionnaire where parents had to indicate how they perceive mathematics. Some other statements required responses to reverse phrasing. For example, the statement, “I am able to help my child in mathematics” and “I am unable to help my child in mathematics” required opposite responses. This is also the same for the statement, “My school experience of mathematics was negative” and, “My school experience of mathematics was positive.” The few questions that were open-ended were coded according to certain trends and patterns of coherence.

The next part, which was the major part of the research, was qualitative in nature. This
involved data collection using a variety of data-collection methods, thus, enabling the possibility of triangulation of data. Cohen and Manion (1994:233) say that exclusive reliance on one method may bias or distort the researcher’s picture of the particular slice of reality that he is investigating. Wiersma (1995:264) defines triangulation as qualitative cross-validation which assesses the sufficiency of data according to the convergence of multiple data sources or multiple data-collection procedures and the interrogation of the results in Chapters 4 and 5 of this study is an attempt to enhance the external reliability of the data.

Internal reliability, in the form of consistency in the research process was directed by the researcher. This study involved participant journaling by parents. In the parent’s workshop they were given guidelines on how to document their interaction with their children. These guidelines appeared in structured participant journals and ensured that the journal data could be analysed according to certain trends and patterns of coherence. The use of the follow-up questionnaires was an attempt for both parents and children to reflect on the parent-assistance programme.

The interviews with parents were a further attempt (much later) for parents to reflect on their participation in the programme and comment on its impact on their children. The interviews with teachers focused on the participation of the children in class, their views on the programme and parental cooperation. The focus group discussions, at the end, were an attempt to bring parents and children from the three casestudies together to discuss and share their experiences.

3.10.2 Validity of data

This use of a multi-method approach to focus on parent involvement in this study is known as triangulation “between methods” (Cohen and Manion 1985: 260). This approach embraces the notion of convergence between independent measures of the same objective and is used as a check on the internal validity of the data.
Thus, the triangulation of the data generated by the four methods used to collect data in the major part of this study, that is, participant journals, follow-up questionnaires, follow-up interviews and focus group discussions, was an attempt to gain the most valid picture of the participant’s reality. Triangulation was further implemented when handling the data.

3.10.3 Organisation and analysis of data

The quantitative data from the initial survey are organised mostly in bulleted form; the parents' perceptions of mathematics in table form; and the qualitative data from the same survey organised according to certain trends and patterns of coherence. From analysing both the quantitative and qualitative data from the initial survey, it was possible to compile a profile of the parents involved in this study.

The rest of the research is organised according to the cases of the parent-assistance programme and in order of the data-collection methods. Parents were allocated certain letters such as A, B, C and so on, at the beginning of each case. The parent codes and the data collected were indicated in table form (Appendix 7). For each parent the data are organised in detail under the headings: journals, follow-up questionnaires, parents and teacher interviews. This is followed by the data from the focus group discussion.

The data were analysed with a view to detecting trends and patterns of coherence. This was done after the data for each case were recorded. The focus group discussion data were also analysed by looking for trends and patterns of coherence.
3.11 Writing up the data

A multi-method approach was used to collect the data for this study in an attempt to ensure that any conclusions arising out of this study would be valid. The data are written in a narrative style and attempts to give an in-depth picture of the initial survey of parents, the journal data, the follow-up survey of parents and children, the parent and teacher interviews, and the focus group discussions. These data are written up in sections in the next chapter. Each section represents a period of time in which a significant stage of the research was conducted. The sections follow in a chronological order.

With the same processes and procedures followed in each case in this study, there is bound to be repetition. To avoid repetition, one event from each case is described in detail and interpreted in Chapter 4 of this study. In case study 1, the journal data are used; in case study 2 the data from the follow-up questionnaires are used; while in case study 3 the data from the interviews are used. In Chapter 5, the event described in Chapter 4 is used as a nucleus in a further interpretation of the data, and the other events, not described in Chapter 4, are used as a means of triangulating the nuclei data for each case. Then all three cases are interpreted together in a search for common trends and patterns. This is intended to be a further form of triangulation.

Thus far, this study has been written in the third person. Since this study is located in the interpretive paradigm, from this moment on it will be written in the first person.

3.12 Ethical issues

There are different stances regarding ethical issues in qualitative research. These include the absolutist stance, relativist stance, contextualist stance and the deception model. This study took into account a contextualist or holistic stance, which refers to describing and understanding events, actions, and processes in the natural context in
which they occur and where no attempt is made to generalise to a larger population (du Toit 2003).

After receiving approval from the principal to conduct this research at the school, I sought permission from the Education Department to formalise this approval. Due to the sensitive nature of some aspects of this research, the school will not be named.

At the outset, informed consent was obtained from parents to participate in the programme, i.e., parents were informed about the overall purpose of the research, its main features and the benefits of participating in the research. This consent was given verbally.

I also had a responsibility to the participants to ensure confidentiality, avoidance of harm, reciprocity and feedback of results. In the initial survey, parents had to complete questionnaires without revealing their identity. There were certain questions that needed personal information and this information required the utmost confidentiality. The questionnaires were returned in sealed envelopes. Thus, only I had access to the questionnaires.

When the participant journals were collected from parents, I had to indicate which parents had completed the journals and thereafter, record and analyse their responses. No names were written on the journals. Only I knew the origin of the journals and for reporting purposes, parents were given codes. The data collected from parents and children in the follow-up survey and from parents in the interviews were recorded under each parent’s code. The data collected from the interviews with the mathematics teachers were also recorded under each parent’s code. This meant that if the interview with a teacher was about parent A’s child, then the data were recorded under parent A’s code, under the heading teacher interviews. Data from the focus group discussions were recorded holistically for each group. This meant that one could not link comments to specific individuals.

During the analysis of the interviews, there appeared to be some inconsistencies in what parents said compared with what the teachers said. Although this is highlighted in the
data analysis process, I ensured that these data were strictly confidential and that there was no harm to the parents, teachers or the children. Some parents also revealed very personal and confidential information in the journals and interviews and this was handled in the strictest confidence.

No controversial issues that could possibly harm or embarrass anyone were discussed. The parents, children and teachers were thanked for their participation in the research and were promised that once the research was finalized, all participants would receive feedback.

3.13 Summary

An explanation on the research methodologies used in this study, and their justification, are presented in this chapter. The research is qualitative in nature and could be classified as a multiple case study, within the interpretive research paradigm. In an attempt to answer the research question, this study, which was preceded by a survey of grade 8 parents via questionnaires, consisted of a parent-assistance programme for mathematics. The programme was conducted as three case studies. Each case of the parent-assistance programme included a workshop which involved a discrete group of parents who were later required to complete structured journals of their interactions with their children. These interactions were monitored by the researcher through periodic telephone calls. At the end of each case, participating parents and their children were surveyed by follow-up questionnaires. This was followed later with interviews of parents and the mathematics teachers. After the completion of all three cases, focus group discussions were held.
CHAPTER 4
DESCRIPTION AND FIRST LEVEL INTERPRETATION OF THE RESEARCH DATA

4.1 Introduction

The first part of this chapter deals with the results of the initial survey which was conducted with grade 8 parents of the school. This survey was administered by the school and was conducted using questionnaires. Its purpose was to establish a profile of the grade eight parents at the school.

The second part of this chapter focuses on the data from the parent-assistance programme. The parent-assistance programme consisted of a parent workshop and the completion of journals during a 7 week period. I kept in contact with parents via telephone. This was to support and motivate them. After this journaling period, the parents and children were surveyed by means of follow-up questionnaires.

This is followed by the data from the parents’ and teachers’ interviews. After the case-study 3 interviews, the parents and children, from all three case-studies, were invited to participate in a focus group discussion. The data from the focus groups are also described and the emergent trends outlined.

4.2 The initial survey

I wanted the questionnaire to reach the parents of all grade 8 learners as these parents would form the population in the study. Of the 180 questionnaires distributed to the grade 8 parents via the school only 148 questionnaires were returned.

To provide the reader with a complete picture of the parents as main participants in this study, I used the initial survey to draw a picture of where the parents were.
4.2.1 The parent background

Of the 148 questionnaires returned, 47 were completed by males and 101 by females. 97 parents spoke Xhosa as a home language and 47 spoke English. Other languages spoken by parents were Afrikaans and Sotho. All Xhosa-speaking parents spoke English as a second language.

Altogether 130 parents indicated that their level of education was grade 10 or higher. Of these parents, 39 stated that they had post grade 12 education. These parents had a wide range of post-grade 12 qualifications in various fields. This situation changed when it came to mathematics qualifications. Of the parents surveyed, 85 indicated their level of mathematics was grade 10 or higher.

The parents were also able to describe their school experiences of mathematics, which were wide ranging. Words such as “fair”, “average”, “difficult”, “struggling”, “challenging” or “demanding” were used to describe their experiences of mathematics at school. Some stated that they had had to work very hard in mathematics and do homework everyday. When mathematics was explained well by the teacher, they enjoyed the mathematics lessons. However, for some parents, mathematics was “their worst subject.” This was ascribed to poor teaching and a lack of motivation.

In some instances they were afraid of the mathematics teacher. In one particular case, a parent reported that the mathematics teacher used to "beat" them and did not care for those who did not know the subject. Many parents believed that mathematics was a subject, which required "a lot of practice." However, those who struggled with the subject were not motivated by their teachers or given help and chose not to take mathematics in grade 9 or grade 10. Those who were motivated and given help enjoyed the subject and tended to do well right up to grade 12. These parents were complimentary of their teachers and expressed their thanks to them for being understanding and patient.
4.2.2 Landscape of parent participation

Only 73 parents indicated that they were aware of the school’s assessment policy and 80 parents indicated they were aware of outcomes-based education. Parents, who indicated that they were aware of outcomes-based education, elaborated further on what they knew about outcomes-based education. Some of their comments were:

“Outcomes-based education is a new curriculum”; “It emphasises the link between theory and practice”; “It ensures good learner performances”; “It is a better system of education, which encourages communication between parents and teachers”; “Learners may work in groups in the classroom or during investigation and projects”; “Learners do research and are encouraged to find out things for themselves”; “Children are assessed throughout the year (continuous assessment)”; “Outcomes-based education would lead to prosperity”; “Team work is emphasised”; “Outcomes-based education is learner-centred”.

It would appear from the above comments that these parents had some knowledge about outcomes-based education. In line with this evidence, 74 parents indicated that they had attended school governing body meetings and other school functions. Most of these parents also indicated they were informed about changes in education on a regular basis. However, at the same time there were 68 parents who claimed they were not aware of outcomes-based education. Some of the reasons advanced by these parents for not being aware about outcomes-based education were:

“I had never heard about it”; “Nobody told me about this new system”; “I had no previous contact with the school”; “The school did not explain the system to me”; “I have little knowledge of education”.

Altogether 82 parents indicated that they had contacted the school at some time to find out about their children’s progress; whereas only 30 parents stated that they been contacted by the school at some time, either through a note or phone call, in connection with their children’s progress at school.
A statistical analysis of parents’ involvement in their children’s homework indicated the following:

- 115 parents monitored the television watched by their children;
- 130 parents stated their children received homework every day;
- 74 parents indicated that their children received mathematics homework every day;
- 130 parents helped their children with homework but this number decreased to 101 when it came to mathematics; and
- 115 parents indicated they would like to participate in the parent-assistance programme for mathematics.

It would appear from the above statistics that a large number of parents claimed that their children received homework every day. These statistics also reveal that parents were able to distinguish between general homework and mathematics homework. Although a large number of parents (101) indicated they helped their children with mathematics homework this statistic may be misleading as it could not be ascertained whether the children asked for assistance regularly. It was determined that 115 parents felt the need to participate in the parent-assistance programme for mathematics.

### 4.2.3 Foregrounding the parents’ perceptions of mathematics

At the end of the questionnaire, parents had to complete the table below by indicating with a tick whether they agreed with the statements. Only 142 out of the 148 parents completed this table. The actual numbers of parents that agreed or disagreed with the statements are indicated in the table that follows.
<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>Agree</th>
<th>Disagree</th>
<th>No tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics is difficult</td>
<td>65</td>
<td>69</td>
<td>8</td>
</tr>
<tr>
<td>2. I like mathematics</td>
<td>118</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>3. I think mathematics is important for my child</td>
<td>140</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4. Mathematics is useful for everyday life</td>
<td>136</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5. Mathematics is a key subject at school</td>
<td>134</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6. I like my child to do well in mathematics</td>
<td>142</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. I am able to help my child with mathematics</td>
<td>101</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>8. I am unable to help my child with mathematics</td>
<td>36</td>
<td>101</td>
<td>5</td>
</tr>
<tr>
<td>9. I am aware of the mathematics that my child is doing</td>
<td>101</td>
<td>34</td>
<td>7</td>
</tr>
<tr>
<td>10. My school experience of mathematics was negative</td>
<td>46</td>
<td>86</td>
<td>10</td>
</tr>
<tr>
<td>11. My school experience of mathematics was positive</td>
<td>86</td>
<td>46</td>
<td>10</td>
</tr>
<tr>
<td>12. I have always encouraged my child in mathematics</td>
<td>132</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>13. I am scared of mathematics</td>
<td>33</td>
<td>101</td>
<td>8</td>
</tr>
<tr>
<td>14. I was never good at mathematics at school</td>
<td>63</td>
<td>71</td>
<td>8</td>
</tr>
<tr>
<td>15. Mathematics should be compulsory</td>
<td>114</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>16. My child is good at mathematics</td>
<td>96</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>17. My school experience of mathematics has shaped my view of mathematics</td>
<td>107</td>
<td>23</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 4.1 Parents’ perceptions of mathematics (from the initial survey)

From statements 3, 4 and 5 in the table it would appear that the parents surveyed viewed mathematics as an important subject. Despite some of them being scared of mathematics, having negative experiences of mathematics or not being good at mathematics, statement 6 provides evidence that all of them wanted their children to do well in mathematics. Statement 2 shows that the majority of parents liked mathematics,
even though 65 parents agreed that the subject was difficult. An overwhelming majority of them encouraged their children with mathematics (statement 12) and were also able to help their children with mathematics (statement 7).

The data from the initial survey enabled me to compose the following picture of grade 8 parents at the school:

- There was a mixture of English-speaking and Xhosa-speaking parents, with Xhosa-speaking parents being in the majority; however, the Xhosa-speaking parents spoke English as a second language;
- they had a wide range of qualifications in mathematics with the majority having grade 10 mathematics as a minimum;
- their mathematics experiences at school were varied with some having negative experiences and others having favourable experiences;
- many were not aware of the school’s assessment policy;
- about half of them were not aware of outcomes-based education;
- many parents made contact with the school at some time to find out about their children’s progress;
- about 50% indicated that they attended school functions and were informed about changes in education;
- an overwhelming majority stated that they monitor the television viewing of their children and are able to assist their children with homework; this number is reduced when it comes to mathematics homework;
- the majority of them stated that they wanted to participate in a parent-assistance programme for mathematics; and
- they view mathematics as an important subject and have encouraged their children in the subject; they would like their children to do well in mathematics, despite some of them having negative experiences of mathematics when they were at school.

In collecting data such as those obtained from the initial survey there can be no guarantee that the information is reliable. Parents can say what they think I wanted to hear or may say what they consider to be socially correct. In an ideal world the literature
indicates that if so many of these parents were so positive about mathematics then their children’s performance should have been exceptional. Conversations with the mathematics teachers at this particular school indicated that learners generally struggle with mathematics.

Key points from the initial survey such as awareness of outcomes-based education, assistance with mathematics homework, assessment of mathematics and the applications of mathematics, some elements of the literature review in Chapter 2 and other sources were used in designing a parent-assistance programme for mathematics. One of the key components of the parent assistance programme was a workshop.

4.3 The parent workshops

The three parent workshops followed the same format. The first workshop (in case study 1) took place on a Tuesday evening. The parents of the first workshop suggested that future workshops be changed to a Saturday afternoon. This suggestion was accepted and workshop 2 (in case study 2) and workshop 3 (in case study 3) were held on Saturday afternoons. Five parents participated in the first workshop, eight parents participated in the second one and five parents participated in the third workshop. The workshops proceeded as follows.

The grade 8 head welcomed the parents to the workshop and introduced me to the parents. She explained to parents that I was involved in a doctoral study on parental involvement in mathematics and wanted them to participate in my study. Their attendance at the workshop was the first part of this participation. The purpose of the workshop was to show them how they could get involved and be supportive of their children’s mathematics learning. As indicated by the initial survey a large number of parents were not aware of outcomes-based education.

Thus, the grade 8 head helped in this regard by outlining to parents the principles of outcomes-based education.
There were two grade 8 mathematics teachers at the school. They attended the workshops in rotation but presented the same information to the parents. Using the National Department of Education Senior Phase Policy Document (DoE 1997) and their own experience as teachers, they were able to give detailed explanations about the application of outcomes-based education in mathematics. They informed parents that:

Outcomes-based education in mathematics was about active learning which encouraged learners to experiment, to build, to investigate and to try out and test new ideas; it also encouraged learners to share their ideas with others, especially during group work; mathematics could be used as a useful tool for solving practical social problems; the rules of work were changing and that it was not only about being smart and having a skill, as these are taken for granted; it was about how well you manage yourself and work effectively with other people; and work in the 21st century was about self-reliance, life-long learning and adapting to a changing environment.

One concern emerging from the initial survey was a large number of parents not being aware of the school assessment plan. As part of their contribution to the workshop, the mathematics teachers informed parents about assessment in mathematics. Parents were informed that their children were now assessed according to the demonstration of outcomes. The assessment was based on specific criteria and was continuous in nature. The teachers also outlined the components of continuous assessment for mathematics in grade 8 (DoE 2001) and the weighting of each component. The grade 8 year plan (Appendix 6) for mathematics was discussed. This plan consisted of the topics that were to be taught during the four terms and covered the specific outcomes (now called learning outcomes) for mathematics.

In all three case studies, parents expressed their gratitude for the information about outcomes-based education and its application to mathematics. They discovered that the new system was different from the one that they were used to. They were used to a system that focused on knowledge. However, in addition to knowledge, outcomes-based education also focused on skills, attitudes and values, and this was new to them. The contributions by the mathematics teachers to the workshop alerted parents to the significant role they could play in their children’s education. In all three case studies, parents stated they were grateful for having access to the grade 8 year plan for
mathematics as this plan would enable them to monitor their children’s mathematics work more closely and check if their children were coping with the work.

I then taught a lesson from the grade 8 learning programme to the parents (Appendix 2). The lesson was on “the product of two negative numbers”. This lesson was chosen as it was usually a very abstract concept to explain to grade 8 learners. In this regard, “2 x 3 could be easily explained as 2 rows of 3”; “3 x 2 could be explained as 3 rows of 2”. However, this method could not be used to find (-2) x (-3). It is also my experience that grade 8 teachers have difficulty explaining this concept to their learners and usually just give them the answer.

In this lesson, parents were taught, using two different but easy ways, that (-2) x (-3) = +6. They followed the lesson closely and all parents demonstrated a very good understanding of the work. They were then asked to work out a few examples in class and they attempted this with a great deal of enthusiasm. The objective of teaching this lesson to parents was to build their confidence in mathematics and show them that they could also participate in a mathematics lesson. It would appear from the responses and the actions of parents in the lesson, that this objective was achieved. After the lesson had been completed, parents were asked to give their views on the lesson.

All parents were very appreciative that I had taken the time to teach them a lesson. Some of the comments from parents such as “I can still do mathematics”; “I didn’t realise that mathematics could be so easy”; “The lesson was easy to follow”; “I got all my answers right”; “I enjoyed doing the exercise” appear to show their enjoyment of the lesson and their positive attitude on successfully working out the exercises. At the end of the lesson it was hoped that parents were motivated and that they would be more positive about the rest of the parent-assistance programme.

