The design and implementation of a classroom-based support programme in Trigonometry for use by underqualified educators.

By

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Submitted in partial fulfillment of the academic requirements for the degree of Master of Education (Mathematics Education) in the School of Mathematics, Science and Technology Education, within the Faculty of Education (Edgewood campus), University of KwaZulu - Natal

October 2005

## PREFACE

The research work in this dissertation was carried out at Siphimfundo High School in the province of KwaZulu - Natal. This was done under the supervision of Dr D. Brijlall and Mr A. Maharaj both of the University of KwaZulu - Natal.

The main purpose of the study was to show the necessity of a classroom-based educator in-service support programme. Educators have unique problems being derived from the uniqueness of their school situations. Thus, the feeling that this kind of support could improve the quality of mathematics teaching and learning.

The study represents the original work by the author and has not been submitted before for other purposes in any tertiary institution. The work of the others has been acknowledged in the text.

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## ACKNOWLEDGEMENTS

I would like to thank all those who helped me with this thesis. The group of students for this initial Master of Education (Mathematics Education) programme. I am also grateful to Mr P.S. Ntenza for his motivation and assistance. Also I would like to thank my 2003 Grade Eleven (viz. 11B) students. Not forgetting my supervisor Dr. D. Brijlall for his guidance, advice and dedicated supervision.

Thanks are also due to the following individuals:

Mr A. Maharaj (co-supervision of this project) -UKZN

Mr B. N. Khumalo, Mr A. Nxumalo, Mr K. Msimang, Mr K.M. Mtshali, Mrs V. I. Mntambo and Ms Z. Hlongwane (Mathematics educators).

Ms B.P. Mbona who has been always helping about typing and the use of the computer facility.

Mr N.M. Mbatha (my school principal) for allowing me to use all the available and relevant facilities at school.

Ms P.N. Msiya, the co-reader of my written work.

My wife, Sibongile, for her continuous moral support, patience and Understanding throughout the period of my study.

Both my parents who lit the candle of success from the beginning of my early school years.

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# CHAPTER 1

# OVERVIEW OF THE STUDY

## 1.1 Introduction

The researcher has observed that some educators are struggling in their teaching practice. The reason could be that some are underqualified and the others lack content knowledge. Thus, the researcher felt that these educators should be supported. One mechanism that could contribute positively is the in-service workshops. The workshops designed and implemented to take place in a venue which differs from the actual classroom environment. This does not really address the educators' basic needs. Therefore, the researcher has opted for a school- or classroom-based support programme.

## 1.2 Purpose of study

The majority of secondary schools in KwaZulu-Natal Department of Education and Culture are under-resourced. The schools are under-resourced in both material and human resources. A report published by EduSource in 1997 found that most mathematics and science educators were not qualified to teach the subjects. Although 85% of mathematics educators were professionally qualified as educators, only 50% had specialized in mathematics teaching (DoE, 2001). The researcher is specifically aware of underqualified educators in his/her district who are teaching mathematics in Grades 10, 11 and 12. This was the main reason why the researcher decided on the design and implementation of support programmes. The learner-educator ratio is presently too high.

There is an inadequate supply of textbooks at schools in my district. Other materials to be used were not easily available. This study focuses on the design and implementation of a classroom-based support programme for use by underqualified educators, and other struggling educators.

The description of "underqualified" in respect of educators is applied in the sense that educators have a Primary Teachers Diploma. This diploma entitles them to teach mathematics in a primary school, not in a secondary school. Furthermore, some of the topics that these educators are expected to teach were excluded in their initial training. This was further emphasized by Morar (2002), who wrote that South Africa represents a particular case because there is a huge backlog of appropriately qualified educators located over a large and under-resourced educational jurisdiction.

Another contributing factor to the educators' plight in their teaching practice is that content-based in-service workshops are no longer offered. In my district for over the past five years orientation workshops were organized and facilitated at the very beginning of each academic year. My experience is that in these kinds of workshops the Subject Advisors only present and orientate educators about different kinds of forms to be used for continuous assessment. As a result of this kind of practice the researcher felt that in-service workshops for educators should be organized. These workshops should address educators needs with respect to the problems encountered in the classroom instruction. There is a gap between what educators were taught at college(s) of education and the reality they encounter at their schools. The situations in which the educators practice their teaching are different, thus there is a need for in-service workshops.

Before the change in government, (prior to 1994), there were in-service workshops organized and implemented by CASME (Centre for the Advancement of Science and Mathematics Education) which is presently situated at the University of KwaZulu-Natal in the Edgewood campus. These workshops were democratically organized. The participants had the freedom to choose the topic(s) for each of the scheduled workshops. In this way the educators' basic needs with respect to the problems being encountered in their teaching-learning situation were addressed. Such workshops are no longer held by CASME.

In the workshops organized and implemented by the Centre for the Advancement of Science and Mathematics Education, topics to be discussed in each subsequent workshop(s) were democratically chosen. Moreover, during the vacations of 1995 and 1996 the researcher attended a Teacher Leadership Course under the auspices of CASME, where the researcher obtained a certificate of organizing and implementing workshops for mathematics. The researcher was at times personally asked by the circuit officials to conduct workshops for mathematics educators. Consequently it was also possible for the researcher, in preparation for the study, to share ideas with attendants about many issues concerning the subject teaching, for example, in-service workshops and curriculum innovations.