After the completion of the lesson, the next part of the workshop commenced. This was a discussion of the parent-assistance programme document (appendix 3) which I facilitated in an informal manner. I explained to them that the parent assistance
programme would attempt to give them guidelines on how they, as parents, could be of assistance to their children in mathematics. In all three case studies, parents expressed their gratitude that an “outsider” (me) had come to them with a programme to assist them. They were very keen and enthusiastic. Overall, the discussions proceeded very smoothly, with parents making notes where necessary. The parents in the first workshop (case-study 1) did not offer any significant comment during the discussion. They just stated that they were happy to have some guidelines on how to support their children’s mathematics learning.

During the second workshop (case study 2), parents complained that their children did not get mathematics homework regularly. However, this was contradicted by the mathematics teacher present. She stated that mathematics homework was given regularly. She also made mention of a mathematics project which was due the following week. However, it appeared that none of the parents knew about this project. After further discussion on the matter, it emerged that homework was given regularly but that it was not properly recorded. It would seem that the learners of the school did not have proper homework diaries where assessment tasks could be recorded. The grade head noted this and promised to take this up with the management team at the school.

During the third workshop (case study 3) the parents, as in the first workshop, did not offer any significant comment during the discussion. However, they were happy to receive guidelines on how to support their children’s mathematics learning. It was reassuring to note that the school management team took note of the grade head’s report of learners not having proper homework diaries (from workshop 2). By the third workshop each learner at the school had started using a homework diary.

At the conclusion of each workshop, parents were each given a journal to complete over a 7 week period (Appendix 4). I went through the journal with the parents and gave them guidance on its completion. There were instructions on the front cover of the journal stating which parts parents and children should, respectively, complete. However,
the full responsibility for the completion of the journal lay with the parent. The parent acted as the initiator and the parts that were to be filled in by children had to be completed under parent supervision.

4.4 Telephonic interviews

Telephonic interviews were conducted with parents during each case study of the programme. This was done to motivate and advise them as well as support their efforts as "participant observers." Each parent was contacted twice during the journaling period. Most parents indicated during the calls that they were following the programme and had started completing the journals. They also thanked me for the interest shown in them. Those parents that had delayed starting the programme promised that they would make an immediate start with the programme. It was later revealed in the journals that parents found these calls to be very motivating.

In sections 4.5 – 4.10 the data collected from the journals, the follow-up questionnaires and the interviews with parents and teachers are analysed. Each case study was analysed for all three aspects of the data collection. Since all three case studies followed the same format, it is likely that they would be similar. To avoid repetition, there is an in-depth analysis of one aspect of the data, for each case. From case study 1, there is an in-depth analysis of the journals; from case study 2, an analysis of the follow-up questionnaires and for case study 3 the follow-up interviews were analysed. The data analysis ends with the combined focus group discussions.
The diagram below illustrates how the data will be presented and analysed.

![Diagram](image.png)

Figure: 4.1 Presentation and analysis of data

### 4.5 Case study 1 (the journals)

Five parents participated in this case study. These parents are referred to as A, B, C, D and E. Although all parents attempted to complete the journals, some parents did not complete certain sections of the journals. Also, some parents gave more details than others. The data are presented in the order stipulated in the journals, with an additional item, the telephonic interviews, included at the end.

#### 4.5.1 Discussion on school

Most parents completed this section of the journal and were able to report a wide range of discussions with their children.
The discussions included both personal and school matters. Parent A gave an informative account of the discussions with her son. The topics discussed included matters of a hygienic nature, the writing of an English essay about childhood memories and preparation for the Entrepreneur’s Day school function, preparation for English and Afrikaans orals and studying for a Human and Social Sciences test. He did not prepare for the Afrikaans oral and had to serve detention as punishment. He also completed an Economic and Management Sciences assignment.

Parent B did not complete this section. Parent C was not specific about the discussions that he had with his daughter. He reported that he had regular discussions his daughter about her schoolwork. They usually spoke about her progress in her various subjects and if there were any projects and other assessments that had to be completed.

Parent D spoke to her son about his poor performances in some of his subjects. Her son was having difficulty with mathematics, especially geometry, and they tried to discuss ways in which he could improve in this section of the work. She indicated that she also regularly checked his books and asked him to complete unfinished work.

Parent E discussed the parent-participation programme with her daughter. She told her daughter it was a very informative programme and showed her the notes she had received at the parent’s workshop. She also described some of the activities that took place at the parent workshop and the fact that “mathematics is all around us.” Her daughter also told her that she would be participating in the “Entrepreneur’s Day” at the school and hoped that her contribution would be a success. They also discussed and planned a revision programme for the forthcoming examinations.
4.5.2 Mathematics homework

All parents indicated that they checked and signed their children’s homework regularly. In some instances, they also helped their children to interpret the homework.

Parents A, C and D indicated that they assisted their children with their mathematics homework. Even though parent B did not complete the section on “discussion on school”, her child spoke to her about the mathematics she was learning at school. This interested parent B to such an extent that she claimed that she was learning mathematics from her daughter. Parent E stated that she always checked her child’s mathematics homework. She found that her daughter coped well and required little assistance from her.

4.5.3 Interaction with the mathematics teacher

Three parents (parents A, B and E) indicated that they initiated contact with their children’s mathematics teachers. Parent A indicated that her son had difficulty with the topics “power of a power” and “power of a product.” She was unable to assist her son with this work and the help of the mathematics teacher was sought. Parent B indicated that she had met her daughter’s mathematics teacher on three occasions. She had discussed her daughter’s work with her teacher. She stated that the teacher was satisfied that her daughter was coping. Parent E indicated that she had met her child’s mathematics teacher during a parent-teacher meeting. The mathematics teacher was full of praise about her daughter’s work.

It would appear that these parents found it easy to communicate with the teachers and this communication made them aware of their children’s progress.

4.5.4 Child’s mathematics experiences at school

There was a great deal of evidence in the journals to suggest that the children were discussing the mathematics that they learnt at school with their parents. All children (with
the exception of parent C’s child) were able to list mathematics topics or sections that they had done in their mathematics classes. The following topics or sections were listed.

- The meaning of algebra, and substitution where numbers are substituted for letters;
- the power of a power and the power of a product;
- multiplying the terms according to the given power; an example of this was $$(2x^2)^2 = (2x^2) \times (2x^2) = 4x^4$$;
- prime factors are factors that can only be divided by itself and 1;
- square roots;
- the meaning of terms and expressions in mathematics;
- the meaning of monomial, binomial, trinomial and polynomial;
- complementary adjacent angles;
- parallel lines, and parallel lines intersected by a transversal;
- describing three types of algebraic patterns;
- explain and describe how flow charts are used in translating flow diagrams into algebraic sentences, e.g. \( y \to -7 \to (y-7) \times 2 = 2(y-7) \);
- word problems;
- algebraic addition where only like terms may be added:
  \[
  \begin{align*}
  &a + b + 2c \\
  &2b + 3c \\
  &a + 3b + 5c
  \end{align*}
  \]
- simplification of expressions such as: \( 4x + 3x + 7x + 2y + 5y = 14x + 7y \);
- complementary and supplementary angles;
- drawing and describing parallel lines; and
- alternate angles and corresponding angles.

This section is significant as it would appear that the children found the mathematics they did in class interesting and successfully completed their class exercises. This may have enabled them to remember what they did in class and write about it.
4.5.5 Child’s mathematics experiences at home and in the environment

The inclusion of this item in the journal was for children to see that mathematics could be linked to real-life experiences. In this regard they were able to come up with novel and interesting ways in which they experienced mathematics at home and in their neighbourhoods. Some of these were:

- Learning a mathematical card game (Maths 24) which helped in the development of calculating skills;
- counting the laps covered by different cars in motor racing and determining which car was leading and which cars did not complete the race;
- measuring ingredients correctly to get the right consistency when baking a cake;
- watching mathematics lessons on the learning channel on a Saturday morning;
- choosing items and calculating costs during grocery shopping;
- the use of mathematical concepts, such as angles, perimeter and area when building houses;
- sleeping at an angle at night;
- observing that dishes were usually round had an angle of $360^0$; and
- the angles between the walls in one’s home were usually $90^0$.

4.5.6 Mathematics in the home

The grocery shopping activity was included in the journal as it was one way in which children could practise their mathematical skills of estimating, budgeting and calculating. Four of the five children completed this section. The grocery items were listed with the quantity of items and the appropriate weights and measures indicated.

The parents used the following words to describe their children’s reactions on being asked to draw up the grocery lists: eager and excited, enjoyed, interested. Parents stated that the shopping experience was an important social outing for them and their children. They claimed that the experience was also educational and informative.
In responding to what they learnt from the shopping experience, the children stated that:

- They became aware of the prices of goods;
- they learnt how to select quality products at "good prices" or bargains;
- they were able to count, measure or weigh articles;
- they became aware of what the weights and measures of the different goods were;
- they were able to compare prices in respect of brands; and
- they learnt about financial responsibility by keeping to a budget.

The section on mathematics in the newspaper was included in the journal because the newspaper was a rich source of mathematical information which parents could use in promoting the mathematical development of their children. However, this section was attempted with limited success. Only two journals had any information about the temperature readings and one journal had information about the rand-dollar exchange.

4.5.7 Parents’ views on the programme

Of the five parents in case 1, three parents completed this section of the journal. Parents B and E left this section out. The other parents were able to list very specific views on the parent-assistance programme.

Parent A believed that she would never be able to do mathematics, but being in this programme helped change this attitude. She described her interaction with her son as “fun and challenging”, and stated that her son was always excited about new challenges in mathematics. She learnt, from being in the programme, that it was possible for parents to understand, guide and assist their children “in their journey through education”. This was especially important in a subject like mathematics. Her son had learnt that he could rely on the support of his parents, teachers or peers to assist him and help him achieve more in mathematics.
Parent A was complimentary of the programme and stated that “children who are encouraged to do well in school would be certain of being successful when they leave school”. She felt that this programme should be implemented in the earlier grades.

Parent C stated that he and his wife were very involved in their daughter's schoolwork and if she had any difficulty with her work she could turn to them for assistance. His daughter had learnt that for one to be successful in mathematics, one had to be disciplined and be able to concentrate on the work at hand. Parent C indicated that one of the highlights of the programme for him was finding out “easier or simplified ways of studying mathematics”. He also learned that it is important to have a good understanding of mathematics if you are to be successful in the subject. He indicated that he had not liked mathematics in the past. By attending the parents' workshop and participating in the parent assistance programme, he had now developed an appreciation for the subject. He repeated the sentiments expressed by parent A about implementing this programme in the earlier grades.

Parent D stated that when interacting with her son, she was able to find out about his weak areas in mathematics. She had learnt helpful hints on how to check and support her son's schoolwork, in general, and with mathematics, in particular. She also said that her son had become more responsible when it came to his schoolwork. However, parent D indicated that she wanted to be given more mathematics exercises or study guides. She would give these to her son to work through as revision.

4.5.8 Telephonic interviews

I kept in telephonic contact with the parents. This was to monitor the implementation of the programme as well as offer advice and support to parents. All parents were contacted twice.

Parent A had indicated that she had commenced the programme and was grateful to be part of such an important programme. She felt motivated by the calls and was
appreciative of my interest in her child. She also suggested that the programme be expanded to include other parents and their children.

Parent B stated that she had started completing the journals but could not give it her full attention as her mother was ill. When she was contacted the second time, she stated that the programme was on track and had found it “interesting”. She qualified the term “interesting” by saying that the programme gave her some structure to work with when discussing schoolwork with her daughter.

Parent C told me that he and his wife were always supportive of their daughter’s work and that it was easy for them to follow the programme. He added that he mentioned the programme to some family members. They appeared to be impressed and hoped for something similar in their area. When contacted a seconded time, he stated that his daughter was enjoying the homework support that she was getting from him and his wife.

Parent D reported that she was having “good communication with her son” regarding his schoolwork. She also reported that her son was responding well to the programme and that it was having “a positive effect on his mathematics and his other subjects”.

Parent E had not started the programme despite being pestered by her daughter. She expressed her thanks to me for phoning her and responded that the phone call would motivate her to start the programme. When contacted a second time, she reported that she had difficulty completing the journal during the week as she worked long and late hours and when she got home her daughter was asleep. This problem was partially solved over the weekend when she attempted to interact with her daughter and complete the journals. She could not say if her daughter’s work had improved at school.
4.6 Analysis of the journal data

It would appear that, based on the responses given in the journals, there were varying degrees of parental intervention during the programme. This was real, intensive intervention for parents A, C and D as these parents gave fairly detailed responses. At the same time the responses by parents B and E were lacking in detail and some sections were left out. It would appear that in these two instances parental intervention was at a more superficial level.

In respect of discussions with their children about school, some parents focused on general issues while others focused on what happened in the mathematics classroom. As far as homework was concerned, parents usually checked their children’s homework and signed their homework diaries. They also tried to help their children with homework when called upon to do so.

Some children were able to give detailed descriptions of what mathematics they learned at school while others gave brief descriptions. This was also the case with their mathematics experiences at home and in the environment. As far as the compilation of the grocery list and the shopping experience were concerned, nearly all parents and children expressed positive thoughts about this activity. The children were eager and excited about drawing up the lists while parents welcomed the assistance given by their children. Children got to know the prices of goods and got to relate this to their family’s spending capacity.

The activity on the temperature was only completed by two of the children. They were able to answer questions based on the readings but made mistakes when calculating the average highest and average lowest temperatures. Only one child completed the rand-dollar exchange activity. Although, an activity on currency exchange was done in the parent workshop, it would appear that parents did not have sufficient practice in these calculations and could not assist their children in this regard. It is likely that the concept of currency exchange was not part of the parents’ experiences. As a result the rand-dollar exchange may have no meaning to them.
To make children aware of average temperature and currency exchanges, mathematics teachers could show them how to do some of these calculations in class. Actual temperature and currency values could be obtained from the newspaper. Parents could learn about these calculations from their children.

Parents appeared to give favourable views about the programme. They enjoyed interacting with their children and were able to follow the guidelines given and support their children’s mathematics learning. They found out what their children were doing in mathematics and learnt from them. The children appreciated this interest in their work and were pleased to show their parents their work. Parents also commented that they learnt more about mathematics in the home and outside environment. This stimulated their interest in the programme.

The evidence supplied by parents B and E in the journals was not sufficient to indicate if there were changed perceptions of mathematics in them or their children. The evidence supplied by parents A, C and D was of sufficient detail for it to be possible to detect changed perceptions about mathematics in themselves and their children. In this regard, the following data may be relevant.

Parent A’s attitude changed from believing that she would never be able to do mathematics to one of realising that it was possible for parents to understand, guide and assist their children “in their journey through education”. Her son reported that he found the support of his parents very encouraging and although he had liked mathematics from grade 1, he found that the involvement of his parents in his work to be a contributing factor in the improvement of his mathematics results.

Parent C stated that he had not liked mathematics in the past but his attendance at the parents’ workshop and participation in the programme made him aware of “easier and simplified ways of studying mathematics“ and he had now developed an appreciation for mathematics. He claimed that his daughter had learnt that to be successful in mathematics, she had to be disciplined and concentrate on the work at hand.
His daughter stated that she used to hate mathematics. However, as a result of her father’s help, support and encouragement, she has now grown to love the subject. She claimed she had a better understanding of mathematics and there was an improvement in her results.

Parent D said that she did mathematics right up to grade 12 and found it to be “a boring subject; this perception had now changed. She now found problem solving to be “exciting”. She learnt helpful hints on how to check and support her son’s work. She claimed that he had become more responsible when it came to his schoolwork. Her son remarked that his participation in the programme made him develop a liking for mathematics and aware of the “fun” nature of mathematics. Previously, he did not care about mathematics and did not complete his mathematics homework. Now, he liked mathematics and made every effort to complete his homework every day.

For three of the five parents (parents A, C and D) in case 1, their participation in the programme appeared to impact positively on the way they perceived mathematics. It is likely that these changed perceptions were as a result of them being intensively and meaningfully involved in the programme. These changed perceptions of mathematics also appeared to influence their children’s perceptions of mathematics.

For parents B and E certain home circumstances may have prevented intensive and meaningful involvement in the programme. Both parents did not respond to the last section of the journal where they had to give their views of the programme. Parent B also left out the grocery shopping activity. As a result, it was not possible to detect any changed perceptions in these parents and their children from their journal data.

4.7 Case study 2 (follow-up questionnaires)

A new set of parents participated in case study 2. Of the eight parents that participated in this case study, six parents completed the journals. Thus, only the data for these six parents are reported. For purposes of reporting the data of these parents, the parents are called F, G, H, I, J and K. This section deals with data from the follow-up questionnaires.
4.7.1 Parent F and his daughter

Parent F stated that one of the highlights of the programme was the emphasis on the importance of the parent-teacher-learner relationship. He stressed that parents should take ownership of their children's development and progress in school. He stated that he was often out of town. When he got back home, he found that his daughter's mathematics work, although complete and correct, was not dated. He, thus, had difficulty in checking what work was covered in the time that he was out of town. He felt strongly that teachers should encourage learners to write down the date when they are doing their class work or homework.

Teachers should also regularly mark, sign and date the work done. This would make it easier for parents to do the necessary follow up. In the meantime, he told his daughter to write the date of work done at school as this would enable them to keep track of what was done on a daily basis.

Parent F said that his style of learning mathematics, that of memorising, was not as effective when compared to the latest methods of learning mathematics. He commented on how he learnt mathematics at school. He used to memorise formulae and rules. He believed that today's learners should understand the basic principles when doing mathematics and refrain from memorising formulae and rules. This comment by parent F would seem to indicate that he had changed the way he viewed mathematics. This is evidence of a changed perception.

This programme emphasised to him the importance of parental involvement in their children's education. After being in this programme, he believed that parents needed to monitor their children's progress in mathematics and help them where possible. The mathematics textbook may also be a source of help to parents. This would enable them to follow what was going on and also help them when they explained certain solutions of problems to their children. He stated that he was very happy to be part of the programme.
Parent F’s daughter stated the highlight of the programme for her was the way the parent-teacher-learner relationship operated. She stated that she was getting support at school and at home and this motivated her. One of the problems experienced was when her parents were out of town and this meant there would be no support for her. However, she said that she would do mathematics every day, even if there were no mathematics classes the next day. As a result of being in the programme, her understanding of mathematics became much clearer. This was why she was able to work on her own. However, sometimes she would need help and her father would help her. She was always able to complete her work on time and she did not need to use her spare time to complete the work. She reported that she had done very well in her last mathematics class test and her previous mathematics examination.

Parent F’s daughter stated that her participation in the programme enabled her to learn more about the importance of mathematics in our daily lives. She said that when doing homework, it was important to first understand the problem and then solve it. She believed that mathematics video-cassettes or audio-cassettes would be of use to parents when they assisted their children.

4.7.2 Parent G and his daughter

Parent G reported that one of the highlights of the programme for him was learning about the mathematics that his daughter was doing. Both he and his wife found the programme very “useful” and “interesting” and they were also able to learn from their daughter. They did not experience any difficulty with the programme as both he and his wife were involved with his daughter’s work. She arrived home earlier than he did and she did an initial check on their daughter’s work, and when he arrived home, he followed up on what had been done. Parent G believed that mathematics is interesting and can become simpler “if you are at it” everyday.

He stated that mathematics used to be a “big rush” for his daughter. However, she has now become more patient when doing her work and she knew if she had any problems, she would get assistance from her parents. She enjoyed this attention from her parents and she developed a more positive attitude to mathematics.
Parent G’s daughter said the highlight for her was the interaction with her parents. She was grateful for the interest that her parents had shown in her work. She also enjoyed the grocery shopping experience and the activity on the temperatures. This made her see that “mathematics is all around us”. However, she found the activity on the currency exchange to be a bit difficult. Nevertheless, her confidence in mathematics grew and she was able to help her mother with stock control calculations in her home-based business.

Parent G’s daughter stated that although she enjoyed mathematics, she found it to be stressful at times. However, she now knew that she would get support from her parents if she was struggling with mathematics. She claimed that she did well in her tests and other assessments in this period.

4.7.3 Parent H and his daughter

For parent H, the highlight of the programme was a new “awareness” of the mathematics that his daughter was doing. Although, he indicated that a lack of time was one of the difficulties in following the programme, he made every effort to make time and implement the programme. He had learnt to get involved in his child’s work and work with her in completing the activities posed in the programme. Parent H had, initially, felt that only the teacher was able to guide or teach his daughter mathematics. However, after following this programme, he believed that he had a role to play as well. He would be able to do problem solving with his daughter and offer her support and guidance when necessary. He also believed that schools should implement parent-assistance programmes for all parents.

The highlight for his daughter was being able to gather information on temperature readings and the rand-dollar exchange. She also enjoyed the way in which her parents got involved with her work and how “we all worked” together. The programme taught her new things and she was able to attempt her mathematics homework and complete it on time. She also learnt that it was important to read questions properly and answer the questions carefully. She described her performance in the various mathematics assessments as average. She wanted more examples of a practical nature to be included in the parent-assistance programme.
4.7.4 Parent I and her daughter

Parent I said that the highlight for her was “learning with my child”. She gave a specific example in this regard. She had difficulty understanding the tessellation concept. During her interaction with her daughter in the programme, her daughter was able to explain this concept to her and she now understood this concept clearly. Although she had no specific view on mathematics prior to participating in the programme, she found that working with her child and helping her child was “interesting”.

Her daughter indicated that one of the highlights of the programme was being able to look for mathematics all around us. Her mother helped her in this regard by referring to the notes received from the parents' workshop. At the workshop I informed parents about the popular TV programme “A word or two”. This programme involves making up words and doing mathematical calculations. Parent I told her daughter about this programme and they decided to watch the programme together and they challenged each other.

Parent I’s daughter stated that, as a result of her mother’s attendance at the parents’ workshop, there was now better cooperation between the two of them. She knew if she had any difficulties with mathematics, her mother would be able to help her. She was now enjoying the subject and claimed her mathematics was improving. She stated that she liked learning about mathematics on TV. She found it “funny” that one could watch TV and be involved in mathematical activities at the same time, citing the examples of the temperature readings and the currency exchange, which were part of the activities of the programme. In commenting on the programme, she stated that she would have liked activities relating to negative and positive numbers to be included in the programme. At the same time she wanted the rand-dollar exchange activity to be removed.
4.7.5 Parent J and his daughter

For parent J one of the highlights of the programme was being able to sit with his daughter and have discussions about her work. In these discussions they were able to find out what her weak areas were and look at ways of overcoming them. However, because he usually worked late hours, he was not always able to have these discussions during the week. Thus, some discussions took place over the weekend.

He stated that in the past his daughter used to struggle with mathematics and that he did not have the confidence to help her. However, he had recently completed his ABET Level 4 mathematics and the knowledge gained from this course, together with his participation in the parent-assistance programme, made him more confident of helping his daughter in mathematics. He was able to show his daughter simpler methods of working out mathematics exercises. She now had a better understanding of mathematics and her results were improving. He believed that improvement would only occur if children understood the mathematics being studied. He remarked that if the subject matter got a bit difficult, ways should be found to make it more “user-friendly” to the children.

Parent J's daughter said the highlight of the programme for her was her interaction with her father and the interest that he had shown in her work. He was able to show her “easier” methods of working out mathematics. She claimed that her understanding of mathematics improved as a result of her father's assistance and she was confident of improving in the next assessment period.

She enjoyed the grocery shopping activity and was “excited” about drawing up the grocery list and estimating the prices. She was able to examine the different measures of the same items and compare their prices. She also enjoyed the activity on the temperature readings but did not understand currency exchange and wanted this activity to be removed.
4.7.6 Parent K and her daughter

The programme appeared to have a very significant impact on parent K. She described her highlights as learning about mathematics in the home, recognising that grocery shopping could enhance one's mathematical skills and identifying geometric shapes in the home and environment. Parent K claimed that she was not good at mathematics but tried to help her daughter with the easy parts of the work. She had difficulty in understanding the share prices and the rand-dollar exchange.

Before participating in the programme, she was not able to help her daughter in mathematics and her daughter was not serious about mathematics. The programme gave her guidelines on how to support her daughter with mathematics. She claimed that this support resulted in some improvement in her daughter's work.

Her daughter found geometric shapes in the home and environment to be "very interesting". She described the interaction with her mother, in the implementation of the programme, as one of mutual respect. She found that if she did not understand the mathematics, she would get "edgy, moody and angry" with herself. However, with the support of her mother, there had been some change in her attitude. She said that sometimes the mathematics was difficult but she tried to finish her work on time. She also claimed that her results had improved as a result of her mother's support.

Parent K’s daughter indicated that she had learnt a lot from being in the programme. Some of the highlights for her were the recording of temperatures and the calculations that followed, drawing up a shopping list and estimating prices and then being able to calculate the prices correctly before going to pay at the till. She had difficulty with the rand-dollar exchange and needed a clearer explanation in understanding this concept.
4.8 Analysis of the data from the follow-up questionnaires

It would appear from the responses in the follow-up questionnaires that parents found the parent-assistance programme very stimulating and rewarding. In this regard, they described a number of highlights of the programme. Some of these highlights were:

“The importance of the parent-teacher-learner relationship”; “Learning about the mathematics my daughter was doing”; “A new awareness of the mathematics my daughter was doing”; “Learning with my child”; “Sitting and having discussions with my daughter”; “Learning about mathematics in the home, the grocery shopping experience and recognising geometric shapes in the home and environment”.

It is possible that these highlights contributed to the successful implementation of the programme. Some parents experienced difficulty in following the programme, citing work commitments and lack of time. This difficulty was overcome by parents using the weekend to catch up on any aspect of the programme not done during the week.

Parents stated that they became more aware of their role in supporting and assisting their children’s mathematical development. They had regular discussions with their children and these discussions made them aware of the mathematics they were doing. They also checked their children’s homework regularly and signed their books. Parents stated that they enjoyed the activities that were included in the programme and helped their children when necessary. These activities made them aware of the applications of mathematics.

According to the evidence generated from the follow-up questionnaires in case study 2, it would appear that there was real parental intervention in the mathematics learning of the children. This intervention effected change in both parents’ and children’s perceptions of mathematics and the following comment by parents and children appears to support this claim:
Parent F recalled that his style of learning mathematics at school, that of memorising formulae and rules, was not a very effective way of learning. He believed that today’s learners should understand the basic principles when doing mathematics and refrain from memorising formulae and rules. His daughter stated that the support she was getting at home “motivated her” and her “understanding of mathematics” became much clearer. She did well in her latest mathematics test.

Parent G stated that both he and his wife found the programme very “useful” and “interesting”. They were also able to “learn” mathematics from their daughter. His daughter used to do her mathematics in a rushed manner but has now become “more patient” when doing her work. She knew if she had any problems she would get assistance from her parents. She enjoyed this attention from her parents and she developed a more positive attitude to mathematics. The highlight for parent G’s daughter was the “interaction with her parents”. Her confidence in mathematics grew and she did well in her tests and other assessments.

Parent H stated that after following this programme, he believed he “had a role to play” in his daughter’s mathematics learning. He would do problem solving with his daughter and give her support and guidance when needed. His daughter claimed she learnt new things like the application of mathematics in the home and environment. Her participation in the programme had given her confidence to attempt her mathematics homework and complete it within a specified time.

Parent I said she had difficulty understanding the tessellation concept which was new to her. Her daughter was able to explain the concept to her during their interaction and she “understood the concept more clearly”. They participated in mathematics activities together. This included viewing the television programme, “A word or two” where they competed against one another. Her daughter commented on the “better cooperation” between the two of them. She learnt a lot from interacting with her mother and claimed she was “improving” in mathematics.
Parent J stated that his daughter used to struggle with mathematics and he was not confident enough to help her. He had completed a mathematics course and the knowledge gained from this course, together with his participation in the parent-assistance programme, enabled him to become more confident in mathematics. He was now more competent in mathematics and was able to help her. She now had a better understanding of mathematics and her results were improving.

Parent K claimed that the programme gave her guidelines on how to support her daughter in mathematics and this support resulted in some improvement in her work. Her daughter said that if she did not understand the mathematics, she would get irritable. However, with the support of her mother, there had been some change in her attitude. She claimed that her results had improved as a result of her mother’s support.

The programme appeared to have a positive impact on both the parents and children in case study 2. The parent intervention had resulted in the changed perceptions of both parents and children.

4.9 The follow-up interviews with parents and teachers: case-study 3

Five parents participated in case study 3. For purposes of reporting the data, these parents are called L, M, N, O and P. The follow-up interviews with parents and teachers will be discussed. These interviews took place two months after the completion of the parent-assistance programme and just prior to the focus group discussions.

4.9.1 Parent L

Prior to their participation in the programme, parent L stated that her daughter used to do her mathematics on her own and then asked her to check the work. She then went over the work with her daughter and helped her with corrections. This continued until she reached grade 7. In grade 7 she found some of the mathematical concepts to be a bit difficult.
By her participation in the parent-assistance programme, parent L claimed that she learnt more on how to support her daughter’s mathematics learning. As a result of this support, her daughter rediscovered her love for mathematics. She was more confident, communication was better and she was not shy to show her mother her work. She had started doing well in mathematics, getting over 75% in her assessments compared to the 60% that she used to get. Parent L claimed that her daughter now enjoyed mathematics as she was able to work out the exercises with relative ease. She understood the work and did not give up.

Parent L said “once you are confident in mathematics, you are not going to be scared.” She stated that she was still very involved in her daughter’s work. Her daughter also helped compile grocery lists and helped with the shopping. She also had a younger daughter and was involved in her work as well. She always checked their schoolwork and she made sure that they also did some schoolwork during the holidays.

Parent L commented that she, as a parent, had always enjoyed mathematics and that “it is the basis for everything you do in life”. She stated that there was no need to contact her older daughter’s mathematics teacher as she was satisfied with her work. However, she said that she would try to meet with the teacher in the new term to “find out more about the new methods that are used in mathematics so I am better equipped to help my daughter”.

She believed that mathematics was a key subject in the curriculum. Thus, she was confident of her daughter continuing with mathematics in grade 10 as her daughter wanted to pursue a career in the medical field.

When asked about what she recalled from the parent-assistance programme that was still valid, she replied that “communication with my child is now much better”. She said that one must have patience with one’s child; “let them understand in their own way and parents should explain to them at their level”. Her daughter used to be shy and did not want to show her books to her mother but there had been a change. They also enjoyed
the shopping experience and had begun to shop wisely. Parent L, commenting on the programme, said “It was really a very informative programme, which should be accessible to every parent. It really helped me understand my daughter better and to be patient with her. Her whole attitude has changed and she has become more confident.”

Parent L's daughter was described by her mathematics teacher as "a very positive and hardworking young girl, who always opens herself up to new learning experiences and is very enthusiastic about her mathematics." She always completed the tasks given with work of an average to above average standard. She liked to put in a little bit extra. Her results in mathematics were very good and her average stood at 79% at that stage. She was a very eager learner and asked lots of questions in class, especially when she did not understand. The teacher was pleased with her performance in mathematics and saw no need to make contact with her parents.

4.9.2 Parent M

Prior to their participation in the programme, parent M said her son used to do his work alone and in a rush. Although he had older brothers to help, he would work independently. Even though the change in her son was not drastic, she said “I found myself communicating with him better and he was showing me his work because I wanted to know how he was doing.”

Parent M said her son did well in his mathematics assessments during the period of the parent-assistance programme. She had made contact with his mathematics teacher who was very complimentary of his work. His average for mathematics at that stage was 89%. His average in mathematics had remained at this level up to the time of the interview.

Parent M indicated that her son has always enjoyed mathematics. He has a “flair for figures.” He enjoyed crossword puzzles and TV shows like “A Word or 2”. She had continued to be involved in his work, and he did not rush his work as he used to. She usually checked his work and signed his homework diary.
In response to how she found mathematics, parent M said "mathematics can be quite scary sometimes". Her job involved working with accounts so she is “working with figures all the time and this helps me in my understanding of mathematics”. She believed that “you need to know the basic things” in mathematics.

Parent M indicated that she phoned her son’s teacher about his progress in mathematics. The teacher replied that his work was fine and that his mathematics average at that stage was exceptional. Parent M stated that her son would definitely carry on with mathematics in grade 10. He wanted to go into the information technology field and mathematics was a prerequisite.

In reply to what she picked up from the programme that was still valid for their situation, parent M stated that she learnt that “communication between parent and child is very important for the parent to play a role in the child’s education”. She also said they found working with the “rand-dollar exchange problems to be informative and interesting”.

Parent M’s son was described by his mathematics teacher as “a very hard-working learner with a flair for mathematics”. She stated, further, that "he is not very confident but always produces excellent results.” He completed all tasks with diligence and care. His marks in the various mathematics tasks were always above 80%. In the recent assessment period, he showed improvement in his work with his average moving closer to 90%. In class he was a very quiet learner and never really communicated unless he was "stimulated individually". The teacher said that this was difficult in a big class. She saw no need to contact his parents as he was doing very well in mathematics.

4.9.3 Parent N

Parent N stated that prior to her participation in the programme, she had no communication with her daughter about her schoolwork. When her daughter was busy with her homework, she did it on her own or with her friend. This situation changed after parent N participated in the parent-assistance programme. There was now better
communication between the two of them. Parent N indicated that she now knew what was going on in her daughter’s work and also checked her work regularly.

Parent N stated that there was now an improvement in her daughter’s work and “she got a good percentage in mathematics”. She ascribed this improvement to the support she had given her daughter. The parent-assistance programme gave her guidelines on how to monitor and support her child’s mathematics learning. Her daughter now found mathematics a bit easier and “there is less complaining from her.” This was so because there was an improvement in her marks. Parent N claimed that she was still very involved in her daughter’s work and checked her work and signed her homework diary regularly.

Parent N stated that her participation in the programme was also a learning experience for her. It helped her as a parent. She found that when she did her grocery shopping, she made sure she budgeted properly so she could save money. These skills also helped her in different projects that she did for the church. She indicated that she made contact with the teacher to ask for assistance for her daughter and would contact the teacher again in the new term. She said that her child would most likely carry on with mathematics in grade 10 as she wanted to go into the medical or science field and mathematics would be a requirement.

It would appear that the parent-assistance programme may have had a major impact on parent N. She stated that she had learnt quite a bit from being in the programme. She had not had this opportunity when she was at school as she only went up to grade 9. This programme “changed the way I view things now and it brought me closer to my child.” She and her daughter found the activities informative and interesting, especially the reading of the daily temperatures and the rand-dollar exchange.

Parent N's daughter was described by her mathematics teacher as one who “works hard and has a positive attitude to mathematics”. She worked neatly and all work was completed accurately. Her average mark at that stage was 67% which was a major
improvement on the 50% that she had achieved previously. However, she was not very active in class and did not participate verbally in the lessons. The teacher ascribed this behaviour to shyness or not being sure. However, parent N approached her about helping her daughter in some of the work which her daughter was not sure of and she obliged.

4.9.4 Parent O

Prior to their participation in the programme, parent O stated that her son was very reluctant when it came to doing his mathematics homework. He struggled with the work and was too shy to come to her for assistance. As a result of her participation in the programme, he was now more willing to come to ask for assistance from his mother and was not shy any more.

Parent O said that her son did well in his mathematics assessments. His marks had improved and he “received his best marks ever in the last assessment period”. He was improving in mathematics all the time and had become more confident in the subject as he knew that his mother would help him.

She also stated that she was still involved in his work. She always checked his work and signed his homework diary. As a parent she used to “hate” mathematics. She only did mathematics up to grade 9. However, a few years ago, she tried to do further study in mathematics but stopped due to work commitments. Her participation in the parent-assistance programme made her realise that mathematics could be a very interesting subject.

She contacted her son’s mathematics teacher about his progress and the teacher replied that he was doing fine. Although parent O was not sure about her son’s future career choice, she appeared confident that he would continue with mathematics in grade 10. However, at the moment he just wanted to play soccer and become a professional soccer player. He was also good at chess.
It would appear that the programme may have impacted positively on both mother and son. Parent O said that the programme made them realise that “mathematics is all around us”. Whenever they saw a building, they tried to identify the different geometric shapes associated with the building. They were also able to see that “mathematics is used everyday in our lives”. Her son now appreciated mathematics even more.

Parent O’s son was described by his mathematics teacher as “always eager and keen to learn”. However, he tended to be slow when completing class work. He did not do homework on two or three occasions and this was noted in his homework diary. He was very quiet and shy in class and did not ask questions if he did not understand. If he was asked a question, he would give no response. His mother was very concerned about his progress and arranged a meeting with the teacher. At this meeting, the teacher informed her about his shyness and not asking questions in class. As a result of this meeting and their participation in the parent-assistance programme, there was a change in his attitude in class. The teacher claimed that she noticed that there was some improvement in his work just after their participation in the parent-assistance programme. She pointed out that this could have been through his mother’s involvement in his work.

4.9.5 Parent P

Prior to their participation in the programme, parent P stated that his son was not so good when doing his mathematics homework. When he did his mathematics homework, he tended to confuse signs and operations.

His son had a very demanding schedule with religious studies in the afternoons. Thus, they followed the parent-assistance programme in the evenings. Parent P stated that the programme gave him ideas on how he could support his son’s mathematics learning. This support was given in the evenings and was welcomed by his son.

As a result of his involvement in his son’s work, his son began to do very well in his mathematics assessments. In his last mathematics test, he achieved 81%, which was a major improvement for him. Parent P was very happy with these results. His son had
now started enjoying mathematics and was also becoming more competitive in the subject. Parent P stated that although he was involved in shift work, he still managed to find the time to check his son’s work and assist him when necessary, either in the evening or at the weekend.

Parent P was less complimentary of subjects like history, which he said were “bad subjects”. He said mathematics is an important subject as it prepared one for life and mathematics was also needed if “you do a trade or go into business.” He said that he kept in regular contact with his son’s mathematics teacher. The mathematics teacher was very happy with his son’s progress. Although his son had not made up his mind about what he wanted to do after completing grade 12, parent P stated that mathematics will be a key subject as it would give his son a wide variety of career options.

Parent P said that he had learnt a lot from the programme and everything that one did required mathematics. If you go shopping, then mathematics is involved. You also need to have a budget. He also said that when reading a newspaper “you will find mathematics everywhere.” He said that a programme of this nature could easily be adapted and used in other subjects, claiming that it gave parents a “vision” on how to help their children in their work. He concluded by saying if teachers promoted this programme, more parents would get involved in their children’s education.

Parent P’s son was, described by his mathematics teacher, as having “a fairly positive attitude and always striving to give of his best.” He was very competitive with his friends. He always did his work on time and his average at that stage was 81%. In class he tended to be playful but got his work done. Parent P contacted her regularly to find out about his son’s progress. She had noted the improvement in his results and was pleased with his progress. She conveyed these sentiments to parent P.

4.10 Analysis of the interviews with parents and teachers

Parents stated that, prior to their involvement in the programme, their children used to do their mathematics homework on their own and the work was usually done in a rush. Parents were not consulted or asked for assistance. It would appear that their
involvement in the programme may have helped to change this situation. In this regard, parents reported that the programme required them to interact closely with their children, and as a result communication with their children improved. Children showed parents their mathematics books and parents were able check and sign their work. Children also enjoyed this attention from their parents. Three parents also indicated they made contact with the mathematics teachers to find out about their children’s progress in mathematics. The feedback from the teachers was positive.

It would appear that the programme may have had a positive impact on the parents. They were able to recall a number of activities from the parents’ workshop and parent-assistance programme. Some of these activities such as identifying mathematics at home and in the environment, the share prices, rand-dollar exchange and the grocery shopping experience made parents and children appreciate mathematics even more.

All parents claimed that there was improvement in their children’s mathematics and this appeared to be corroborated by the mathematics teachers. The parents also indicated that it was highly likely that their children would take mathematics as a subject in grade 10. In three instances, mathematics was a prerequisite for the career choice of the children; in the other two no career choices were stated but these parents were convinced that doing mathematics would give their children a wide range of careers from which to choose.