Generally South African educators have been emphasizing rote learning, passivity and conformity (Glover, 1993). Knowledge was transmitted by the educators which was the passive assimilation of knowledge by the learners. During their schooling years,

educators were also deprived of these opportunities of internalizing the knowledge. During the discussions with other educators, it seems that they are still exercising rote learning. The teaching is thus for examination purposes rather than for understanding. Research shows that knowledge must be actively constructed by the learners. Therefore, according to Vygotsky (1986) the knowledge building takes place within a social context. So learners should be given enough opportunities to interact with each other during the process of knowledge construction. To the researcher all this calls for the kinds of workshops, which will support educators during their teaching-learning practices. Many educators do not use different methods of teaching. According to Delaney (2001), mathematics teaching should be resourcefully. The situations from which practicing educators come from or where they are in, are not all conducive to quality teaching. Therefore, as a result of that, they rarely use resources in their teaching practice.

Consequently with this kind of practice (mentioned above) the learners' skills are not observed. This type of teaching practice offered, do not let the learners actualize their innate skills. Becker & Pence (1998) pointed out that some educators are completely unfamiliar with the content that they are being asked to teach. Therefore, there is a need for classroom-based support programmes to address all the gaps observed during teaching-learning situations. According to Cornelius (1982) educators of mathematics should be given ample opportunities to keep themselves up-to-date through appropriate in-service courses and activities. The underqualified mathematics educators can upgrade their content knowledge by registering with tertiary institutions which offer specific programmes allowing the educators to upgrade their qualifications.

The advantages of focused in school- or classroom-based support programmes are attained because they will address the individual educator needs. Moreover, the programme will develop materials to be used in the classroom during the teaching and learning situations. The researcher's project does not deny support for in-service workshops organized and implemented in neutral venues as this is going to address content knowledge. But such workshops tend to theorize the educators' problems, and the situations under-which teaching and learning takes place are not recognized. According to the researcher's notion we should marry the two, that is, the support programme and the situation(s) from which the struggling educators come. This project hoped that the classroom-based support programme will evolve into an "ideal" intervention and assist underqualified educators or struggling educators teach successfully and independently in their classrooms. The classroom- or school-based support programme involved :

- visit the educators in context,
- observe the educator whilst teaching,
- organise common workshops when necessary and
- even teach in his/her presence

## 1.3 Background information

In this section, the background leading to the design and implementation of the classroom-based support programme(s) are interrogated.

Since the inception of the democratically elected government, the number of in-service workshops had been reduced. The workshops were very important since educators derived opportunities to share the ideas and the problems encountered during their

respective teaching-learning situations. These workshops by classroom- or school-based support programmes would prove more effective. The school- or classroom-based programmes could address real problems. As a result mathematics teaching would not be a burden.

In this kind of support programme many factors which influence the poor performance of both educators and learners could be easily observed. These factors could be educator-pupil ratios, educators being underqualified or unqualified, the conditions conducive to good learning. Adequate supply of resources (both human and material) could promote the teaching and learning of mathematics. If mathematics is taught resourcefully then it becomes meaningful and interesting to the learners. Therefore, the researcher had a belief that if educators were supported through the classroom- or school-based programmes, problems being encountered in any teaching-learning situation could be minimized. Glover (1993) indicated that it seemed likely that the in-service training of underqualified mathematics educators will remain an urgent need well into the future. The school- or classroom-based support programme will address the specific educators' needs. Such programme would help the educator develop materials to be used in the classroom whenever it is necessary.

Inadequate supply of material resources have a negative effect on the teaching and learning practices. This has been mainly observed in black schools and moreover, it has resulted in a number of problems. In the early 1980's the problems (protests, marches, uprisings) of black educators were becoming too much for the government to handle. As a result in 1980 the government requested the Human Sciences Research Council to

compile a comprehensive report on the state of education in South Africa. The eagerly awaited de Lange Report (1981) contained a detailed outline for the modernisation of educational provision all race groups (Ntenza, 1991). The government responded to this report by saying that it could not attend to the acknowledged crisis in education. The reason put forward in support of this was that it did not have enough financial resources to tackle all the problems embedded in black education. A number of our educators are the products of this crisis in education, the training to them was "inappropriate". Modules like Materials Development or Technology in Education were not available. According to the researcher's perception these kinds of modules can help educators to teach mathematics resourcefully and for understanding, rather than only for examination purposes. Again, a classroom- or school-based support programme will address the individual's problems in a most relevant way.

Consequently the private sector was requested to come out with programmes that would alleviate some of the problems. In the early 1980's Shell South Africa made feasibility study of where and how it could contribute to the development and enhancement of mathematics, biological and physical science education in South Africa. After initial discussion and consultations with various groups, communities, authorities and other interested parties, it was decided to operate the project for the then KwaZulu mathematics and science educators. The main reason for this was that the KwaZulu Department of Education and Culture had been identified as one of the biggest and most needy department of education in South Africa. The project was known as the Shell Science and Mathematics Resource Centre (SSC).

The main aims of the project was to be achieved through in-service training and professional development of educators. But all these processes took place outside the classroom- or school-based situations. This resulted in educators' specific needs not clearly addressed. The situations in which teaching and learning take place are different. For this reason the researcher had a notion that the classroom-based support programmes for underqualified and struggling educators should be designed and implemented. The researcher felt that this will help in addressing the individual educator's basic needs and at the same time motivate the learners. In support of this Cockroft (1982) argued that school-based in-service support for educators was of fundamental importance. The researcher believed that the school-based in-service workshop(s) should be based on specific educators' needs. This kind of support programme will bear fruits because educators' specific problems will be minimized. They could share ideas about content knowledge and approaches to the subject content that can be used in class.