It would appear that based on the evidence, generated from the interviews with parents in case study 3, there was real parental intervention in the children’s mathematics learning and this intervention resulted in changed perceptions in both parents and children. The following comments by parents may support this claim.

Parent L claimed she learnt more on how to support her daughter’s mathematics learning and as a result her daughter rediscovered her love for mathematics; her daughter was more confident, communication was better and she was not shy to show her mother her work. She was getting over 75% in her mathematics assessments; she now enjoyed mathematics and was able to work out the exercises with relative ease.
Parent L also said she had learnt to be more patient with her daughter. Her daughter was given an opportunity to have her own understanding of her work and took this into account when explaining to her. Parent L remarked that the programme was informative and should be accessible to every parent and commented on how it had helped her in her interaction with her daughter. She observed that her daughter’s attitude had been positively affected; she became more confident.

Parent M claimed that the programme improved the communication with her son. Communication between parent and child is very important for the parent to play a role in the child’s education. Her son began to show her his work because she asked to see it. He did very well in his mathematics and had a high average. Parent M commented that mathematics could be quite intimidating but found that her job, which involved working with figures, helped her in her understanding of mathematics.

Parent N reported that her participation in the programme resulted in better communication with her daughter and she now knew what was going on in her daughter’s work. There was improvement in her daughter’s work and she ascribed this to the support she had given her daughter. Parent N claimed that she had also learnt mathematical skills from the programme and she was able to use these skills in the different projects she did for the church. She said the programme changed the way she viewed things and it brought her closer to her daughter.

Parent O’s son used to struggle with mathematics and did not appear to be concerned about doing his mathematics homework. After their participation in the programme, his attitude changed to one of enthusiasm as he was not shy to ask his mother for assistance. He was also improving in mathematics and became more confident in the subject. Parent O stated that she used to “hate” mathematics but her participation in the programme had made her realise that mathematics could be a very interesting subject.

Parent P claimed that his son was not so good when doing his mathematics homework. The parent-assistance programme gave ideas on how he could help his son. This was
welcomed by his son and he began to do well in his mathematics assessments. His son was enjoying mathematics and becoming more competitive in the subject. Parent P claimed that he learnt a lot from the programme as it gave him very specific guidelines on helping his son in his schoolwork.

The mathematics teachers were interviewed to find out about the children’s attitude in the mathematics classroom, their levels of participation and their performance in mathematics. The mathematics teachers commented positively on the children, using the following descriptions:

“a very positive and hard-working young girl, always opens herself to new learning experiences and very enthusiastic about her mathematics”; “a very hard-working learner with a flair for mathematics”; “works hard and has a positive attitude to mathematics”; “always eager and keen to learn”; “a fairly positive attitude and always striving to give of his best.”

According to the teachers, all children improved and in four of the cases their percentages were improved. However, some children tended to be shy in class and did not contribute to the lessons. Although the teachers attempted to encourage their involvement, they found that this was difficult in large classes.

It is possible that the children’s participation in the programme-assistance programme may have contributed to the changes in their attitudes to mathematics and their improved performance. However, the teachers believed that a parent-assistance programme would work in the long term if there was a closer cooperation between parents and teachers.

4.11 Focus group discussions

After the follow-up interviews with the parents and teachers, all parents and children who participated in the three case studies, were invited to a central venue to share their experiences of the parent assistance programme. This took the form of focus group discussions. Of the 18 parents and children invited, 11 parents and their children
attended. The parents were placed in groups according to the case studies in which they were involved. All the children were placed in a single group. Two teachers and I worked with the parents and another teacher worked with the children. There were three focus group discussions, three comprising parents and one comprising the children.

Each group was asked to respond to the statement: "Discuss your experiences during the parent-assistance programme"

The parents of case study 1 were very keen to share their experiences with each other. All parents in the group claimed they learned a lot from the programme. The programme helped them understand how mathematics is used in their daily lives. The programme gave them a focus on how they could assist and support their children's mathematics learning. They enjoyed the interaction with their children. They were happy with the progress made by their children. The children had become more positive about mathematics and they enjoyed the interest shown by their parents in their work.

One parent stated that she had difficulty in getting started but a telephone call from me motivated her to start the programme. They continually checked their children's books to see if their work was completed and if they understood their work. Another parent stated that her older son's work used to be incomplete and was not marked and as a result he fared badly in mathematics, and she did not want the same to happen to her second son who was part of this programme; this programme also inspired this parent to start a study group for her daughter, who was in grade 6, and with her daughter's friends. The parents were full of praise for the programme and wanted the school to take the lead in implementing such programmes.

In case study 2 it was noted that the programme emphasised the importance of mathematics to the parents. They got involved and learnt at the same time. In some cases, the children felt that they should "relax" and the parents should do the work but parents did not allow this to happen. Some parents found the programme time-consuming. All parents stated that their children made progress in mathematics. The
programme had also given their children **confidence** to approach them or their teachers to ask for help. They were adamant that a **proper foundation** in mathematics in grades 8 and 9 was crucial for later success in mathematics. In this regard, they wanted teachers to play a more **active role** and form **partnerships with parents**. Parents agreed that the programme was a success. However, they felt it was important that a **strategic plan** be put in place for the **long-term success** of parental involvement at the school.

Again in case study 3 parents said they “**learned a lot from the programme**”. There was **better communication** between them and their children. They were able to pick up **problem areas** and **work through them**. One parent stated that her daughter was busy with religious studies in the afternoon so they used the evenings and week-end to complete the journal. This parent said that she had to **analyse** the work from her **daughter's way of thinking**. This enabled her daughter to understand the work better and her younger daughter also learnt from the experience. The **shopping experience** was an important **learning experience** for all of them; they learned to shop wisely and work with a **proper budget**. Although some children experienced **frustration** when they did **not understand** the work, they **appreciated** the support shown by their parents. One parent said the programme enabled them to have "**quality time**" together. Another parent, representing her husband, said the programme was “**good**” but they had insufficient time to complete all sections of the journal because her son was involved with religious studies in the afternoons.

The fourth group consisted of all 11 children present at the function. They found that before being in the programme, they would have **conflict** with their parents since their **parents' way** of doing mathematics was **different** from what the teacher did in class. They were **happy** to have their parents take an **interest** in their work but sometimes they became too "**in your face**". Parents were "**doing fine**" in their interactions with them. They also felt there was a need for parents to be **continually informed** of what the content was. They were fine then but the children were concerned about what would happen when the work changed. They understood that mathematics was **important**.
Two children were not so keen on mathematics before but now found it more acceptable; they liked it when they solved problems and found it frustrating when "things go wrong". However, one child in the group still found mathematics "confusing".

Through the focus group discussions more light was shed on the experiences of parents and children in the parent-assistance programme. In general the programme was seen as a learning experience by the parents. Communication between parents and children improved and parents enjoyed interacting with their children. Because the parents now understood some of the new ways of doing mathematics there was less conflict between parents and children. As a result the children enjoyed having their parents interested in their work. The children became keener in the subject and there was improvement in their results.

Parents were complimentary of the programme but expressed the need to be continually supported. They believed that teachers should play an active role in this process by forming partnerships with parents. In this regard, a long-term strategic plan for parent involvement needed to be put in place at the school.

**4.12 Summary**

This chapter focused on the first level of interrogation of the data, which involved the description, analysis and an initial interpretation of the data. The initial survey gave a perspective of where the parents were. The first part of this programme involved parents attending workshops where a number of key issues on their involvement in their children's mathematics learning were addressed. These workshops elicited some responses from the parents and these responses are outlined.

The workshops also helped prepare the parents for their role in the rest of the programme. They documented their interactions with their children in journals. These interactions provided key data which were augmented with data from follow-up questionnaires, interviews and focus group discussions.
Besides the description of the data, this interrogation involved a detailed analysis and interpretation of one event per case study. It also involved a discussion of the emergent trends from the focus group discussions. The second level of interrogation follows in the next chapter.
5.1 Introduction

There are two levels of interrogation in this study. The first level focused on the description of the data supplied by the parents and an initial interpretation thereof. This was addressed in Chapter 4. This chapter focuses on the second level of interrogation which is a further interpretation of the data.

The second level of interrogation is done by examining and interpreting the data from each case separately. The data, described in Chapter 4, are augmented by the data from other sources. Each case study and event analysed in Chapter 4 is used as a nucleus and the other events around the case study are used as a means of triangulation. The following diagram indicates how this will be done:

Figure 5.1 Interpretation of data (second level)
This interpretation is done within the context of the literature survey, where appropriate. The trends and features and resulting patterns of coherence from all three cases are then outlined, also within the context of the literature survey.

The claim by Wallen and Wallen (1978), that most parents would like to help their children succeed but they usually possess little knowledge of child development, appeared to have relevance for this study. The parents who participated in this study were keen to get involved in their children's mathematics education and help their children succeed but were not sure about the actual role they could play. The aim of the parent assistance programme was to give them an idea of what this role could be and was designed in such a manner that it would appeal to parents from a wide range of backgrounds.

The parents in the programme came from varied educational, social and cultural backgrounds. They all had the same desire; to get involved in their children’s mathematics education and help their children succeed. They believed that the parent assistance programme could help them achieve this desire.

5.2 Case study 1

The journal was used as the nucleus in case study 1. The details of the journal data appear in section 4.5 of Chapter 4.

The five parents of case study 1 participated in the programme with different levels of interest. At the workshop for parents of this case study, all parents appeared keen and interested in the programme. However, based on the data received from parents during the implementation of the programme, two of the parents (parents B and E) had difficulty in implementing the parent-assistance programme. They were not able to complete all sections of the journals and also failed to hand in the follow-up questionnaires. This was not the case with the other parents (parents A, C and D). These parents satisfactorily implemented the programme. This ensured that there was sufficient and meaningful data to work with in case study 1.
The structured nature of the journals made it easy for the parents to follow and complete. Parents recorded the discussions they had with their children on what they did at school and it appeared that the children were very involved in school activities. These discussions focused on both academic and extra-curricular matters. The parents were able to check the children’s work and assist them where necessary. This gave them an idea of what mathematics their children were studying.

A further opportunity for parents to know what their children were doing in mathematics came in the part of the journal where the children had to describe to their parents what they were learning in mathematics. This task was done very well; children were able to recall, in a very clear and descriptive manner, what they learnt in their mathematics classroom (see Chapter 4, section 4.5.4). The children were able to extend these learning experiences to outside the classroom. They came up with some novel ways, indicated in Chapter 4, section 4.5.5, in which they used mathematics at home or in their environment.

Parents A, C and D and their children completed the follow-up questionnaires. The follow-up questionnaires revealed information which triangulated with the journal data. The highlights described by these parents, such as; “enjoying being involved in my son’s education”; “finding out easier and simplified ways of studying mathematics”; “being involved in my son’s work” appeared to confirm their interaction with their children and a meaningful involvement in their mathematics learning.

A further confirmation of this involvement could be drawn from the highlights described by the children. Some of the activities they were involved in and what they learnt from these activities were described. These highlights, which showed how the programme affected the children, were:

“the shopping experience”; “liked working with my mother and father and enjoyed their closeness and support”; “drawing up the shopping list and selecting the items in the supermarket”; “how to pay and save money when you want to buy something”
These highlights indicate that the parent-child interaction in this programme, whether at home or outside the home, contributed to the children’s mathematical learning experiences. This also reinforces the remarks of de Kock (1999) who stated that parents have the opportunity of using the everyday contact between them and their children as a means of communication as well for teaching mathematics.

All three parents who completed the follow-up questionnaires revealed that they had difficulty keeping up with the completion of the journals during the week. Parent A reported that administration was not one of her strong points and there were occasions when she did not make any notes during her interaction with her son. She, thus, had to review what had transpired with her son. At times there were other commitments that had to take precedence over the completion of items in the journal. Her son stated that he enjoyed the activities in the programme but had difficulty with the rand-dollar exchange.

Although parent C reportedly had no difficulties, he did explain that his daughter had difficulty keeping up with recording the daily temperatures and the rand-dollar exchange rates. As a result, only the temperature readings were recorded. These readings were backdated from the newspaper. Parent D experienced similar difficulties to those of parent A. However, the difficulties experienced by these parents did not appear to have a negative impact on the way they completed the journals. These difficulties also showed that the context of currency exchange was beyond the comprehension of most children.

Parents A, C and D claimed in the follow-up questionnaires that the programme provided them with opportunities for learning. Parent A indicated that she learnt how to interact with her son; she learnt that problem solving could be made easy to follow and understand. She had, previously, perceived mathematics as a "difficult subject" which she would not be able to understand. After her involvement in the parent-assistance programme, she had come to realise that mathematics was not as difficult as she thought. Parent C reported that he learnt that it is important to have a good understanding of mathematics if you are to be successful in the subject. He claimed that
he had not liked mathematics in the past but this had changed and he had developed an appreciation for the subject. Parent D said that she had done mathematics at school until grade 12 but found it to be a boring subject. After being involved in the programme she began to realise that mathematics, in the form of problem solving, was “exciting”. These comments by the parents also appeared to be in line with the views they expressed in the journals.

Parents A and C’s suggestions in the journals, that the programme be introduced in the earlier grades, was also repeated in the follow-up questionnaires. This seems to indicate that the programme impacted positively on them and that they felt that more parents, especially parents of junior learners, could benefit from the programme. Parent C’s enthusiasm towards the programme was taken further when he spoke about the programme to family members from another part of the country.

The interviews with the parents reflected a positive disposition toward the assistance programme and shed further light on their involvement in their children’s mathematics learning. All parents, including parents B and E, were interviewed and all stated that the programme had helped change the way their children did mathematics. In most cases there appeared to be an improvement in their children’s attitudes to mathematics and this was corroborated by the mathematics teachers. All parents were keen for their children to continue with mathematics in grade 10. However, parent B was not sure how her daughter would do.

As stated earlier, parents B and E had difficulty with the implementation of the programme. Their journals were incomplete and they did not hand in their follow-up questionnaires. The interviews with parents B and E shed light on this situation.

Parent B was very keen for her daughter to be successful in mathematics. Her younger daughter had tasted success in mathematics by winning a certificate in the Mathematics Olympiad and she wanted the same success for her older daughter. When I called parent B at the beginning of the programme, she stated that her mother was sick and that had delayed the implementation of the programme. Once they started with the
programme, it would appear that there was mother-daughter interaction. Parent B’s
daughter tried her best and was keen to show her mother what she was learning in
mathematics. Parent B wrote in the journal that she was learning from her daughter.
However, after the fourth week of the programme, this came to an abrupt end. It would
appear that parent B was no longer interested in the programme. However, this was not
the case.

In the interview with parent B, she stated that she was always interested in her
daughter’s work but had started experiencing “domestic problems”. Her children were
sent to live with a friend and she could not check or support her daughter’s learning. The
“domestic problems” and lack of parental support also affected her daughter in her
mathematics class. This came to light in the interview with the mathematics teacher who
said that parent B’s daughter became very withdrawn in class and appeared to lose
interest in her work. It is likely that the teacher was not aware of the “domestic problems”
that affected parent B’s daughter in class.

Parent B said in her interview that she visited the school, not to check on the progress of
her daughter, but on “personal business”. For parent B, the parent-child interaction
halted because of “domestic problems”. It would appear that she could not give her
daughter the support she needed. This may be the reason why her daughter was
withdrawn in class and appeared to lose interest in her work.

In her interview, parent E reported that she was a single mother of four children. She
worked long hours and when she got home she was tired and her daughter was asleep.
Thus, she could not follow the programme during the week and had to use weekends
instead. Her daughter pestered her to be involved in her work and my phone call was a
motivating factor in forcing her to act. From parent E’s daughter’s detailed descriptions of
her mathematics learning at school it would appear that she was making a concerted
effort in mathematics. Although not all sections of the journal were completed, parent E’s
daughter was very happy with the interest shown in her mathematics and the support
that she was given.
The aforementioned scenarios regarding parents B and E also shows that, while parent involvement in education is an ideal that all parents should strive for, there are certain factors that discourage parental involvement. In parent B’s case, “domestic problems” and the fact that her daughter had lived with a friend for a period affected her involvement in her daughter’s education. There was no interaction between mother and daughter and consequently no learning took place at home.

The long and late hours that parent E worked affected her involvement in her daughter’s education and she was not always able to give her daughter the necessary support she needed. The claim by Arcaro (1995) and Magabane (2001) that economic conditions often determined the level of parental support has relevance here. In parent E’s case, it was important that she worked these long late hours so that she could provide for her family, as she was the sole breadwinner. This affected her support for her daughter’s learning. Despite these circumstances, her daughter was described by her mathematics teacher as being “quite positive”. She was always eager to learn in class and when given any tasks she would attempt them to the best of her ability. If she had any problem, she would go to the teacher’s table for assistance. Her teacher stated that her commitment to her work made her stand out in class.

Parents B and E could not fully support their children’s learning as a result of socioeconomic reasons. If teachers were to identify such cases, then they could intervene and play a supportive role to such parents and their children.

The enthusiastic nature in which parent D took to the programme was evident when she stated she was proud of her son’s improvement in mathematics. This improvement was also noted by the mathematics teacher during the interview. However, the teacher also remarked that he still needed to put in a lot more effort in his assessment tasks. The teacher also described him as having “a very short attention span” and that he was easily distracted. He would listen in class for a few minutes and then he would tap on the desk. However, the teacher made no attempt to inform parent D about her son’s behaviour in class. Shinn’s (2002) call for effective communication between parents and teachers has relevance here, as a meeting between parent D and the mathematics teacher could have addressed the matter but such a meeting did not take place.
The data from the follow-up questionnaires and interviews tended to support and clarify the data from the journal. The highlights described by parents A, C, D and their children in the follow-up questionnaires confirmed that there was meaningful interaction between parents and children and the activities, especially the grocery shopping, was enjoyed by the children and enhanced their budgeting, estimation and calculation skills.

The interviews with parents also revealed that there was meaningful interaction between the parents and the children during the programme, even though for parents B and E, this interaction was limited. The fact that all parents, with the exception of parent B, were able to recall specific incidents from the programme showed the impact of the programme on them. These incidents were linked mainly to the activities prescribed in the programme and included the following:

“concepts such as the rand-dollar exchange and temperature readings”; “compiling a shopping list and budgeting for the items on the list”; “examining the mathematics in the newspaper and on television”, “applications of mathematics in the home and environment”.

An analysis of these incidents suggests that the activities prescribed in the programme left an indelible mark on parents and their children. This does not suggest that those tasks, such as checking and signing their children’s work, are less important. What it does suggest, however, is that these routine tasks should be interlinked with interesting activities in the attempt to promote mathematics learning in children.

With the exception of parent B’s daughter, all children had shown improvement in their work; they were active in class and eager to do their work, although parent D’s son tended to be easily distracted. Despite parent E’s problems in supporting her daughter, the teacher noted that she tried very hard in mathematics.
In examining the various events during case study 1, it is noticeable that although parents participated with different levels of interest and commitment, certain trends and features emerge, leading to the following conclusions:

- Although all parents were enthusiastic and keen at the parent workshop and promised to follow the programme, completing the journals appeared to be a daunting task for some of the parents; they needed to be reminded about their commitment to the programme by telephone; three of the parents took this commitment seriously and completed the programme successfully; the other two parents were affected by certain factors which were made known to me during the interviews; this shows that for meaningful parental involvement in education to take place, parents must be committed and be prepared to make the necessary sacrifices for their children; teachers should assist parents who have problems supporting their children;

- one of the requirements of the journal was for parents to have discussions with their children about what they did at school; this forced parents to talk to their children about what they did at school; these discussions took place regularly, were constructive and focused on general and mathematical issues,

- parents were able to check their children’s work and assist them when necessary; they became aware of the mathematics their children were studying when examining their children’s mathematics books and their children’s journal writings on their mathematics experiences at school; these mathematics experiences were extended to outside the school; the children came up with novel ways in which mathematics could be used at home and in their environment;

- although the activities involving real-life experiences had mixed success, the children were able to use a wide range of mathematics skills during the activities; the success of the grocery shopping experience was due to the active role played by the children where they drew up the list, estimated prices and selected the items in the supermarket, thereby using both their estimation and calculation skills and learning to stay within a budget; the activity on temperature readings
was attempted with some success, but the one on the rand-dollar exchange was poorly executed; although all these activities incorporated real-life experiences, the lack of success for the latter activity could be attributed to the fact that the concept of currency exchange may not be part of their daily experiences;

- despite the mixed success with the mathematical activities, nearly all parents were able to recall these activities during the interviews, thus, highlighting the impact of these activities during the programme; this suggests that any programme that promotes mathematics learning should incorporate interesting activities that would enhance this learning; and

- the highlights described by parents A, C and D and their children in the follow-up questionnaires also suggests that there was meaningful interaction between these parents and their children during the programme; this interaction impacted positively on the way the children participated in the mathematics classroom; despite parent E’s limited support of her daughter, it would appear that her daughter was very determined in mathematics and gave of her best in class; this was not the case for parent B’s daughter (see reasons earlier in this section).