# CHAPTER 2

# THEORETICAL CONSIDERATIONS

## 2.1 Introduction

Mathematics teaching must not be for examination purposes only. It must be taught resourcefully and insightfully. There is a great deal of thinking and various activities involved in mathematics teaching and learning. There are learning theories which influence the effectiveness of mathematics teaching. Some learning theories are cognitive psychology, socioculturalism, situated cognition and constructivism. But for the purpose of this study the researcher will mainly consider constructivism. At times reference to situated cognition and socioculturalism will be made to strengthen the views of the researcher

## 2.2 Passive versus active learner participation

One trait of mathematics is that it is a practical subject. During teaching and learning learners should be given enough opportunity to practice what has been taught. In some cases, the teaching and learning of mathematics is often seen as an activity in which knowledge is transmitted from the educator to the learner(s), through whole-class, chalk-and-talk educator exposition and passive learner practice. Actually in the classroom situation there is no new knowledge altogether. New concepts emanate from what has been learned previously. A much clearer understanding of the kinds of knowledge and experiences learners bring to school is required (Vithal, 1993). The educator must

encourage students' questions, help interpret them when necessary, review and guide their sequence towards a solution (Bradford, Nordberg & Odell, 1962). Therefore, the latter two statements above invite for active participation of the learners. In this way they will feel knowledge construction as theirs and thus earn ownership of this constructed knowledge. The previous knowledge forms the fundamental basis of the new knowledge to be learned and taught. However, recent developments in the subject teaching and learning is emphasizing learner active participation rather than passivity. The move has been to the one in which learners are more actively involved in constructing their own meanings, and educators and learners talk together to create and share knowledge.

In mathematics teaching and learning the researcher recognized that three learning theories:

- constructivism,
- socioculturalism and
- situated cognition, play a role in education. Constructivism is the learning theory, which advocates that each individual can construct knowledge. Learners have different experiences from their social lives. So in a teaching-learning situation these experiences should be shared so that new knowledge can be constructed. Knowledge is actively constructed, that is why von Glasersfeld (1989b) wrote that constructive activity occurs as the individual interacts with other members of the community. Socioculturalism is a learning theory, which incorporates two things, that is social life and cultural life of a human being. The way a particular society lives, and their cultural habits have a positive influence on the learning of the individual. According to Vygotsky (1978), this is mainly observed when

learners get involved with tasks or problems which go beyond their immediate individual capabilities in which the adults help their performances, or in collaboration with more knowledgeable peers.

Situated cognition is a learning theory that emphasizes the fact that has a bearing on the situation. According to this learning theory we should marry the inside-classroom and outside-classroom experiences. Lave & Wenger (1991) argued that, "there is no activity that is not situated". Therefore, individuals learn through active participations relative to their situation contexts. However, the researcher focused on constructivism and at certain stages referred to the latter two theories. Also the researcher considered what other researchers have written about the in-service programmes for educators. In this study the in-service programme was designed for the underqualified mathematics educators.

According to the researcher's opinion the programme should be school- or classroom-based because that is where the educators' problems are encountered.

## 2.3 Constructivism

According to Simon (1995), learners have the ability to construct knowledge based from what they know. So, during teaching and learning such opportunity should be made available. Each mathematics educator should strive for teaching mathematics for understanding. What has been learnt should remain indelible in the learners' mind. This can only be achieved if learners construct their own conceptual knowledge through necessary and relevant interpretations under the educator's guidance. He/she must guide them with the intention of minimizing misconceptions.

It is not easy to construct knowledge in isolation. An educator should not be the only active participant in the classroom situation, learners too should actively participate. In constructivist approaches, learners are assumed to construct their own mathematical conceptual understandings as they interact with others. Learners have differences in understanding conceptual knowledge. It is important to give them opportunities to interact with others so that at the end they come to common and meaningful understanding. Von Glasersfeld (1989b) concluded that learning is a process of self-organisation whereby the individual re-organises his or her activity to eliminate perturbations. He also acknowledged that this constructive activity occurs as the individual interacts with other members of a community.

Learners should be given enough opportunity to actively participate in the classroom situation, thereby knowledge construction is internalized. Knowledge is constructed from our world of perceptions and experiences, through previous knowledge. However, it must be noted as well that through constructivism there may be more than one solution in mathematics problem(s). In mathematics teaching and learning knowledge is constructed in different ways, but even though there may be more than one solution, a common understanding must be reached. Through educators' guidance, a consensus about the knowledge constructed must be reached.

Learning takes place when learners get involved with tasks, which go beyond their immediate individual capabilities in which educators help their performance or in collaboration with more knowledgeable peers. Further, whereas a socio-cultural theorist might see a student appreciating the educator's contributions, a constructivist would see a

student adapting to the actions of others in the course of ongoing negotiations (Cobb, 1994). Therefore, knowledge is socially constructed and no knowledge can be constructed in isolation. Knowledge construction is socially negotiated. As a result of this social construction, sufficient consensus should be reached because without that a diversity of perceptions and conceptions might emerge. During the teaching and learning process the educator supports and encourages the learners to express their mathematical problems, interpretations and solutions.

Lave (1988) and Lave & Wenger (1991) have cited that, (a) much of what is specific to the situation in which it is learned, and (b) there should be a greater emphasis between what is learned in the classroom and what is needed outside the classroom. Teaching and learning practice is not isolated from the social, cultural and contextual factors. Different situations in knowledge acquisition are characterized by different structured resources, like, ongoing activities, different social relationships and different cultural forms of quantity. So, knowledge construction depends on social factors and situation related factors. Mathematical learning is more often indirect and occurs as the learners get involved in implicit negotiations that take place outside their own and the educator's awareness.