In examining the trends and features for case study 1, it would be reasonable to say that the data from the follow-up questionnaires and interviews in this case study supported and triangulated with the journal data for parents A, C and D while the interviews with parents B and E attempted to clarify their journal data.

5.3 Case study 2

In case study 2 the nucleus was the follow-up questionnaires. Here again, the parents in case study 2, implemented the programme with varying degrees of success. Of the eight parents that participated in the workshop, six parents completed the programme in its entirety. These parents, for purposes of recording and reporting the data, were called F, G, H, I, J and K. This section is written, with the follow-up questionnaires (the nucleus) first and then the other two events, the journals and interviews.
In the follow-up questionnaires, the parents and children described a number of programme highlights and these are detailed in section 4.7 of Chapter 4. Due to work commitments, some parents were not able to give the programme their full attention during the week and used the weekend to complete the journals. Despite the difficulties expressed by parents, it was noted that the programme had an impact on the way the parents and children viewed mathematics. In this regard, parents stated that being in the programme offered them the opportunity of being able to monitor and check their children’s mathematics homework and assist them whenever necessary. They took this task very seriously. Parents claimed that their children became very interested in mathematics and developed a positive disposition to the subject while the children stated that they enjoyed the interest shown by their parents in their work. It would, thus, be in order to assume that parents played a vital role in fostering positive attitudes towards mathematics. This is in line with the claims by Southwood and Spannenburg (1996) about the role of parents in this regard.

It would appear from the follow-up questionnaires that the programme impacted positively on both the parents and the children and this reinforced what parents said in the journals. In their discussions with their children, the parents focused mainly on mathematics. This was unlike case study 1 where matters of a general nature were also discussed. Parents indicated that they checked their children’s mathematics homework and signed their books. This enabled them to find out what their children were studying in mathematics. Some parents stated that they assisted their children with the more difficult aspects of the work. As with case study 1, parents also discovered what their children were learning in mathematics through what they wrote in their journals about their mathematical learning experiences at school. As case study 2 occurred in another part of the school year, the mathematics learnt was different when compared with case 1. Some of the concepts or sections learnt were:

*Parallel lines; co-interior angles; equations; factorization; word problems; scientific notation; exponents working with fractions; polygons; positive and negative numbers; supplementary adjacent angles; right-angled triangles; tessellation and circles.*
The children were able to give clear descriptions of the various concepts learnt in their mathematics classes. From these descriptions, it would appear that the children knew what they were talking about. This would have made it easier for them to exchange information with their parents. These mathematics learning experiences were also applied in the home and environmental context. As in case study 1, the children came up with very interesting and novel ways in which they used mathematics in their everyday life and some of these are listed below:

*Working with cash in supermarkets and shops and improving addition and subtraction skills; plucking of flowers from the garden, and dividing the flowers into equal quantities for distribution to the neighbours; calculation of the bill during a family outing at a restaurant; estimation of the time and distances to travel during a family holiday.*

The fact that the children focused on ways in which mathematics was used in their homes and environment further illustrates the positive impact that the programme had on the children. This activity also showed children that the mathematics they studied in school was not isolated from their everyday lives. This led to a better understanding and appreciation of mathematics by both parents and children.

Three of the parents stated that they met with the mathematics teachers to find out about their children’s progress in mathematics and a fourth parent sent a note in this regard. This contact between parents and teachers was initiated by the parents. No contact was initiated by the teachers despite some parents being regular visitors to the school in their capacity as governing body members.

All children in case study 2 attempted the grocery shopping activity and this activity was done successfully. The activity on temperature readings was satisfactorily attempted while the activity on the rand-dollar exchange was poorly attempted. In this regard, the comments for case study 1 are also valid.
In describing their views of the parent-assistance programme, the parents gave the following remarks:

“I learnt more about the mathematics my daughter is doing”; “Mathematics can be very interesting”; “I enjoyed supporting my child;”; “My daughter found that mathematics is not as difficult as it looks and it can be a very interesting and exciting subject”; “The activities in the programme were fun activities”.

The impact of the programme on parents and children also surfaced during the interviews with parents. When parents were asked to name specific incidents from the programme, which impacted on them, they came up with the following:

“the teaching of the mathematics lesson by the researcher showed how interesting mathematics could be”; “the caring nature of the researcher for the mathematics well being of the children”; “there are ways in which mathematics can be made simpler for children to understand”; “compiling a grocery list, buying the items on the list and working out the cost and expected change” and “the activities on temperature readings and currency exchanges”.

Some of these activities, such as the grocery shopping, temperature readings and currency exchanges, are similar to those expressed in case study 1 while the others are different. Thus, the activities prescribed in the programme aided the children’s mathematics learning. At the same time, parents place a high premium on people who care for the well being of their children.

The parents in case study 2, is a repeat of the views expressed by parents in the initial survey and in case study 1. They saw mathematics as an important subject and were keen for their children to continue with mathematics in grade 10. Only parent K expressed reservations on whether her daughter would cope with mathematics in grade 10.

Although the children had different levels of interest in mathematics prior to their involvement in the programme, all parents detected a noticeable change in the way their
children approached mathematics. This change was attributed to the interest shown by their parents in their work and the fact they received support from the parents. Parents also claimed that there was an improvement in their children’s mathematics results with some giving actual marks to justify their claims.

The interviews with the teachers appeared to corroborate the improvement in the mathematics results for five of the children. Only in parent’s H case was there contradictory data. Parent H believed his daughter improved and was doing well in mathematics. However, the mathematics teacher saw things differently. She described parent H’s daughter as “not very focused in the mathematics class.” His daughter was easily distracted and always had to rely on her friends for homework; she did not take the initiative to do her own work. As a result, there was no real improvement in her work. Although the mathematics teacher saw parent H coming to school on governing body business, she made no attempt to meet with him to discuss her concerns regarding his daughter. A meeting with parent H may have helped in this regard, again highlighting Shinn’s (2002) call for effective communication between parents and teachers.

Although both mathematics teachers stated in their interviews that a parent-assistance programme would work if there was contact between parents and teachers, none of them made any contact with parents to support them or advise them during their participation in the parent-assistance programme. The mathematics teachers reported that some children showed them the journals they were completing and the children appeared to be enthusiastic about their participation in the parent-assistance programme. However, it would appear that the teachers offered no support to the children.

As stated earlier, the nucleus for case study 2 was the follow-up questionnaire. The data from the other events in case study 2, the journals and interviews, appeared to correlate well with the data from the follow-up questionnaires. Although some inconsistencies arose in the data for parent H, certain trends and patterns of coherence emerge from case study 2, leading to the following conclusions:
Six of the parents were committed and followed the programme in its entirety; they responded frankly and gave me appreciative remarks;

there was meaningful social interaction between parents and children; this social interaction led to an exchange of mathematics information between parents and children implying that there was some mathematics learning at home; this mathematics learning took place as a result of the social interaction between parents and children (Brodie and Pournara 2005);

as in case study 1, parents learnt about the mathematics their children were studying through discussions with them, examining their books and reading what they wrote in the journals;

the comments in case study 1 about the mathematics activities involving grocery shopping, temperature readings and currency exchange also hold true for case study 2.;

the parents’ views on how their children had improved in mathematics was corroborated by the mathematics teachers for five of the children; and

the mathematics teachers, although supportive of the programme, did not appear to support the children in the programme and did not initiate any contact with the parents; it would have been a great boost for the programme if the mathematics teachers had contacted the parents and offered their support to parents and children.

There appears to be a great deal of synergy in the data from the follow-up questionnaires, the journals and the interviews. The journal data gave some clarity to the data from the follow-up questionnaires and an insight into the way parents and children interacted in the programme. The interviews gave further clarity on this interaction and other aspects of the parent-assistance programme used in this study and validated the data gathering process. It would also be reasonable to claim that a rich source of reliable data emerged from case-study 2 of this study.
5.4 Case study 3

The five parents who participated in case study 3 were called parents L, M, N, O and P for coding purposes. The parents participated in all data collection methods, with only parent P not completing the follow-up questionnaire due to work commitments.

The nucleus for case study 3 was the interviews, with the data from the journals and follow-up questionnaires being used to triangulate with the data from the interviews.

Parents claimed that as a result of their interaction with their children in this programme they saw a change in the way their children approached their mathematics. The children took time with their work, knowing that parental support was available. Parents now had more self-confidence in their ability to help their children. Parents and children discussed a variety of school and other issues. Included in the school issues was discussion about the mathematics that was learnt at school. The children became more confident when doing mathematics and parents noted an improvement in their children’s mathematics marks.

This improvement was also corroborated by the mathematics teachers. The mathematics teachers praised the manner in which the children participated in the mathematics class and complimented them on their improvement in mathematics. The parents of case study 3 stated confidently that their children would take up mathematics in grade 10 as mathematics would open doors to a wide range of careers.

As with the previous case studies, the programme left an indelible mark on the parents as they were able to describe very specific details from the parents’ workshop and the programme. One example of this was the grocery shopping activity, a socio-educational outing, which was enjoyed by both parents and children.
The journal data correlated well with the data from the interviews. In the journals parents wrote about discussions with their children that focused on both general and school issues. Some of the issues discussed were:

- the need to value friends;
- working neatly and tidily when doing projects and assignments;
- sporting and academic matters;
- good behaviour;
- study methods and leadership.

Parents also checked their children’s mathematics homework and signed their books. Four of the parents arranged for their children to go to the library to do research for a mathematics assignment. This showed that their involvement in their children’s mathematics was not restricted to the home. This is also in keeping with the assessment demands of outcomes-based education, where parental support is vital in research tasks such as projects and assignments.

Parents L and P also stated that their children were involved with religious studies in the afternoon. Although this put pressure on the children, both parents saw to it that their children focused on their school academic studies as well.

All parents, with the exception of parent L, contacted the mathematics teacher to find out about their children’s progress in mathematics. In three of the instances (where the teacher was contacted by a note or phone call), the teacher was satisfied with the children’s progress. In the other instance, the parent met the teacher in person to seek help for her daughter as she was having difficulty with the work. The teacher advised the parent on what to do and also promised to help her daughter. Again, as with case study 2, parent-teacher contact was initiated by the parents.

As with case study 1 and case study 2, the participation of the parents in the programme made them aware of the mathematics their children were studying. This information was obtained from their discussions with the children, scrutinizing their mathematics books and what they wrote in the journals. The parents enjoyed working closely with their children and were keen to listen to their children’s views of what they were learning in
The children also knew that they could count on the support of their parents. Similar sentiments were expressed by parents in their interviews.

Some of the mathematics topics or sections they covered in class were:

Cubes and cube roots; squares and square roots; bigger and smaller integers; variables; monomials and binomials; adding of like terms; additive inverse; the highest common factor (HCF); lowest common multiple (LCM); the BODMAS rule; prime numbers; finding perimeter; nets of cubes; multiplication of integers, graphs, geometric patterns and the theorem of Pythagoras.

The children also came up with ways in which they used mathematics at home and in their environment. Some of these were similar and others different to the experiences of the children in case study 1 and case study 2 and included the following:

Weighing of flour when baking such as 250 g = 1 cup and 1 kg = 4 cups; cutting up pastry into squares; Adding up accounts that must be paid and budgeting accordingly; calculation of distance when walking; dividing sweets among friends for party packs; mixing of fruit juices where one sachet is mixed in one litre of water.

By extending their school mathematics learning to their homes and environments, the children began to realise that mathematics had value outside the classroom and they appreciated the mathematics they were studying. This was especially noticeable in the grocery shopping activity. All children completed this activity. They enjoyed the responsibility associated with this activity, that of drawing up the grocery list and selecting the items in the supermarket. They found this activity to be educationally rewarding.

The activity on temperature readings was completed by four of the children; only two children completed the activity on the rand-dollar exchange. Again, the comments in case study 1 and case study 2 regarding the concept of the currency exchange not being in the context of the parents’ and children’s experiences may also hold true.
Parents also gave various views about the programme, some of which were:

“It was interesting to learn about my daughter’s views and opinions about mathematics”; “I learnt to be patient with my daughter when she did her work”; “We communicated better with each other during the programme”; “The programme taught me to be positive about mathematics”; “A programme like this gives you time with your child”; “My son learnt that school can be fun and there is so much to learn if you pay close attention”

These remarks showed that there was meaningful interaction between the parents and the children during the programme. A confirmation of this meaningful interaction also emerged in the follow-up questionnaire where parents had to describe highlights of the programme. Some of these highlights were:

“working with my daughter and understanding new concepts”; “interacting with my son and finding out how he is doing in mathematics”; “all the activities we did”, “introducing my son to other currencies such as the dollar.”

The children were also able to describe their own highlights of the programme. Some of these were:

“doing mathematics with my mother”; “trying to work with my mother as we never seem to agree on anything”; “the grocery shopping experience” and “identifying mathematics around us”

The parents’ views of the programme and the highlights described by them and their children would appear to show that the programme impacted positively on both parents and children. Parents also came to realise that they had to be patient with their children when helping them as they were still developing mathematically. The follow-up questionnaires also revealed that tasks such as the grocery shopping, temperature readings and currency exchanges made parents and children aware of the applications of mathematics. The children found further applications of mathematics in the home and environment. This correlated well with what was written in the journals. By becoming
aware of the various applications of mathematics, both parents and children viewed mathematics in a new light. This helped make the interaction between parents and children more constructive and meaningful. Although some parents indicated they were busy and could not always give the programme their full attention, it would appear from the detailed responses in their journals that these parents were very committed to the mathematics learning of their children.

The use of the interviews as a nucleus in case study 3 and its comparison with the data from the journals and follow-up questionnaires reveals certain trends and patterns of coherence, leading to the following conclusions:

- There was meaningful interaction between the parents and the children during the programme; parents were able to learn about what their children were doing in mathematics from their discussions, scrutinizing their mathematics books and reading what they wrote in the journals;
- the parents were very supportive of their children and were keen to listen to their views on what they learnt in mathematics; they made arrangements for their children to go to the library to do research for a mathematics project;
- the programme brought the parents and children closer together;
- most of the parents initiated contact with the teachers to find out how their children were doing in mathematics and they received positive feedback from the teachers;
- the children put into practice what they learnt in mathematics by coming up with original ways in which they used mathematics in their everyday life;
- the children became more confident in mathematics;
- the parents’ claim that their children improved in mathematics, was confirmed by the mathematics teachers; and
- the programme impacted positively on both parents and children
5.5 The focus group discussions

The details and comments on the focus group discussions appear in Chapter 4, section 4.11. The purpose of having the focus group discussions was two-fold, firstly, for parents and children to discuss and relive their experiences in the parent-assistance programme, and secondly, to remind parents about their obligations in respect of their children’s education in general and mathematics learning in particular. The focus group discussions provided positive feedback from parents and children. This feedback triangulated well with the journals, follow-up questionnaires and interviews. As participants, they were able to see and reap the benefits of the programme for themselves. Parents wanted the school to take the lead in implementing an assistance programme for all parents. The children expressed appreciation for the involvement of their parents in their work but wanted to know whether they would be able to receive assistance from the parents when the work changed and became more difficult.

5.6 Interpretation of the 3 case studies

In interpreting the three case studies, it is important to go back to the beginning of this study. One of the key points emerging from the initial survey of this study was that a number of parents were not aware of the new outcomes-based approach to education and its application to mathematics. This new approach called for parents to play meaningful and significant roles in their children’s education, yet it would appear that there was no concerted effort to bring parents on board.

Parents need to be notified about changes to the mathematics curriculum (Peressinni 1997; de Abreu and Cline 2005). Difficulties arise from changes to the curriculum where children are involved in school mathematics practices which are different from those of their parents. This makes it difficult for parents to support their children in mathematics (de Abreu and Cline 2005).

In this study, this situation surfaced during the parents’ workshops. Parents complained that the new way of doing mathematics was different from what they were accustomed
to and it was difficult to assist their children. To ensure that the parents in the study were familiar with outcomes-based education and its applications in mathematics, parents were given an overview of its philosophy during the workshops. The grade head presented an outline of the outcomes-based approach to education; the mathematics teachers explained how this approach was used in mathematics and I taught a mathematics lesson, using the outcomes-based approach. I also prepared a document on how parents could involve themselves in their children’s mathematics learning and discussed this document with them, in an informal manner. The various components of the workshop also served as a preparation for the parent-assistance programme.

5.6.1 The workshops

It would appear from the initial survey that although many parents indicated that they helped their children in mathematics, a large number indicated their willingness to participate in a parent assistance programme showing that they needed help in this regard. However, only a total of 18 parents were finally prepared to participate in the programme and 16 actually completed it.

These parents appeared to be keen and enthusiastic during the workshops and expressed their appreciation for the information and various tips given about the different roles that they could play in education. During telephonic contact with parents, some of them requested follow-up workshops. It was expected that the school would fulfil this role. This request gave an indication of their positive experiences in the workshops and the fact that they preferred school meetings where matters specific to their involvement in their children’s education are discussed, rather than matters of a general nature.

5.6.2 Parental involvement

In all three case studies of this study, parents played the role of initiators. They had to document their involvement with their children’s mathematics in journals. These journals helped parents to structure this involvement, and consequently, most of the parents completed the assigned tasks. These tasks also included the ones that had to be done by the children, under parental supervision. Some children showed the mathematics
teachers what they were doing in the programme and appeared to gain the teachers’ support. Although there was contact between parents and teachers, this contact was initiated by the parents. As a result of the lack of initiative on the teacher’s part, Bloomstran’s (2002) triangle of effective school design, with the three vertices of the triangle representing the parents, teachers and the learners, was only partially successful during the programme.

It was reassuring to note that the parental involvement in this study was not restricted to the limited period of the assistance programme. In all three cases of this study, the majority of parents claimed, in the interviews held later, that they were still involved in their children’s mathematics learning, as they realised that their children would reap the benefits of this involvement. However, this level of involvement appeared to less intense than previously. This may have been due to the fact my involvement such as phoning parents to motivate and support them had ended. In this regard, it would have been ideal for the mathematics teachers to assume this role but this did not happen. This clearly highlights the need for effective communication between parents and teachers (Shinn 2002).

The mathematics teachers missed a golden opportunity of getting the parents on their side. In Canter and Canter’s (1996) four qualities that effective teachers share, three of them refer to parents. They are: the need for teachers to have the support of parents; treating parents cordially and demonstrating professionalism, as well as having confidence in their interaction with parents. Even though the teachers’ attendance at the parents’ workshop would indicate support for the parents’ assistance programme, the teachers made no attempt to demonstrate these qualities during the programme.

5.6.3 Factors that discourage parental involvement

The study by Mbokodi, et al (2003) on parental involvement in education revealed a number of factors that discouraged parental involvement in education, one of which was the parental level of education.
Although the 18 parents were not asked to reveal their level of mathematics education in this study, three parents told me during the interviews that their highest level of mathematics was grade 9. However, it would appear that the lack of further mathematical knowledge did not inhibit their involvement in the programme. These parents claimed that they also learnt some mathematics, first from the workshops, and later from their children during their interactions.

There were other factors, in this study, that made parental involvement difficult. Some of these factors were domestic problems, shift-work, late working hours and a lack of time. These factors suggest that parental involvement in education is not easy and that parents need to be supported in this regard. In this study, I was in regular contact with the parents and gave them the necessary support. This ensured the commitment of the majority of the parents and the completion by them of nearly all aspects of the programme. It would be fair to say that this contributed to reliable data in this study which appeared to be validated through a multi-method approach of data analysis.

5.6.4 Models of parental involvement in education

Of the three models of parental involvement in education described by Springdale and Stegelin (1999), I chose the curriculum-enrichment model as an appropriate model for the parent-assistance programme. This is due to the fact that parent-child interaction in this programme resulted in mathematics learning taking place at home and in the environment.

However, in order for this programme to become fully representative of the curriculum-enrichment model, parents should be encouraged to visit mathematics classrooms. These visits would be constructive in nature and parents could assist in classroom activities. While some parents may be able to assist in class activities, the majority of parents work during the day and such involvement would be impractical.
5.6.5 Mathematics as a school subject

The fact that mathematics is an important school subject has been well documented in various studies over the years. The most well-known of these studies was the Cockroft Report (1982) which was conducted in the UK.

This view was also endorsed by the parents in the initial survey in this study where nearly all parents stated that mathematics was an important subject for their children. This view was repeated in the interviews with parents when most parents stated that their children would continue with mathematics in grade 10. This was so because the anticipated career paths for many of the children had mathematics as a prerequisite. Those children who were not sure of their future careers would also continue with mathematics as their parents believed that the subject opened doors for a wide range of careers.

Mathematics has been regarded as a difficult subject (Howson and Wilson 1986; Cockroft 1982). Although some children in this study found mathematics difficult, the majority of the children appeared to be coping with the work. However, during the focus group discussions, the children voiced their concern on whether their parents would be able to assist them when the work became more difficult.

5.6.6 The role of parents in developing positive attitudes to mathematics

In the initial survey of this study, some parents were able to recall negative experiences of mathematics when they were at school. This was consistent with the research undertaken in the Cockroft Report (1982) about the adults’ attitudes to mathematics and the case study by Fiore (1999) on mathematical anxiety where adults were able to recall negative experiences of mathematics many years after these experiences occurred.

Some parents in this study also revealed negative feelings about mathematics. However, it was reassuring to note that these negative feelings did not have an effect on their participation in the programme. It would be fair to say that the majority of the
parents were very committed to the programme and those with negative feelings appeared to have a change of heart.

This programme made it possible for parents to support their children’s mathematics learning. The children appeared to enjoy this support. The participant journals brought parents and children closer together and they were able to discuss and share feelings about schoolwork in general and mathematics in particular. The children were able to describe the mathematics that they learnt at school and linked mathematics to their home and environment. The grocery shopping experience turned a normal family outing into a mathematical learning experience. The other activities on temperature and currency exchanges made children aware of the applications of mathematics in society. Parents also enjoyed these experiences and learnt from them. The children enjoyed interacting with their parents. These activities show that real-life activities, in which children are given meaningful roles, are likely to encourage working with mathematics outside the classroom.

The interaction between parents and children and the activities prescribed in the programme ensured that the children developed positive attitudes to mathematics. Parents played a major role in this matter and confirmed Southwood and Spannenburg's (1996) views about the role of parents in developing positive attitudes to mathematics.

The interactions between parents and children in this programme made it possible for both parents and children to learn mathematics from each other. This is in line with the socio-cultural approach to learning (Brodie and Pournara 2005). These interactions also enabled children to develop positive feelings to mathematics. This echoed de Kock’s (1999) pronouncements about parents using the everyday contact between them and their children as a means of communication as well as teaching mathematics. This study went further; the parents also learnt from their children.
5.7 Summary

In this chapter, the events analysed in Chapter 4, were used as a nucleus together with other events around the case studies as a means of triangulation. Thus, triangulation was carried out using a multi-method approach. This was the second level of interrogation of the data. In all three cases the data from the other events triangulated well with the nucleus, thus ensuring the internal validity of the data.

The findings of this study are discussed and the various elements of this study are brought to a logical conclusion in Chapter 6, the final chapter.
6.1 Introductory comments

The purpose of this chapter is to bring all aspects of this study together. Firstly, there is a summary of the findings of this study. These findings are related to the research questions posed in this study in an attempt to draw conclusions about the research undertaken. This is followed by recommendations and suggestions for further study.

6.2 Summary of the findings

The interrogation of the data in Chapters 4 and 5 of this study made it possible to document parents’ and children’s perceptions of mathematics before and after their participation in the parent-assistance programme. The tables that follow represent my interpretation of the changes that occurred. I will start with the parents.

6.2.1 Parents (see next page)
<table>
<thead>
<tr>
<th>Parent</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>She perceived mathematics to be a difficult subject and could never do mathematics. She did not understand the subject matter and became despondent when she could not help her son.</td>
<td>Being in the programme helped to change her attitude to mathematics. It was not as difficult as she thought and she was able to assist her son. She felt the programme should be introduced in the earlier grades.</td>
</tr>
<tr>
<td>B</td>
<td>She did not make any comment.</td>
<td>She found the programme “interesting” and she was also able to learn mathematics from her daughter.</td>
</tr>
<tr>
<td>C</td>
<td>He did not like mathematics. It was taught in an abstract manner and was perceived to be for a select few. His teachers did not emphasise the applications of mathematics.</td>
<td>He developed an appreciation for mathematics. He became more positive and &quot;broad-minded&quot; about the subject. He had a better understanding and was able to support his child more effectively.</td>
</tr>
<tr>
<td>D</td>
<td>Although parent did mathematics up to grade 12, she found it to be a boring subject and did not get a good foundation in mathematics.</td>
<td>It was not boring any more. Her attendance at the parent workshop renewed her interest in mathematics. She found mathematics, in the form of problem solving to be “exciting”.</td>
</tr>
<tr>
<td>E</td>
<td>She was not bright at school. Mathematics was difficult for her.</td>
<td>She learned a lot about mathematics; that mathematics is all around us. She has become more positive about mathematics.</td>
</tr>
</tbody>
</table>

Table 6.1 Case study 1: Parents’ perceptions of mathematics (before and after)
<table>
<thead>
<tr>
<th>Parent</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>He had a different style of learning mathematics; that of memorising formulae and rules</td>
<td>He stated that principles should be understood when learning mathematics; this helped him when assisting his child. There was no need for memorisation in today's learning.</td>
</tr>
<tr>
<td>G</td>
<td>He did not give any specific comment on mathematics but was pleased that a programme of this nature was made available to parents at the school.</td>
<td>He believed that one can learn more about mathematics when interacting with one's child. Mathematics can be simple if you are at it everyday. Mathematics is an important subject and he would like his daughter to do well in mathematics.</td>
</tr>
<tr>
<td>H</td>
<td>He felt that only the teacher was able to guide and teach his daughter mathematics.</td>
<td>He realised that he had a role to play in his child's learning. Mathematics is an important subject and it is &quot;the way to go forward.&quot;</td>
</tr>
<tr>
<td>I</td>
<td>She felt that mathematics was an important subject and wanted her daughter to do well in mathematics.</td>
<td>She said the programme enabled her to support the learning of her daughter and learn at the same time. She described the programme as &quot;interesting.&quot;</td>
</tr>
<tr>
<td>J</td>
<td>He regarded mathematics as being important in his quest for career advancement. He completed the ABET level 4 mathematics course at work.</td>
<td>He found the programme to be &quot;interesting&quot;. He learned that mathematics is all around us and mathematics can be enjoyable. He enjoys the subject and tries to show his daughter simpler methods.</td>
</tr>
<tr>
<td>K</td>
<td>Parent stated that she was not good at mathematics and did not do mathematics after grade 9. She could not assist her child.</td>
<td>Mathematics is an important subject and can be fun. It is also a requirement for many careers. She was able to support her daughter's mathematics learning.</td>
</tr>
</tbody>
</table>

Table 6.2 Case study 2: Parents’ perceptions of mathematics (before and after)
<table>
<thead>
<tr>
<th>Parent</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>She always loved mathematics and found it to be an interesting subject.</td>
<td>She found that mathematics can be used &quot;anywhere and everywhere.&quot; It is the basis of everything you do.</td>
</tr>
<tr>
<td>M</td>
<td>She was &quot;fearful&quot; of mathematics. She felt threatened that her son knew more than she did and that she was incapable of helping him.</td>
<td>Even though she felt that &quot;mathematics can be quite scary at times&quot; she believed that things are not as difficult as they seem and that there is &quot;always a solution to a problem.&quot;</td>
</tr>
<tr>
<td>N</td>
<td>She &quot;did not have a clue about mathematics.&quot; She only went up to grade 9 at school and did not have the opportunity of studying mathematics.</td>
<td>She learnt about the mathematics her daughter was doing. She was able to get closer to her daughter and support her learning. She also learnt about budgeting skills which helped her in church projects.</td>
</tr>
<tr>
<td>O</td>
<td>She believed that mathematics was a difficult subject and to be successful in mathematics, &quot;you must be focused.&quot; She only did mathematics up to grade 9 as she &quot;used to hate mathematics.&quot;</td>
<td>She now realised that mathematics does not have to be difficult. There are easier ways to study mathematics. Mathematics is an interesting subject and &quot;it is all around us.&quot;</td>
</tr>
<tr>
<td>P</td>
<td>He always regarded mathematics as an important subject and wanted his son to do well in mathematics. He participated in the programme to find out how he could support his son's mathematics learning.</td>
<td>He learnt that mathematics is all around us and prepares you for life. He said that mathematics is needed if you pursue a &quot;trade&quot; or a career in business. He felt the parent-assistance programme for mathematics could also be used for other subjects.</td>
</tr>
</tbody>
</table>

Table 6.3 Case study 3: Parents' perceptions of mathematics (before and after)

It would appear from the information set out in Tables 6.1 to 6.3 that there was a change in the parents’ perceptions of mathematics after their participation in the programme. Those who found mathematics to be “difficult”, “abstract” and “boring” became more positive about the subject, and wanted their children to do well. Even parents who had no comment or those parents who loved mathematics seemed to be appreciative of the programme as they became aware of the applications of mathematics and the fact that mathematics is all around us. Parents who had a poor background in mathematics, also appeared to have benefited from the programme as they claimed to have learnt some mathematics from the programme.
### 6.2.2 Children

<table>
<thead>
<tr>
<th>Child</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>He was always interested in mathematics and usually worked till late.</td>
<td>This interest continued and he enjoyed his mother’s involvement in his work; he saw this as an opportunity to teach his mother some mathematics; he also helped others in class.</td>
</tr>
<tr>
<td>B</td>
<td>She struggled with mathematics; she found it difficult.</td>
<td>There was some change; her mother reported that she learnt from her. However, this ended as a result of “domestic problems”.</td>
</tr>
<tr>
<td>C</td>
<td>She was interested in mathematics but struggled at times; she hated mathematics when she struggled.</td>
<td>Her understanding of mathematics improved; she saw mathematics in a new light and began to enjoy mathematics; she was eager in class and always went to the teacher’s table for acknowledgement; she became keen and happier in the mathematics class.</td>
</tr>
<tr>
<td>D</td>
<td>He found mathematics to be difficult; he did not care about mathematics.</td>
<td>He became interested in and developed a liking for mathematics. However, he was easily distracted in class.</td>
</tr>
<tr>
<td>E</td>
<td>She was always diligent with her work but worked on her own.</td>
<td>She began to seek help from her mother (at the weekend); she was keen to show her mother her work and explain what she was learning. This was evident by the detailed descriptions in the journal.</td>
</tr>
</tbody>
</table>

Table 6.4 Case study 1: Children’s perceptions of mathematics (before and after)
<table>
<thead>
<tr>
<th>Child</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>She was always interested in mathematics and adopted a very positive attitude to mathematics; she was a top performer.</td>
<td>This trend continued and she developed an even clearer understanding of mathematics.</td>
</tr>
<tr>
<td>G</td>
<td>Her work was done in a hurry and she saw no need to consult with anyone.</td>
<td>She became more serious about mathematics and she saw mathematics in a new light; she developed a more positive attitude in class.</td>
</tr>
<tr>
<td>H</td>
<td>She would work on her own and did not consult with anyone.</td>
<td>She found mathematics to be more manageable but appeared to be not focused in class and relied on others for mathematics homework.</td>
</tr>
<tr>
<td>I</td>
<td>She always displayed a positive attitude to mathematics; was good with her work and treated mathematics seriously.</td>
<td>This trend continued. She also became interested in the applications of mathematics.</td>
</tr>
<tr>
<td>J</td>
<td>She did not appear to be interested in mathematics and struggled.</td>
<td>She adopted a more positive attitude to mathematics but appeared not to be active in class activities.</td>
</tr>
<tr>
<td>K</td>
<td>She did not appear to be interested in mathematics and struggled.</td>
<td>She saw mathematics in a new light, especially the applications of mathematics in society. Although she tried hard, she still found mathematics to be difficult.</td>
</tr>
</tbody>
</table>

Table 6.5 Case study 2: Children’s perceptions of mathematics (before and after)
<table>
<thead>
<tr>
<th>Child</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>She had a very positive attitude to mathematics until grade 7 when she found the work to be difficult; she lost confidence but did not share these concerns with her parents.</td>
<td>She became more confident; she was enthusiastic in class and put in extra effort in her mathematics.</td>
</tr>
<tr>
<td>M</td>
<td>He always had a flair for mathematics and was a successful student. However, he did not share his success in mathematics with his parents.</td>
<td>He took pride in his success and shared this with his mother; he saw mathematics in a new light.</td>
</tr>
<tr>
<td>N</td>
<td>She worked on her own; she did not share her views of mathematics with anyone.</td>
<td>Although she was not very active in class, she had a very positive attitude to mathematics, became more confident and shared her feelings with her mother.</td>
</tr>
<tr>
<td>O</td>
<td>He was a reluctant learner and as a result struggled with mathematics; he did not talk about his views of mathematics with anyone.</td>
<td>He became confident; he was ready to share his views with his mother; he saw mathematics in a new light.</td>
</tr>
<tr>
<td>P</td>
<td>He was a successful student; he enjoyed mathematics but made mistakes when working with positive and negative numbers.</td>
<td>This trend continued; the activities that he participated in made him see mathematics in a new light; he had a fairly positive attitude in class although at times he tended to be playful.</td>
</tr>
</tbody>
</table>

Table 6.6 Case study 3: Children’s perceptions of mathematics (before and after)

When examining Tables 6.4 to 6.6, it would appear that the programme also had a positive effect on the way the children perceived mathematics. Those who had a flair for the subject or were diligent continued in this manner. They also tended to see mathematics differently in that its applications in society further stimulated their interest. Those who had unfavourable views of mathematics or struggled with mathematics appeared to have a change of heart. This change was, most likely, influenced by their participation in the programme.

The data emerging from the three case studies suggests that the programme used as a
basis for this research affected both the parents’ and children’s perceptions of mathematics. Those with a positive disposition to mathematics were likely to continue in this way as they saw mathematics in a new light which helped reinforce these feelings toward mathematics while those with a negative disposition were likely to change.

It is, thus, likely that parents’ perceptions were positively affected for the following reasons:

- They were **keen to participate** in the programme where they were given assistance;
- they **enjoyed** their interaction with their children;
- the parents wanted their children **to do well** in mathematics; and
- they **appreciated** the importance of mathematics and the role it was likely to play in the **future careers** of their children.

The children’s perceptions of mathematics also appeared to be affected in a positive manner. The following reasons may have caused this to happen:

- They **enjoyed** their parents’ interest in their work;
- they **appreciated the support** given by their parents;
- parent-child discussion took place in a **private home setting** without any outside distraction; this discussion focused mainly on mathematics; it gave children an opportunity to **tell their parents** about the mathematics they were learning at school;
- their children enjoyed looking for **applications** of mathematics in their homes and environment and **shared** these with their parents; this made them see mathematics in a **new light**; and
- it would appear that while the **top achievers continued** with their good performances in mathematics, many of the other children also appeared to **improve**.

The data collected in this study and the interpretation thereof provide strong evidence to suggest that the parent assistance programme, used in this study, affected both children’s and parents’ perceptions of mathematics in a positive and constructive manner.
6.3 Conclusion

This study provided very detailed and rich data which resulted in a number of findings. It is now possible to relate these findings to the research question and draw certain conclusions.

6.3.1 The effect on children’s perceptions of mathematics

In analysing the data emerging from the three cases of this study in terms of the effect on children’s perceptions of mathematics, certain trends emerge and these were explained in the summary of the findings (section 6.2 of this chapter). From these findings, conclusions are drawn on how this study affected children’s perceptions of mathematics.

The interest that parents showed in their children’s mathematics and the support they gave their children resulted in most of the children, including those with perceived negative attitudes to mathematics at the outset, developing positive attitudes to mathematics. By becoming aware of the various applications of mathematics at home and in the environment, children’s perceptions of mathematics as a difficult and abstract subject began to change. The grocery shopping activity, in which the children played a key role, also fostered positive attitudes to mathematics. The change in children’s perceptions and the fostering of positive attitudes to mathematics predicted further study in mathematics. Most parents stated in their interviews that their children would proceed with mathematics in grade 10 as the subject would be required for their intended careers. Even those parents who were not sure, stated that their children would, most probably, also opt for mathematics as they believed the subject would later offer them a wide range of careers from which to choose.

It would be reasonable to conclude that the fostering of positive attitudes to mathematics in children was a key feature of this study and that the perceived importance of mathematics as a school subject was enhanced in the process. This was possible because of the close interaction between the parents and the children in this study.
The relationship that developed between parents and children also strengthened as a result.

6.3.2 The effect on parents’ perceptions of mathematics

In analysing the data generated in this study in terms of the effect on parents’ perceptions of mathematics section 6.2 of this chapter covers the summary of the findings. From these findings, the conclusions may be drawn on how the parents’ perceptions of mathematics were affected as a result of their participation in the programme.

The parents’ workshops made them aware of the role they could play in their children’s mathematics learning and they played this role effectively. Their interaction with their children made them aware of the mathematics their children were doing. They found the outcomes-based approach to mathematics to be different from what they were used to; but they began to understand this approach and their role in this new approach. They became aware of the wide-ranging applications of mathematics; something that was absent when they were at school. Notwithstanding what their perceptions of mathematics were, most parents viewed mathematics as a key subject in the curriculum and their participation in this study made them more appreciative of the subject. This appreciation for mathematics surfaced in the parents’ interviews, when most parents indicated that their children would continue with mathematics in grade 10.

One may, thus, conclude that, as a result of their participation in this study, parents’ perceptions of mathematics were affected. Those parents with positive attitudes to mathematics had these attitudes reinforced while those with negative attitudes to mathematics had a rethink and changed these perceptions once they understood what their children were doing in mathematics.
6.3.3 The perceived effect on children’s achievement in mathematics

Jones’s (2001) suggestion, that a well-designed parent involvement programme could boost academic achievement and raise students’ test scores, may have relevance for this study. Although it is not possible to make such claims for the assistance programme used in this study as the cases were held in different school terms and may or may not have included summative assessment, it may be useful to examine what the perceived effect of this study on the children’s achievement in mathematics was.

This information is presented in three tables, which represent the three case studies (Appendix 8). The primary sources for this information were the parents and mathematics teachers. It would appear that the majority of the children became more confident in mathematics and developed positive attitudes to the subject. For most of the children, this meant an improvement in their mathematics results and overall averages.

It is likely the children’s increased confidence and development of positive attitudes to mathematics came about as a result of parental involvement. It is also likely that this involvement resulted in an improvement in the children’s mathematics.

6.4 Recommendations

This study has demonstrated the importance of parental involvement in education. To encourage this involvement, it is crucial that parents and teachers work together. The recommendations arising from this study are based largely on how this parental involvement could be improved and that the relationship between the teachers and parents could be strengthened. Although the recommendations are stated separately there is some overlap in the various recommendations.
During the focus group discussions the children voiced their concern on whether their parents would be able to assist them when the work became more difficult. The parents were concerned about long-term sustainability of the programme and wanted the school to take the lead in this regard. In the initial survey only about half the parents knew about outcomes-based education. This study also showed the need for parents to be informed about curriculum changes on a regular basis and how the changes would impact on their involvement in their children’s learning. One way in which to address these concerns is to hold regular “back to school nights” for parents (Huetinck and Munshin 2002).