Learners should be given opportunity to engage in practice. They must be given work that requires their active participation and eventual compulsion them to seek knowledge from the knowledgeable group. This will in turn help them to construct their own knowledge and as a consequence writing and production skills are developed. In this respect, learners would be given tasks that would allow them to be engaged in activities

such as talking to each other, negotiating mathematical meaning, understanding of particular concepts and sharing ideas about the task such as why it has been in a particular manner rather than another.

A similar feature to be remembered in constructivism is that, there is out-of-school mathematics knowledge, which should be connected to the mathematical experiences in school. This can be achieved through the guidance and structures provided by the educator. A gap that exists between mathematics practices in school and out-of-school situations must be closed. Learners should be part of mathematics community by being actively involved in doing mathematics, working with others towards common goals, discussing and refining mathematical ideas. Learners should be encouraged to make connections between how they do mathematics in school and how they do mathematics out-of-school. This feature concurs with the theory of situated cognition.

These connections can be maximized through problem solving. To illustrate this one problem from Masingila (1992) can be cited: *An army bus holds 36 soldiers. If 1128 soldiers are being bussed to their training site, how many buses are needed?* Here there could be more than one possible solution. These could be 31,3 buses; 31 buses remainder 12 or 32 buses. The first two solutions are impractical. Therefore, if the learner has realized that this is a real life situation the precise answer is that 32 busses are needed. If there are no connections, learners will not be able to construct mathematical knowledge. However, there is a shortfall in the present curriculum in the sense that learners' out-of-school experiences are divorced from in-school experiences. Mathematics teaching can be more effective and will yield more equal opportunities, provided it starts from and

feeds on cultural knowledge or cognitive background of the students (Masingila, 1992). Mathematics teaching should be carried out in an inquiry-oriented, problem-solving atmosphere.

### 2.3.1 The strength of constructivist theory

In any teaching-learning situation learners should not be taken as a group who know nothing. They are from the different societies where informal or formal education has taken place. Moreover, their abilities to construct cannot be denied. When it comes to providing the learners with opportunities to construct knowledge factors like, individual ability and their background should be taken into consideration.

Situated cognition theory advocates abstract teaching (Anderson et al, 1996). This approach at times bears no significant results on the instruction which becomes hopeless and ineffective in the sense that there is no relationship between in- and out-of-school experiences. There is always a discontinuity between the experiences gained at school and those gained outside the school. However, it must be noted that at some stages learners do not choose to come to school, they are compelled to. During the teaching-learning situation learners should be offered an opportunity to internalize knowledge and be motivated. These are achieved via constructivism.

A cognitive psychology theory views teaching and learning as involving the transmission and internalization of a body of knowledge and skills. In particular the ideas that come out of these approaches seem to indicate that mathematical problems and the

mathematical thinking involved in resolving the problems, can be sufficiently explained in abstract terms with minimal or no reference at all to context. However, constructivism is more important in any teaching-learning situation since if the learners are offered opportunities to construct knowledge, this has a reference to the context. In the long run this knowledge becomes indelible in their minds. In mathematics activities learners observed make use of the resources that support those activities in the situations they are in (Lave, 1988). The analysed reasoning activities reach mathematically correct conclusions, but do not make significant use of the kinds of algorithms typically taught in school. An important conclusion based on these findings is that people can learn adaptively in situations where they engage in activities. More specifically, learning of algorithms that are typically taught in school is not a necessary condition for successful reasoning in many everyday activities.

Mathematics should be taught for understanding and it must have everlasting effects in the lives of the learners. So, this can only be achieved if the knowledge construction is theirs. In any teaching-learning situation learners should be given enough opportunity to construct knowledge. The knowledge construction will eventually show the relationship between the in-school activities and activities in their immediate environment.

### .2.3.2 A critique of the constructivism theory

Constructivism indicates that learners have the ability to construct knowledge. Cobb (1994) cited that, basically within constructivism there is generally an accepted view that students actively construct their mathematical ways of knowing as they strive to be effective by restoring coherence to the worlds of their personal experience. There is a

wide debate about the construction of knowledge, that is, whether the development of knowledge is seen as fundamentally a social process or cognitive process. Learners have to interact with others during the construction of knowledge. However, social interaction is seen as an important and critical context for the learning to take place, but the focus is on the resulting reorganization of individual cognition.

Simon (1995) has argued that constructivism does not tell us how to teach mathematics. So, the educator has to find the best possible approach(es) to use, so as to sustain teaching mathematics for understanding. Learning should be viewed as an active and constructive process. Therefore, learners should attempt to resolve problems that arise as they participate in mathematical activities.

Learning is a constructive activity that the learners themselves have to carry out. Therefore, the task of the educator is not to dispense knowledge but to provide learners with opportunities and incentives to build up, (von Glasersfeld in Fosnot C.T.,1996). The educator must trigger active participation of the learners through direct instruction(s). But these instructions must be in such way that they call for socially shared knowledge construction. So, constructivism alone cannot bring forth a success, other factors like social and cultural should be considered. Hence, socio-culturalism theory is important in the knowledge construction. During knowledge construction learners interact with others, thus a social perspective.

Socio-cultural theorists maintain that individual cognitive processes are divided from social and cultural processes. Vygotsky (1979) argued that the social dimension of

consciousness is primary in time and fact. The socio-cultural perspective challenged theories such as constructivism and early mainstream psychology because they fail to account for the production and reproduction of the practices of schooling and the social order (Cobb, 1994).