Thus, my first recommendation is for schools to have “back to school” sessions for parents. This may take place on week-day evenings or on a Saturday morning. At these sessions, teachers can meet with parents and inform them about what they teach in the mathematics classroom. They could also inform parents about any changes to the curriculum. Parents may also be given an opportunity to work through some of the activities and be informed about the various assessment tasks that are given. Children may also be invited to join parents at these meetings. In this way, parents and children could learn mathematics together.

It is possible that these “back to school” sessions may not work for all parents due to work or domestic commitments or a lack of transport. In this regard, I recommend that mathematics teachers write regular newsletters to parents. This will ensure that all parents are targeted. These newsletters could feature details of the children’s progress, tips on how parents can help their children in their work, including guidelines on how to do certain sections of the syllabus, as well as the assessment tasks given.

One of the features of this study was the applications of mathematics in a wide range of contexts. Of the prescribed activities in the programme, the most successful was the grocery shopping activity. This appeared to be so because the children were actively involved. The temperature activity was attempted with some success but the activity on the currency exchanges was poorly attempted. This may have occurred because currency exchange may not be part of their normal daily context. However, the children also came up with innovative ways in which they used mathematics in their home and
The new mathematics curriculum for grades 7-9 calls for mathematics to be taught using real-life contexts. The activities in the parent assistance programme addressed this requirement.

Thus, **my third recommendation is for mathematics teachers to develop activities for learners that will stimulate and sustain their interest in mathematics.** Examples of these activities, such as grocery shopping and applications of mathematics in the home and environment, may be set as class-work, homework or as research tasks. These and other real-life activities should show learners that mathematics is widely used in society. Parents could also get involved by providing support during homework and research tasks.

Although there was parent-teacher interaction during the programme, this interaction was initiated by parents. In some instances, the teacher’s view of how a child performed in mathematics differed significantly from the parent’s view. A meeting between parent and teacher could have resolved the matter but this did not appear to take place. **My fourth recommendation is for there to be effective communication between parents and teachers.** This should occur regularly and could be initiated by both parents and teachers. It could take place through notes, phone calls or in face-to-face meetings. Parents would be kept informed about their children’s progress in mathematics and if any aspect of the work needed attention. Parents may request extra classes for the children. Teachers could also make house visits to help and advise parents.

One way in which parents can keep track of what their children are doing in the mathematics class is for them to cross check their children’s books with a mathematics year plan supplied by the mathematics teacher. In this way parents become aware of the mathematics their children are studying and whether the teacher is behind or ahead of the work.

Thus, **my fifth recommendation is for teachers to supply a mathematics year plan or work schedule to parents.** This work schedule would show what topics or sections
are being covered in the mathematics classroom. The assessment tasks are also included in the work schedule. In this way, parents may keep up with what is happening in the mathematics class and see how they can assist their children with homework or other assessment tasks. Parents can also keep track of the work by signing the children’s homework diaries and cross checking the homework diary with the work schedule.

The data emerging in this research suggest that the majority of the parents successfully implemented the programme used in this study. These parents had a support structure at home. The two parents (from case study 1) who had difficulty in implementing this programme did not appear to have any support and could not do justice to the programme. The only support for the children of these parents would be the teacher.

*My sixth recommendation is for mathematics teachers to make a note of such cases and make a concerted effort to help these children during class time or after school.* The teachers may also have special information sharing sessions with such parents.

It is important for schools to have a comprehensive parental involvement policy. This policy should engage parents and ensure that parents become active partners in education. Thus, *my final recommendation is that a comprehensive parental involvement policy, developed by schools, should focus on how parents could be involved in curriculum matters, thereby ensuring that schools move toward the curriculum-enrichment model of parental involvement in education.* Some of my previous recommendations may overlap with this one.

More parental involvement in mathematics is likely to lead to better mathematics results as children are able to count on their parents for their support. In grade 8, continuous assessment of mathematics counts for 75% of the overall mark and parents can play an important role in ensuring that their children do well in their various assessments.
6.5 Suggestions for further study

The majority of the parents who participated in this study successfully implemented the parent-assistance programme. Even though the parents were from different backgrounds and had different mathematical ability, the common factor for all parents was their interest in their children’s mathematics learning. Thus, it would be logical to say that only interested parents participated in this study, which is a limitation. A suggestion for further study would be to choose parents of children who generally performed poorly in mathematics and then see if the programme makes a difference to these parents and their children.

Another possible suggestion for further research may be to monitor the progress of the children in this study until they reach grade 12. The first task may be to see if they have taken up mathematics in grade 10 and examine the reason/s for any child not proceeding with mathematics; the second task may be to see if their parents are still supporting them in mathematics and how they were doing in the subject. A further suggestion would be to try this programme with parents of children in senior classes and examine the impact of the programme on the parents and the children.

6.6 Concluding remarks

In this study, although many parents indicated in the initial survey that they would be interested in participating in the parent-assistance programme, this did not materialize. Of the parents surveyed, only 18 parents were prepared to take part in the main part of this study. Of these two parents did not hand in their journals. It is possible that some parents may have had other commitments, but it would appear that the vast majority were not interested in participating in the programme.

It is vitally important that parents become more involved in their children’s mathematics learning as there is widespread concern about the success rates of mathematics learners. There are many reasons why children do badly in mathematics with two possible ones being related to this study. These are the lack of interest by parents and
the failure by teachers to involve parents. The data in this study supported the view that parental involvement in education and support of their children’s mathematics learning was likely to result in improved mathematics results and raised enthusiasm and confidence levels about mathematics. Parents themselves, stated that they benefited from the programme.

If a comprehensive parent-assistance programme for mathematics is implemented at a school, this study shows that it is possible that confidence in mathematics will increase and the mathematics results of children could improve. This would have a positive effect on the school and ensure that children proceed to the next grade with the full confidence and support of their parents. A real challenge for schools is to get all parents involved. Although this is not likely in the foreseeable future, it is important that a start be made to getting an increasing number of parents involved.
APPENDICES

APPENDIX 1: INITIAL SURVEY OF PARENTS

Dear Parent/Guardian

The Department of Education has given permission for the survey of grade 8 parents at the ________ High School, by means of a questionnaire. Please complete the questionnaire to the best of your ability. Information from this survey will be used in the development of a parent-assistance programme for mathematics. The programme would attempt to guide parents on:

- Developing mathematics skills in their children
- Assisting their children with their mathematics homework
- Monitoring their children’s homework

Only one parent /guardian per household should complete this questionnaire. Your cooperation in the accurate completion of this questionnaire will be highly appreciated.

After completing this questionnaire, place the questionnaire in a sealed envelope.

Do not write your name on the envelope or questionnaire

NB: Where alternatives are given in this questionnaire, please place a tick next to your choice.
A. INTRODUCTION

1. Your sex: Male
Female

2. Your home language: English
Afrikaans
Xhosa
Other (please specify) __________

3. Highest standard/grade passed at school
   e.g.) Standard 10 or grade 12 __________________________

4. Do you have any post-grade 12 education: Yes No

5. If your response to number 4 is yes, please specify:
   ___________________________________________________________________
   ___________________________________________________________________

6. Your highest mathematics qualification:
   • University/college
   • Grade 12
   • Grade 11
   • Grade 10
   • Grade 9
   • Below grade 9

7. Briefly describe your own experience of mathematics when you were at school:
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

B. INVOLVEMENT IN SCHOOL MATTERS

8. Are you aware of the assessment policy of the school that your child goes to? Yes No

9. Are you aware of Outcomes-Based Education? Yes No

10. If your response to question 9 is yes, please explain briefly what you know about
    Outcomes-Based Education:
    ___________________________________________________________________
    ___________________________________________________________________
11. If your response to question 9 is no, could you briefly explain why you are not aware of Outcomes-Based Education:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

12. How often have you phoned or visited your child’s school to find out about your child’s progress?

- Not at all
- Once
- Twice
- More than twice

13. Have you received a call/letter from your child’s school, during a school term in connection with your child’s progress at school?  Yes  No

14. Do you attend school governing body meetings and other school functions?  Yes  No

15. Are you informed about changes in education on a regular basis?  Yes  No

C. HOMEWORK

16. Do you monitor the television that your child watches every day?  Yes  No

17. Does your child get homework every day?  Yes  No

18. Does your child get mathematics homework every day?  Yes  No

19. Do you assist your child with homework?  Yes  No

20. If your response to question 19 is yes, briefly describe how you assist your child with homework:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
21. Are you able to assist your child with his/her mathematics homework? Yes  No

22. Would you like to be involved in a mathematics-assistance programme which gives parents ideas/pointers on how to assist and support their children in mathematics? Yes  No

23. What would you like to see included in a mathematics assistance programme?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

D. YOUR PERCEPTION OF MATHEMATICS (please place a tick under agree or disagree for each statement below)

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>AGREE</th>
<th>DISAGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics is difficult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I like mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I think mathematics is important for my child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Mathematics is useful for everyday life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mathematics is a key subject at school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I like my child to do well in mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I am able to help my child with mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I am unable to help my child with mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I am aware of the mathematics that my child is doing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. My school experience of mathematics was negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. My school experience of mathematics was positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I have always encouraged my child in mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I am scared of mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. I was never good at mathematics in school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Mathematics should be compulsory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. My child is good at mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. My school experience of mathematics has shaped my view of mathematics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your cooperation!
APPENDIX 2: LESSON TAUGHT TO PARENTS OF GRADE 8 LEARNERS

**Topic:** The product of two negative numbers

**Specific outcomes (from Curriculum 2005):**
SO 1  Demonstrate understanding of ways of working with numbers
SO 2  Manipulate number patterns in different ways

**Lesson outcomes:**
Compute examples such as (-1) \(\times\) (-3); (-2) \(\times\) (-3); etc.

**Lesson steps:**

Consider \((-2) \times (-3)\)

Compute 16 \(-2(6-3)\)

**First way**

\[
16 - 2(6 - 3) \\
= 16 - 2(3) \\
= 16 - 6 \\
= 10
\]

**Second way**

\[
16 - 2(6 - 3) \\
= 16 - 2(6) -2(-3) \text{ (using the distributive law)} \\
= 16 - 12 -2(-3) \\
= 4 - 2(-3)
\]

But this answer is 10 and 4 + 6 = 10. Therefore \(-2(-3)\) must be +6.
Another way of showing: \((-2)(-3) = +6\)

We know that
\[-2 \times (3) = -6\]
\[-2 \times (2) = -4\]
\[-2 \times (1) = -2\]
\[-2 \times (0) = 0\]

Now using number patterns complete:
\[-2 \times (-1) = _____\]
\[-2 \times (-2) = _____\]
\[-2 \times (-3) = _____\]

Now use the results you established to compute:

(a) \((-4) \times (-3)\)  (b) \((-2) \times (3)\)  (c) \((-3) \times (2) \times (-4)\)  (d) \((-1) \times (-5) \times (-2)\)
APPENDIX 3: DISCUSSION DOCUMENT AT PARENTS' WORKSHOP

This document was discussed with parents as part of the workshop at the beginning of each case study:

1. **Introduction**

   Education is a complex undertaking involving parents, teachers, students and other members of the community. Parents who take an interest and are involved in the education of their children can help them perform better in school.

Chapter 2  **NOTE: PARENTAL INVOLVEMENT = SUCCESS FOR CHILDREN**

   Fear of numbers is a common complaint often gleaned from the attitudes of others. Many parents are mathematicians in their own right. The parent who says s/he was never good at mathematics is usually very capable of balancing the weekly budget and timing the various components of the Sunday dinner. We are constantly using the mathematical process in our daily life and once we realise this we can relax and be confident in our dealings with numbers. This may seem to have little or no relevance in helping our children with their numeracy, but our attitude to mathematics will colour our children's view of the subject. A positive approach will encourage children to try.

2. **Important tips for parents**

   There are many ways you can show your child that you are interested. Some of them are:

   (a) Read with your child every day and encourage independent reading. Make frequent trips to the school and public library. Studies show that children whose parents read to them perform better in school.

   (b) Make every effort to become familiar with your child’s school programme and its expected results.
(c) Discuss your child’s progress with the teachers regularly, not just at report card
time.
(d) Ask to see samples of your child’s schoolwork.
(e) Talk to your child daily about school activities and experiences.
(f) Keep yourself informed about your child’s homework and provide assistance
where needed. Homework can tell you a lot about your child’s progress.
(g) Provide an appropriate place for your child to study at home.
(h) Encourage your child’s natural curiosity and efforts to learn.
(i) Reinforce your child’s learning by joining in some activities. These could include
reading and discussing books with your child, writing poems, watching and
discussing television programmes, visiting children’s theatres, museums, bus or
train stations, airports, farms and exhibitions.
(j) Encourage your child to compare recent achievements with earlier efforts and to
take satisfaction in progress.
(k) Show you have confidence in your child’s abilities, and look for your child’s
particular strengths.
(l) Visit your child’s school regularly and become involved in school activities as
often as possible.
(m) Monitor the television that your child watches.
(n) Be aware that your attitudes about school and teachers influence your child’s
attitudes
(o) Set goals for your child that are challenging but attainable. Challenges keep
children interested; attainable goals prevent them from becoming frustrated.

3. Homework

3.1 Definition: Homework is an academic work assigned to student by
schoolteacher that is designed to extend the practice of academic skills during non-
school hours into home environment.

Homework is emphasised as an integral part of raising standards and making course
content more challenging. The most common functions of homework are the
following:
(a) skill mastery and maintenance;
(b) involvement with learning tasks;
(c) student development;
(d) enhancing parent-child communications;
(e) fulfilment of administrative policy regarding homework;
(f) parents acquaintance with class and school activities;
(g) teaching academic and behaviour requirements to students.

3.2 How can you help your children with mathematics homework?

a) Providing an appropriate place where they can do their homework. The area must be well-lit, quiet and having necessary supplies close at hand.
b) Purchasing mathematical instruments and a scientific calculator for your child.
c) Suggesting reference materials such as books, dictionaries and educational software and offering your or referring to someone's expertise.
d) Discussing homework topics, encouraging and monitoring homework completion.
e) Tutoring and checking the homework.
f) Check important assessment dates; ensure that child completes formative assessment such as assignments, investigations and projects in the specified time; check that child prepares thoroughly for summative assessment such as tests and examinations.

3.3 What do you do when your child fails to bring homework home? (From Canter and Canter: 1996) This works well with a subject like mathematics:

a) State clearly that you expect all homework to be brought home.
Tell your child that you expect him/her to bring all the assigned work and all the books that are needed to complete the homework. If the homework is finished during free time at school, the work must be brought home for scrutiny by your-self.
b) **Work with the teacher(s) to know what homework has been assigned.**

Students should be writing all homework down in a diary or a weekly assignment sheet. When the homework is completed, the parent signs it. The teacher may request to see the diary/assignment sheet.

c) **Provide praise and support when all homework assignments are brought home.**

Make sure that your child knows that you appreciate it every time he or she brings home all homework assignments." It's great to see that you remembered to bring home all homework assignments. I knew you could do it."

d) **Institute Mandatory Homework time.**

If your child still fails to bring homework assignments, he or she may be avoiding homework in favour of spending time with friends or watching TV. Mandatory Homework Time eliminates the advantages of forgetting homework. Mandatory Homework time means that your child must spend a specific amount of time on academic matters whether homework is brought home or not. If an hour or two is allocated each night for homework, the entire time must be spent on academic work such as reading, or reviewing textbooks or class notes. When students learn that their irresponsible approach to homework will not be rewarded with more free time, they will quickly learn to remember to bring home their assignments.

e) **Use a Homework Contract**

A Homework Contract is an effective motivator for young people of any age. A Homework Contract is an agreement between you and your child that states: " When you do your homework, you will earn a reward." For example: " Each day that you bring home your homework and complete it appropriately, you will earn on point. When you have earned five points (or ten points) you will earn a special privilege.

f) **Work with the teacher to follow through at school for homework not completed.**
If your child continues to forget homework, discuss with the teacher the possibility of imposing loss of privileges at school. Loss of lunch time, or assigning after-school detention lets your child know that you and the school are working together to ensure that he or she behaves responsibly.

4. Shopping

Shopping is an ideal way to foster mathematical thinking in children. Prior to going to the shops children can be encouraged to take an active part in writing the shopping list. An estimated price can be placed alongside each item (Parent to provide input). Seeing the symbol that represents the numbers of items required and, in the shop, putting the physical objects in the trolley enforces the link between symbols and value. Children can be encouraged to compare the sizes of packages in supermarkets, using language such as bigger, smaller and same. This sort of stimulation can make shopping a more interesting experience for the children and hence, less stressful for the shopper.

Things don't get less mathematical when you get home. The children can sort the shopping into different groups such as tins, frozen foods, fruit, vegetables, packets, bread, cakes, etc. The children could be encouraged to sort the shopping by their own criteria and then you have to guess what it is. Things we like to eat and things we don't, could be one idea. When putting things away, children may assess if the items will fit into a certain space and estimate the number of tins that can be stacked in the grocery cupboard. This will help develop their spatial skills.

If children have helped in drawing up the shopping list, they can examine what was paid for the items and compare this price to the estimated price.

5. Mathematics in the newspaper
5.1 Temperature

Ask your child to observe the expected maximum and minimum temperature for Port Elizabeth for 5 consecutive days (from the newspaper or TV):
For example:

<table>
<thead>
<tr>
<th>DAY</th>
<th>Max. temp. (°C)</th>
<th>Min. temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>31</td>
<td>20</td>
</tr>
<tr>
<td>Tuesday</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td>Wednesday</td>
<td>27</td>
<td>21</td>
</tr>
<tr>
<td>Thursday</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Friday</td>
<td>27</td>
<td>19</td>
</tr>
</tbody>
</table>

(a) What was the average maximum temperature for the 5 days?

Add the temperatures: 31 + 28 + 27 + 25 + 27 = 138 and divide by 5:
Average maximum temperature is 138/5 = 27.6 °C

(b) What was the average minimum temperature for the 5 days?

Add the temperatures: 20 + 18 + 21 + 18 + 19 = 96 and divide by 5:
Average minimum temperature is 96/5 = 19.2 °C.

(c) What was the median maximum temperature? Arrange from highest to lowest: 31; 28; 27; 27; 25: The median maximum temperature is 27 °C.

(d) What was the mode of the maximum temperature? 27 °C appears more than once; so it is the mode
5.2 **Rand – Dollar exchange**

Explain to your child about the Rand-Dollar exchange and its significance. On __________, the Rand-Dollar exchange was (Per dollar):

<table>
<thead>
<tr>
<th>Buying</th>
<th>Selling</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 6,80</td>
<td>R 6,60</td>
</tr>
</tbody>
</table>

(a) You have R10000 to use for an overseas holiday. How many dollars will you get for this amount on this particular day?

You are buying so it is 10000 ÷ 6,80 = $1470,58

(b) Your uncle has gone for a three week holiday and returns with $350. How many rands will he get for this dollar amount on this day?

You are selling so it is 350 x 6,60 = R2310

5.3 **Share prices**

Share prices impact on the economy of our country. Teach your child to read share prices from the newspaper. The following share prices, from the JSE Securities Exchange; was published in the Herald on __________.

<table>
<thead>
<tr>
<th></th>
<th>Buy</th>
<th>Sell</th>
<th>Last traded price</th>
<th>Ruling price</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Mutual</td>
<td>R11-76</td>
<td>R11-85</td>
<td>R11-80</td>
<td>R11-80</td>
<td>R11-95</td>
<td>R11-72</td>
</tr>
<tr>
<td>Sanlam</td>
<td>R9-10</td>
<td>R9-12</td>
<td>R9-10</td>
<td>R9-10</td>
<td>R9-15</td>
<td>R8-90</td>
</tr>
</tbody>
</table>
Questions and answers

(a) Mr. Smith has a long standing Old Mutual policy and received 2500 free shares from Old Mutual in 1999 when it listed on the JSE. The ruling price of the share was R12 per share. If he had to sell the shares now, how much would he lose?