Knowledge construction by the learners is tantamount to self-discovery learning. Even though self-discovery may be successful in terms of attaining the required goals, it has some demerits. Discovery learning is time consuming. Discovery learning may have unsuccessful results. Moreover, it may lead to a decrease in the motivation of learners. The fact that in constructivism, learners have to construct knowledge, may at times be used wrongly by the educators. The researcher here mean that, the educator might just give the tasks to the learners without relevant and proper guidance. It is true that learners come to school knowing something, which forms the foundation of the new knowledge. There should be a close relationship between in- and out-of-school experiences. Educators have a major role to play with an intention of maximizing this relationship. He/she must lay meaningful instructions (that is, relevant directions to be followed or guidance) to learners. Properly constructed instructions will in turn help the learners to construct knowledge.

## 2.4 Theory and data collection

During this study data was collected by questionnaires, audio-recording, video-recording, interviews and observations. Questionnaires and interviews were directed to educators with an intention of finding more about personal information. Here, the researcher wanted to find out more about their initial training, situations at their working places and

educator support programmes (that is, in-service workshops). Classroom observations, through video-taping, focused on both learners' and educators' actions during teaching-learning situation(s).

In the constructivism theory there are concepts, like active construction, self-organisation and personal experiences; which the researcher found useful and relevant to his/her data collection process. In constructivist approaches, learners are assumed to construct their own mathematical conceptual understandings as they take part in cultural practices, whilst they interact with others. To the researcher, this means that in the classroom situation learners should be given enough opportunity to interact with others. Knowledge is not passively receiver but actively built up by the cognising subject, (von Glasersfeld, 1989a). Learners should always be active recipients of knowledge. Therefore, during classroom observations the researcher expected to see them playing the major role in activities.

Since this study focused on classroom-based support it was imperative to observe the underqualified educator(s) in the classroom situation. The intention of these observations was to design a support programme for such educators. Our perceptions and experiences have a bearing in the knowledge construction, therefore, they should be considered even in the design of support programmes. This is emphasized by Simon (1995) when saying that learning is a process by which human beings adapt to experiential world. Also social constructivist, with a socio-cultural orientation, see higher functions and processes as socially determined. In the interviews with educator(s) social factors were incorporated because teaching and learning cannot be divorced from social and cultural contexts. This

implied that whatever is taught in the classroom should be related to out-of-school experiences. It must be borne in mind that previous knowledge and experiences form the basis of the new knowledge construction. Thus a major claim by social constructivists is that, at least in as far as learning is concerned, knowledge cannot be instructed or transmitted by a teacher. Therefore, this means that learners should be in the forefront of knowledge construction if we assume that the particular educator is teaching for understanding. The internalised knowledge remains indelible in the learners' minds. According to the researcher the underqualified educator should have attended a number of in-service workshops. In these workshops the educator should be aware that there is a relationship between the out-of-school and in-classroom mathematical experiences. Therefore, in the interview schedule the educators had to show whether do they advocate for the approach where the learners construct knowledge themselves.

## 2.5 Specifics of constructivist in data collection

During any research process data is collected and interpreted using specific methods. The main reason behind this interpretation was to find the cause of the problem, which in turn will assist in coming out with possible solution(s) to that particular problem. However, in this interpretation process important concepts from constructivism were useful.

The following aspects gained from constructivism guided data interpretation:

- *Learning is a process by which human beings adapt to their experiential world,* (Simon, 1995). In the process a learner undergoes different experiences. These have to be interpreted in a meaningful way for better common understanding. It is further claimed that learning is a process of self-organisation and enculturation

that occurs while participating in cultural practices, frequently while interacting with others. Thus different social cultures from which learners come from, should be considered for common understanding of social and cultural experience. These social and cultural experiences have a bearing on the teaching and learning situation.

- *People respond to things in terms of the meaning they have for them rather than conveying the constructs of the researcher project into their worlds.* Cobb (1994) argued that within constructivism there was a generally accepted view that students actively constructed their mathematical ways of knowing, as they strive to be effective by restoring coherence to the worlds of their personal experience. Therefore, learners come to school with personal experiences from their immediate environments. Those experiences form the basis of the new knowledge and moreover, this is used further to construct new knowledge. The researcher was aware of this fact in the data interpretation process.

- *The prominent objective of mathematics education is not that learners produce correct solutions to mathematical problems, but that they do it insightfully and by reasonable thinking.* Enough opportunities should be given to learners when finding solutions to mathematical problems. Although this approach is deemed to be time consuming, it cannot be divorced from mathematics teaching for understanding. However, mathematical learning is a process of active construction that occurs when learners engage in classroom mathematical practices, frequently while interacting with others. The mathematical concepts

they each individually construct are relative to, and are constrained by their participation in these practices. Since all the learners in the classroom actively participate, a number of solutions to one particular problem might result because of their personal socio-cultural experiences. In reality no knowledge can claim uniqueness (von Glasersfeld, 1996). But these different solutions to particular mathematics problem should be consolidated in such a way that the expected outcomes of mathematics teaching are achieved.

## 2.6 **Other researchers' perspectives**

The teaching and learning of mathematics is often seen as such an activity in which knowledge is transmitted from the educator to the learner, through whole-class, chalk-and-talk educator exposition and passive learner practice, (Dickson, 1999). However, recent developments have seen a move away from this approach in some schools, to one in which learners are more actively involved in constructing their own meanings, and educators and learners talk together to create and share knowledge, (Dickson, 1999).

This study focused on educators, especially the underqualified ones, getting sufficient and relevant support. The underqualified educators did not receive enough training to teach mathematics up to grade twelve. According to Henning (1994), their existing images of teaching stem mostly from their own experiences as students in school. At times there are in-service workshops which are organized by the education departments, which are of the traditional type because the officials of the department solely decide how and in what manner the curriculum innovation will be implemented. This does not really help and support struggling educators.

Glover (1993) has argued that there should be a move away from out-of-school in-service workshops. He advocated an essentially pragmatic approach:

- addressing specific classroom issues and
- focusing on strengthening and deepening the subject knowledge.

The latter should be appropriate experience which emphasize the relational rather than the instrumental aspects of mathematical understandings. Therefore, classroom-based support programmes should address specific and basic educator needs. The basis of school- or classroom-based support programme should be a suitable scheme of work which gives guidance on:

- syllabus content and also about teaching methods,
- the availability and design of resources,
- assessment and record keeping, and
- necessary administrative procedures.

There is a need for mathematics educators to be given opportunity to observe and work with each other and to share teaching materials and other resources. According to the researcher, there should be resource centers or mathematics support centers around in any district to support the struggling educators. Educators must receive all possible support to enable them to improve the effectiveness of their teaching, (Cockroft, 1982). However, all those who teach mathematics need continuing support throughout their careers to be able to develop their professional skills and maintain and enhance the quality of their work. This can only be achieved through classroom-based support programmes because such programmes have the power to address the educators' specific problems.

There is dire need for the classroom- or school-based in-service workshops. The fact that the educators have different qualifications and specific classroom-based teaching problems is not catered for. Many mathematics educators find themselves in a position requiring them to implement the mathematics syllabus which contain topics that they are not familiar with. According to Adler (2002), educators with a very limited knowledge of mathematics need to first develop a base of mathematical knowledge. They need the opportunity over a period of time to relearn mathematics, in such a way that they can develop conceptual knowledge. This was further emphasized by Ntenza (1991) who wrote that research had shown programmes based on some described conceptual model, tend to be more successful. Thus there should be support programmes empowering educators to take responsibility for their own personal and professional growth and development. Educators should no longer become consumers of some finished "product" created by "experts", rather they should be placed at the center of the action.

Constructivism advocates a learner centred approach, where the educator talks least and the learner is actively involved. This approach helps the learners to develop the use of knowledge ownership. Learners should be actively engaged to build their own understanding. This was further emphasized by Ball & Mosenthal (1992) who wrote that according to the constructivist view, learners developed conceptual understanding and the ability to solve mathematical problems when actively involved, and their engagement moved from the concrete to the abstract level. Also Jaworski (1999) wrote that the effective nature of the teaching role lies in influencing the quality of students' thinking without directing it. To achieve this, there is a great need for the classroom-based in-service workshops. These workshops will support educators in such a way that they shift

away from chalk-and-talk educator exposition and passive learner practice in all their lessons. In a classroom teaching and learning situation there are lessons which call for activities, and they must be approached as such to achieve the maximal understanding on the part of the learners.

# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 Introduction

Each research project determines the kinds of methods that can be used. For the purpose of this study the researcher has decided to use questionnaires, interviews (that is, both formal and informal) audio-recording and video-recording.

## 3.2 Adopted model of study

The KwaZulu-Natal Department of Education and Culture has a number of underqualified educators, who are teaching mathematics in grades ten, eleven and twelve. Such educators need ongoing support during the teaching-learning situations. There should be in-service workshops organized and implemented for the educators. These workshops should be conducted in classroom-based situation.

In the researcher's local district there were no such workshops. The educators were invited to a neutral venue where they were given a number of papers for paper-work purposes in their subject. These educators encountered problems in their classrooms' teaching-learning situations. Such problems could be dealt with in classroom-based in-service workshops.

There are factors, like teacher-pupil ratio, inadequate supply of material resources, geographical situation of the particular school, which constitute the individual educator's problems in his/her teaching practice. Such factors contributed to the researcher conclusion that a classroom-based in-service workshops be organized and adopted. The individual educator's problems are observed in his/her classroom setting(s). In-service workshops, which are conducted in a neutral venue seem to generalize the processes. Actually the in-service workshops(s) should be seen in terms of a mediator between the educator and the teaching-learning situation, educator behaviour and promoting professional development amongst educators of mathematics.

The researcher had informal interviews with the underqualified educators. They were not ashamed to say that they are not man enough to carry the load, thus they needed support. They all had the opinion that in-service workshops would be an answer to their day-to-day teaching problems. These workshops should be classroom-based to address the individuals' unique problems. Moreover, after workshop there should be a follow up programme with an aim of addressing and refining some problematic issues.

## 3.3 Research design

The research project was mainly targeting Ms Khumalo (fictitious name), the underqualified educator in one of the neighbouring schools. However, the study could not be completed just with herself alone. Therefore, the grade eleven learners in the researcher's school and colleagues who are mathematics educators were part of the working group. The number of learners in three grade eleven classes, were fifty four,

forty three and thirty eight. The class with forty three learners was chosen. As a result of the large sample the researcher worked with, the study had divided the data capture in phases. According to Cohen et al (2001), there is no single prescription for data collection instruments to use. Since in this study participant observations, interviews, video-recordings and audio-recording were used, this study was divided into phases.