In 1999, the shares would have been worth 2500 x R12 = R30000. If he had to sell the shares now, he would get 2500 x R11-76 = R29400. His loss will be R30000 – R29400 = R 600.

(b) Ms. Naidoo has 2200 shares with Sanlam and Ms. Cassim has 1600 shares with Old Mutual. Whose shares are worth more now and by how much?

Ms. Naidoo: 2200 x R9-10 = R20 020
Ms. Cassim: 1600 x R11-76 = R18 816

Ms. Cassim shares are worth R1 204,- more

6. Mathematics on television

One interesting television programme is “A word or two”. It involves making up words from given letters, using sets of numbers to make a bigger number, and determining what a scrambled 9 letter word is. Encourage your children to watch this programme when it comes on again (SABC 2)

Example

Suppose a contestant selects 2 high numbers and 4 low numbers. The high numbers are 100 and 25 and the low numbers are 3, 5, 7, 6. The target is 819. How would you get this number?
Solution

100 x 7 = 700

25 x 5 = 125 add: 825 and subtract 6 = 819.

Now you try the following: The two high numbers are 50 and 75. The four low numbers are 2, 4, 7 and 8. The target is 793. Do the necessary calculations. Get your child to practice these calculations.

Other games that develop mathematical thinking are chess and scrabble.

7. Mathematics in the home
A lot of mathematical opportunities exist in the home. Make your child aware of them. Some of them include:

7.1 The contents of the refrigerator/freezer. Check whether each has volume or mass:

Examples: Coke in cans: 340 ml; Coke in bottles: 500 ml; 1.5 litres; 2 litres
            Milk in sachets: 1 litre
            Milk in bottles: 1 litre; 500 ml.
            Juice: 200 ml; 1 litre; 2 litres
            Meat in kilograms (kg)
            Chicken in kilograms (kg)
            Frozen mixed vegetables (grams or kilograms)
            Margarine or butter (in grams or kilograms)
            Oil in litres or ml

7.2 The contents in your grocery cupboard.
Examples:
(a) Description of the containers:
    Cereal in boxes (rectangular prism); canned fish/beans in tins (cylinders) and so on
(b) Mass of the containers in grams:
Canned Fish 410 g; Peanut butter 450 g; Tea bags: 500 g and so on

7.3 The contents of the bathroom cupboard:
(a) Description of the deodorant, shampoo and other containers:
cylinders; boxes; tubes and so on

(b) How many millilitres of liquid are found in each container?
It varies. There are both small and larger containers; children can compare the prices of the containers.

7.4 The tile formation in your bathroom or kitchen:

Example: The diagram below represents a 4x4 section of a tiled bathroom wall.

You may ask your child to work out the answers to the following questions:
(a) Calculate the total number of tiles on specific walls/floors in your house
(b) On a section of a wall with tiles in the above formation, how many tiles appear on the diagonal of a
1. 3 x 3 section of tiles
2. 5 x 5 section of tiles
3. 7 x 7 section of tiles

What do you notice?

(c) How many tiles will appear on the diagonal on wall or floor tiles that is 50 x 50?
(d) Suppose each tile in the above diagram is a square. How many squares are there altogether?

8. Geometric shapes in the home/environment

Make your child aware of the geometric shapes/features, etc. that may be found in your home/environment. Ask your child to answer the following questions. This may help him or her see mathematics in a different light:

(a) Describe the shapes of the window frames, windows and doors of your home.
(b) Describe the roof. Why do you think the roof is designed in this way?
(c) Find objects in your home or environment that are:
   (1) rectangular
   (2) spherical
   (3) triangular
   (4) cylindrical
   (5) circular

9. Conclusion

Use your interaction with your child to praise his/her schoolwork and promote positive attitudes to mathematics (as well as other subjects/learning areas)

END!
APPENDIX 4: JOURNAL

Instructions on completing this journal

Please complete this journal carefully, and to the best of your ability.

For numbers 1 to 3: to be completed by the parent weekly.

For numbers 4 to 5: to be completed by your child weekly, under your supervision.

For numbers 6.1 and 6.2: to be completed by your child (just once-off), under your supervision.

For number 7: to be completed by the parent at the end of 7 weeks

Please hand in this journal to the Grade 8 Head at the school after its completion
1. **Discussion with child about school:**
   Briefly describe any discussion you had with your child about school during this week:
   ___________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

2. **Mathematics homework:**
   Indicate your involvement next to each statement with a tick

   2.1 Checked child’s homework, including assignments/projects/investigations
   2.2 Assisted child with mathematics homework
   2.3 Signed child’s homework/tests/assignments/etc
   2.4 Help child to interpret homework
   2.5 Arranged for child to go to friends house to work on group project (mathematics)
   2.6 Arranged for child to do research at library/internet. etc to complete homework/assignments/projects
   2.7 Briefly describe your involvement in your child's mathematics homework:
       ____________________________________________________________________
       ____________________________________________________________________
       ____________________________________________________________________

3. **Interaction with child’s mathematics teacher:**
   Indicate your interaction with your child’s mathematics teacher next to each statement with a tick

   3.1 Phoned the teacher about your child’s mathematics work
   3.2 Sent a note to the mathematics teacher
   3.3 Received a note or phone call from your child’s mathematics teacher about your child’s work
   3.4 Met the mathematics teacher during a parent-teacher meeting
3.5 If you have ticked any of 3.1 – 3.4, briefly describe these encounters:
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

4. **Your child's mathematics experiences in school:**

For each week ask your child to write down two new mathematics terms or words that he/she has learned during that week as well as its meaning/description: Diagrams may be drawn where possible.

Week number: ____________

Mathematics term or word:______________________________________________
Its meaning or description:______________________________________________
____________________________________________________________________

Mathematics term or word:______________________________________________
Its meaning or description:______________________________________________
____________________________________________________________________

5. **Your child's mathematics experiences/encounters at home and in the environment:**

For each week ask your child to write down 2 mathematics experiences/encounters that he/she has come across at home or in the environment.
Week number:_________________

Mathematics experience/encounter number one: (a brief description):_____________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

What did your child learn?_______________________________________________
____________________________________________________________________
____________________________________________________________________

Mathematics experience/encounter number two: (a brief description):_____________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

What did your child learn?_______________________________________________
____________________________________________________________________
____________________________________________________________________

6. Mathematics in the home:

6.1 Grocery shopping: (to be completed just once)

At the end of a week ask your child (with your help) to draw up a grocery shopping (of about 10 items) list for the following week. Ask your child to **estimate** (with your help) the prices on your shopping list. Take your child shopping with you. Ask your child to choose the items on the shopping list and make a note the prices of groceries purchased.
(a) List the items purchased together with estimated price and actual price paid as follows:

<table>
<thead>
<tr>
<th>Grocery item</th>
<th>Estimated Price</th>
<th>Amount actually paid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Describe your child's reaction at being asked to draw up the grocery list:

_________________________________________________________

_________________________________________________________

(c) Compare the estimated prices to the actual prices of the groceries: Are you under or over your grocery budget? Discuss:

________________________________________________________________

________________________________________________________________

________________________________________________________________

(d) What do you think your child learnt from this shopping experience?

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________
6.2 Mathematics in the newspaper: (to be completed just once)

Ask your child to check the newspaper (or television) for the maximum and minimum temperatures for Port Elizabeth for a specific week:

<table>
<thead>
<tr>
<th>Days</th>
<th>Highest temp (H)</th>
<th>Lowest temp (L)</th>
<th>Average daily temperature [ \frac{(H + L)}{2} ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Thursday</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With your supervision, ask your child to answer the questions 1-3:

6.2.1 What was the overall highest temperature for the week and on which day did it occur?

6.2.2 What was the overall lowest temperature for the week and on which day did it occur?

6.2.3 What were the average highest daily temperature and the average lowest daily temperature?

6.2.4 What do you think that your child learnt from this activity?
Ask your child to check the newspapers/television news for the rand–dollar exchange

Select a week and write the Rand-Dollar exchange each day:

<table>
<thead>
<tr>
<th>Day</th>
<th>Buying</th>
<th>Selling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
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<tr>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With your supervision, ask your child to answer the following questions:

6.2.5 On which day was more profitable to bring dollars into South Africa? Why?
___________________________________________________________________
___________________________________________________________________

6.2.6 Suppose a relative of yours comes to South Africa with $3000. How many rands will he/she get for this dollar amount on this particular day?
___________________________________________________________________
___________________________________________________________________

6.2.7 You want to go for an overseas trip and would like to buy dollars. On which day would it have been the cheapest?
___________________________________________________________________
___________________________________________________________________

6.2.8 Suppose you wish to change R10000 into dollars on this particular day. How many dollars would you get for this amount of South African currency?
___________________________________________________________________
___________________________________________________________________

6.2.9 What did your child learn from doing the above activity?
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
7. Parent’s view on the parent assistance programme (to be completed by the parent at the end of the period)

7.1 Briefly describe the experience of interacting closely with your child in this programme: ____________________________________________________________
_______________________________________________________________
_______________________________________________________________

7.2 What did you learn from the programme? _____________________________
_______________________________________________________________
_______________________________________________________________

7.3 What did your child learn from the programme? _________________________
_______________________________________________________________
_______________________________________________________________

7.4 What suggestions do you have, if any, to improve the programme? _________
_______________________________________________________________
_______________________________________________________________

THANK YOU FOR YOUR COOPERATION
CHAPTER 3 APPENDIX 5a: FOLLOW-UP QUESTIONNAIRES FOR PARENTS

Chapter 4

This questionnaire is given as a follow-up to the parent workshop and parent assistance programme for mathematics in which you participated. Answer the questions carefully and to the best of your ability (use the back of this page if necessary).

1. What were some of the highlights of the programme?
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

2. What were some of the difficulties in following the programme?
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

3. How were the difficulties expressed in (2) overcome?
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

4. What did you (the parents) learn from the programme?
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

5. What were your perceptions (views) on mathematics before you followed this programme?
   ___________________________________________________________________
6. **After** following this programme, what are your perceptions (views) on mathematics *(now)*?

   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________

7. What do you think could be
   (a) added to the programme? _____________________________________
       __________________________________________________________
   (b) removed from the programme? _________________________________
       __________________________________________________________
APPENDIX 5b: FOLLOW-UP QUESTIONNAIRES FOR CHILDREN

This questionnaire is given as a follow-up to the parents' workshop and parent assistance programme for mathematics and must be completed by children of parents who participated in the programme (use back page if necessary).

1. What were some of the highlights of the programme?
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

2. Describe the interaction between yourself and your parent in the implementation of this programme:
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

3. What effect/s did your participation in this programme have on your attitude/s to mathematics?
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

4. What effect/s did your participation in this programme have on:
   (a) your understanding of the mathematics taught to you?
   ____________________________________________________________________
   ____________________________________________________________________
   (b) your ability to complete all your mathematics homework effectively and on time?
   ____________________________________________________________________
   ____________________________________________________________________
(c) your mathematics results in class tests, examinations and other assessments? _________________________________________________
________________________________________________________________
________________________________________________________________

5. What did you (the children) learn from the programme?
________________________________________________________________
________________________________________________________________
________________________________________________________________

6. What do you think could be
   (a) added to the programme?
________________________________________________________________
________________________________________________________________
________________________________________________________________

   (b) removed from the programme?
________________________________________________________________
________________________________________________________________
________________________________________________________________
APPENDIX 6: GRADE 8 MATHEMATICS YEAR PLAN

Term 1

1. Natural and whole numbers
   - Natural numbers, whole numbers and the number line
   - One and zero
   - Multiples
   - Factors
   - Prime numbers
   - HCF and LCM
   - Squares and square numbers
   - Square roots
   - Cubes and cubic numbers
   - Cube roots
   - Rules for combining operations
   - Rules for divisibility
   - Introduction to statistics

Control test

Term 2

1. Algebra topics
   - Translating ordinary language into algebra
   - Construct formulas from patterns
   - Investigations
   - Algebraic expressions; variables, constants, terms, etc.
   - Exponents
   - Powers and variables
   - Multiplying powers
   - Power of a power; product of a power
• Adding algebraic expressions
• Multiplying polynomials

2. Geometry topics

• Points and lines
• Intersecting lines and pairs of angles
• Using a protractor
• Complementary angles
• Supplementary angles
• Parallel lines
• Corresponding angles
• Alternate angles
• Consecutive interior angles

3. Integers

• Natural numbers, whole numbers and the number line
• Description of integers
• Bigger and smaller
• Inequalities
• Adding integers
• Integers and variables
• Additive inverse
• Subtracting integers
• Multiplying integers
• Dividing integers

4. Project

5. Revision

6. Examination
Term 3

1. Triangles
   - Naming triangles
   - Sum of the interior angles of a triangle
   - Investigation
   - Calculations involving the interior angles of a triangle
   - Exterior angles of triangles
   - Investigation
   - The theorem of Pythagoras
   - Calculations involving the use of the theorem of Pythagoras

2. Rational numbers
   - Simplification of fractions
   - Addition
   - Subtraction
   - Multiplication
   - Division

3. Equations
   - Trial and improvement method
   - Solving equations more efficiently
   - Solving equations containing more than one operation
   - More complex equations
   - Problems leading to equations

4. Ratio and proportion
   - Comparing quantities
   - Investigation
   - Ratio
   - Equal ratios
• Dividing a quantity in a given ratio
• Increase and decrease in a given ratio
• Proportion
• Scale drawings

Control test

Term 4

1. Statistics
• Natural numbers, whole numbers and the number line
• Line graph
• Bar graph
• Pie chart
• Reading and interpreting graphs

2. Area and volume
• Natural numbers, whole numbers and the number line
• Two-dimensional and three-dimensional shapes
• Investigation
• Surface area
• Investigation
• Volume

3. Geometric Patterns
• Geometric patterns in nature
• Focus on other geometric patterns

4. Revision

5. Examination
## APPENDIX 7: SUMMARY OF DATA COLLECTED IN ALL CASE STUDIES

### Case study 1

<table>
<thead>
<tr>
<th>Parent gender</th>
<th>Child gender</th>
<th>Journals</th>
<th>Follow-up questionnaire</th>
<th>Parent interviews</th>
<th>Teacher interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Female</td>
<td>Male</td>
<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>B Female</td>
<td>Female</td>
<td>Not fully completed</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C Male</td>
<td>Female</td>
<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>D Female</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>E Female</td>
<td>Female</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Case study 2

<table>
<thead>
<tr>
<th>Parent gender</th>
<th>Child gender</th>
<th>Journals</th>
<th>Follow-up questionnaire</th>
<th>Parent interviews</th>
<th>Teacher interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>F Male</td>
<td>Female</td>
<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>G Male</td>
<td>Female</td>
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<tr>
<td>H Male</td>
<td>Female</td>
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<td>Yes</td>
<td>Yes</td>
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<tr>
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<td>Female</td>
<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>J Male</td>
<td>Female</td>
<td>Not fully completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>K Female</td>
<td>Female</td>
<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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### Case study 3

<table>
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<th>Parent gender</th>
<th>Child gender</th>
<th>Journals</th>
<th>Follow-up questionnaire</th>
<th>Parent interviews</th>
<th>Teacher interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Female</td>
<td>Female</td>
<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>M Female</td>
<td>Male</td>
<td>Mostly completed</td>
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<td>Yes</td>
<td>Yes</td>
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<tr>
<td>N Female</td>
<td>Female</td>
<td>Mostly completed</td>
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<td>Yes</td>
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<tr>
<td>O Female</td>
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<td>Mostly completed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>P Male</td>
<td>Male</td>
<td>Mostly completed</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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APPENDIX 8: A SUMMARY OF THE PARENTS’ AND TEACHERS’ PERCEPTIONS OF THE EFFECT OF THE PARENT-ASSISTANCE PROGRAMME ON LEARNER ACHIEVEMENT

Case study 1

<table>
<thead>
<tr>
<th>Child of parent</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>He was always interested in his work. Schoolwork was not a problem. He was doing his work well into the night.</td>
<td>He became more enthusiastic about mathematics. His mother's interest in his work motivated him. His results improved.</td>
</tr>
<tr>
<td>B</td>
<td>She &quot;battled&quot; with mathematics and struggled to complete her homework.</td>
<td>She was interested at first and there was an improvement in her work. However, this improvement was short-lived as she became quiet and shy in class and lost interest in her work.</td>
</tr>
<tr>
<td>C</td>
<td>She was interested in her work but tended to &quot;battle&quot; a bit.</td>
<td>She began to grasp concepts a bit better. She became more confident in mathematics and her results improved.</td>
</tr>
<tr>
<td>D</td>
<td>He was &quot;not very good in mathematics&quot; and his homework was poor.</td>
<td>There was improvement in his assessments but had the potential to do better.</td>
</tr>
<tr>
<td>E</td>
<td>She was diligent, worked independently but struggled with her mathematics.</td>
<td>She was eager to learn and performed &quot;not too badly.&quot; Her work improved.</td>
</tr>
</tbody>
</table>
Case study 2

<table>
<thead>
<tr>
<th>Child of parent:</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>She was a diligent worker and always took her work seriously</td>
<td>She did very well in mathematics and was a top achiever in the subject.</td>
</tr>
<tr>
<td>G</td>
<td>Mathematics was a big rush for her. As soon as she started her work, she wanted to finish it.</td>
<td>Although she was an average student, she developed a positive attitude to mathematics. There was also some improvement in her work.</td>
</tr>
<tr>
<td>H</td>
<td>She would work on her own without asking for assistance from her parents.</td>
<td>Although the parent said there was improvement in her work, this was contradicted by the teacher who said that she was not focussed in class and was easily distracted by her peers. Thus, there was no real improvement in her work.</td>
</tr>
<tr>
<td>I</td>
<td>She was a good student and took her work very seriously.</td>
<td>She enjoyed mathematics and her results were very good.</td>
</tr>
<tr>
<td>J</td>
<td>She used to struggle with her work and asked her father for assistance.</td>
<td>Her assessments were more or less the same as in previous terms. She had a positive attitude to mathematics but was not active in class.</td>
</tr>
<tr>
<td>K</td>
<td>She struggled with mathematics and used to get frustrated.</td>
<td>She began to try her best; her parent stated that she made some improvement. However, according to her teacher there was no real improvement.</td>
</tr>
</tbody>
</table>
## Case study 3

<table>
<thead>
<tr>
<th>Child of parent</th>
<th>Before participation</th>
<th>After participation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L</strong></td>
<td>She used to do her work on her own and her mother used to check her work. She had no problem with mathematics until grade 7.</td>
<td>Her teacher described her as an &quot;average to above average&quot; mathematics learners. She loves mathematics and did very well in her assessments</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td>He was diligent learner but used to do his work on his own and in a rush</td>
<td>Although he had a flair for mathematics, by getting support from his mother, his average for his assessments improved even further</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>She used to do her work on her own or with her friend. Her mother was not involved in her work.</td>
<td>The involvement of her mother in her work helped ensure better communication between mother and daughter. Her mother supported her learning. Her overall average for mathematics improved</td>
</tr>
<tr>
<td><strong>O</strong></td>
<td>He struggled with his work and was too shy to ask for assistance.</td>
<td>He enjoyed having his mother take an interest in his work. He became keen and eager to learn. His overall average improved</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>His father stated that his work in mathematics was &quot;not so good.&quot; He had problems with the signs and working with different operations</td>
<td>He enjoyed the support of his father in his work. Although he was very busy with religious studies in the afternoons, he made sure he did his mathematics in the evenings. His overall percentage improved</td>
</tr>
</tbody>
</table>
LIST OF SOURCES AND TEXT REFERENCES


Szemcsak, D.D. and West, O.J., 1996. The whole town is talking about it… “Math month, that is”. In: Teaching Children Mathematics, 3(4), pp.170-173.