### 3.3.1 Informal interviews

The researcher, a mathematics educator (secondary school), met mathematics educators at workshops and at other schools. He was requested by:

- mathematics educators to visit schools to help them in the preparation and teaching of particular topics, and
- some school principals to set grade eleven examination papers with an aim of trying to maintain the "standard" of mathematics question paper(s).

The need for classroom-based in-service workshops was expressed by these educators when informally interviewing them.

### 3.3.2 Semi – formal interviews

In the researcher's district there were three underqualified educators, who were supported by him. The one underqualified educator (that is, Ms Khumalo) was chosen over the others for the following reasons:

- she lived close by,
- she had problems in her actual teaching practice, despite being the Head of Department and

- she has attended orientation workshops organized by the Subject Advisors and in-service workshops organized by CASME (that is, JULA PROJECT).

An open-ended interview schedule was used. The respondent was asked to provide "open-ended" comments on each of the questions in the schedule list. A semi-formal interview style was used, see Appendix A. This semi-formal interview was tape-recorded. The semi-formal interview was designed to determine the respondents views on impact of:

- pre-service college training and
- in-service workshops attended.

### 3.3.3 Articulation of interview schedule

This interview schedule (Appendix B) was designed for Ms Khumalo . Here the question items pertained to her teaching-learning situation. During this period Ms Khumalo had experience teaching secondary school mathematics. She had attended in-service workshops organized for mathematics educators.

The interview schedule was designed to gather as much data as possible concerning:

- her learners performance in mathematics teaching and learning
- her perceptions about in-service workshops and its effectiveness, as well as
- college of education preparation for classroom reality.

The in-service workshops were designed to minimize the gap between what colleges of education offer and demands of reality in a school situation. Should it happen that this was true, the educator(s) would perceive in-service workshops as effective. The

educator's perceptions could help in finding out educator's problems, and which problems the in-service workshops should address to be effective.

The college of education should have prepared the underqualified educators for the realities in a teaching-learning situation. van Tonder (1988) indicated that research done by MATIP (Mathematics Teacher In-service Training Project) of INSET courses held during the period January to March 1988 showed clearly that mathematics qualifications of educators did not satisfy the criteria. The criteria was that the educators' qualifications in mathematics must be higher than the standards that he/she teaches. This criteria was laid down by Human Sciences Research Council (HSRC). During an informal interview Ms Khumalo mentioned that some of the topics she had to teach at school were not taught to her during her training era. These topics were Differential Calculus, Solution of Triangles (Trigonometry), Analytical Geometry and Circle Geometry. Thus difficulties were encountered during teaching-learning situations. Therefore, the in-service workshops should minimize the problems encountered. Since the situations in which we teach are different, the in-service workshops should be classroom-based.

### 3.3.4 Conduct of interviews

It was explained to Ms Khumalo that she would be interviewed more than the others both in formal or informal settings. The project work involved four other mathematics educators from the researcher's school, Ms Khumalo from the neighbouring school and one other educator from another neighbouring school. The purpose of this study was well explained to their respective principals, who permitted the researcher to engage in the

said research. Both educators and their principals suggested the dates and the time for the project.

The reasons for choosing this type of study were:

- the targeted group grade eleven learners were at the researcher's school, and were easy-to-reach.
- the researcher could negotiate with his school colleagues over their teaching periods.
- Ms Khumalo and the other educator participants were easy to reach, and this minimized traveling costs.
- the questionnaires for the interview would be dispatched to each participant without posting costs.

In Appendices B and C, the questions gave Ms Khumalo more latitude to elaborate on her responses. This was done with an aim of getting all the significant information of the data required. These interviews were at different stages of the project work. Appendix B was scheduled to be before the classroom teaching situations. Throughout the interviews, especially those concerning Appendices A and B notes – taking was carried out by the interviewer. The interviews at those two early stages were tape-recorded, to improve the quality of data. Therefore Appendix C was scheduled after the teaching-learning situations.

At the end of each lesson there were informal talks with the participant educators. The reason for this was to get their feelings about the lessons progress. These talks were tape-

recorded, notes were taken and photocopies of their notes during the teaching-learning situations were made. The interview was open and free since the interviewer and the interviewees were of the same language group. At any stage the interviewees were free and responded in their mother tongue. Therefore, more relevant and informative data was offered since educators responded freely with respect to what their colleague(s) had cited. The Appendix D questionnaire was administered after the whole project had been finished.

## 3.4 Construction of interview schedules

The interview schedule was divided into five categories, Appendices A to E.

Appendix A, Appendix B and Appendix C were mainly for Ms Khumalo, since she was at the center of the project study. Appendix D was for the educator participants (including Ms Khumalo) and Appendix E was for the learners. Only those questions in the interview schedule, which related to the theme of the research project were included.

Aron & Wiseman (as cited in Ntenza, 1991) checklist for constructing questions:

- Is the question useful?
- Does it get at the desired information?
- Is it possible that respondents will have the information necessary to answer the question?
- Are several questions needed on a specific topic to cover it adequately?
- Is the question free from bias?
- Is the wording of question clear?
- Does it contain difficult words that the average respondent may not understand?

These were taken into consideration during the construction of Appendices A to E.

Appendix E was piloted in three sections of grade eleven mathematics classes. The researcher did this because learners were unfamiliar with questionnaires. The lesson topics used were different to that for the project study. During the pilot study the learners needed some explanations. Therefore, the format and wording of questions in Appendix E were similar to those used during the pilot study.

## 3.5 Data analysis

The rating scale type of a questionnaire was so easy to complete and was not a time consuming exercise. Both educator respondents and learners had a five-point rating scale kind of a questionnaire, that is, Appendices D and E. Ms Khumalo had other questionnaires, that is, Appendices A, B and C which are not in a rating scale form.

However, in the data analysis of the interviews, (those tape-recorded and where notes were photocopied) the researcher would look for overlapping points and comments, similarities and differences in their responses. Actually in any analysis the researcher would be attempting to find the following relative to the research questions:

- How should the programme be structured?
- How does one assess the success of such a programme?
- What impact will such programme have on both educators and learners?

In Appendices D and E the researcher would be looking at rating scales that have been frequently used. This should be in line with what the researcher was attempting to find,

for instance, if S.A (Strongly Agree) or A (Agree), have been used more than the others the programme is a success. In Appendices A, B and C the researcher would be analysing Ms Khumalo responses with respect to:

- qualifications in mathematics,
- college of education preparedness and
- the impact of in-service workshops.

Relative to Ms Khumalo's responses the data analysis must show to the researcher whether there is need for classroom-based support progrmmes. Also there were video-recorded classroom lessons. The main purpose for that was to observe the learners in action and the support rendered by the educators. Therefore, the researcher should be sitting in a conducive place where he may watch and interpret what was happening during the proceedings of the lessons. Above all the researcher would be analyzing the interviewees' perceptions about the classroom-based support programmes that should be assisting the underqualified and other struggling educators.

# CHAPTER 4

# FINDINGS AND ANALYSIS

## 4.1 Introduction

In a research project, there are predicted and unpredicted findings. These findings have to be analysed in relation to the research questions. The instruments that were used in the research project have to be considered during the analysis process. This chapter focuses on the findings and analysis of the research project.

## 4.2 Some problems in the teaching of mathematics

Relative to Appendix A, Ms Khumalo indicated that she was not sufficiently prepared to teach mathematics. During her training era she did Primary Teachers Diploma. This diploma is not relevant to her present teaching situation because she is currently teaching mathematics in a high school (that is, teaching Grades eleven and twelve). In informal talks and diarised observations the following findings were discovered:

- Up to this point in time there are no in-service workshops organised for such educators. This is the chief contributing factor that forces educators to strictly follow the prescribed work programme(s).
- At most the educator(s) start by teaching first what they are comfortable with. Then the other parts of the content are treated very late within a short space of time.

- Some educators teach by imitating their high school mathematics educators, whereby the approach is educator centred.

The underlying tenet of constructivism is that a learner must construct meaning for himself or herself rather than be a passive recipient, (Delaney, 2001). The researcher had no doubt that the on-going support through the in-service workshops will bring about a shift away from this kind of practice. Furthermore according to Cornelius (1982) educators of mathematics should be given ample opportunities to keep themselves up-to-date through in-service courses and activities.

## 4.3 Findings on the usefulness of in – service workshops

Basically there is a disparity between what was taught at college(s) and what the educators find in their respective schools. This encourages in-service workshops to bridge the gap created. At most the college of education was only offering the methods of presenting the content. Should it happen that the educator was having some problems with content knowledge, the college do not really address that. However, in Appendices A and B, Ms Khumalo was of the opinion that the in-service workshops should be organised for them. The researcher attended a number of in-service workshops organised and implemented by CASME. In these workshops the educators were at liberty to suggest the topic(s) for the next scheduled in-service workshop. Each time and gain the educators were suggesting that mathematical content should be covered.

Although Ms Khumalo has attended workshops organised by CASME she was unsatisfied because the content knowledge was not covered in-depth. As a result of this, the individual educator problems are not addressed. The in-service workshops organised

and implemented at neutral venues do have some demerits, like for instance, they always offer general solutions, the time frames do not allow for in-depth treatment of the content knowledge. Educators have unique problems in their teaching-learning situations since the settings and geographical areas are totally different. Therefore, with respect to Appendices A and B, Ms Khumalo recommended the follow-up by the in-service workshop tutors to their respective schools. This kind of follow-up will address the individual educator's problems. So, this colludes with the researcher's recommendation that classroom-based or school-based in-service workshops should be organised for underqualified educators and even other struggling educators

## 4.4 Findings on problems with in – service workshops

According to the researcher's notion in-service workshops has been designed with an aim of helping the professionally practicing educators. But for many educators this means doing the subject content in detail. Educators do sometimes criticize the in-service workshops, because they are not regularly organised. Also the Adepartment officials decide on the topic(s) to be discussed in the workshop(s). The topic of the day might not be interesting to other educator(s) or it may happen that it is something that some educators are comfortable with. Therefore, as a result of this the in-service workshop is meaningless to the educators.

It does happen that the timing of the workshops is not right. It might happen that the topic(s) have long been taught in class, during that particular academic year. The researcher has observed that in-service workshops tend to treat participating educators as similar in their interests, their background and their contexts. Educators are unique and

their problems too. The respondents felt that in-service workshops must then be a mediator in such a way that it addresses individual problems. According to the researcher's perception the in-service workshops should be classroom-based or rather school-based. Furthermore, the respondents felt that the issue about the in-service workshops should not be top-down. Educators must be given an opportunity to decide on the topic(s) to be treated even if the workshop is organised to take place in a neutral venue. By a neutral venue, the researcher here mean one venue that could be used for all educators in a particular jurisdiction area. This could be one school in the area, community hall, hotel, etc.

## 4.5 The respondents' perceptions about methodology

The researcher has earlier mentioned that he enjoys a good rapport with all the educators who were helping him is this project. It has been easier for them to criticize the processes and mechanisms of the research. Appendix D has been used to assess the success or failure of the lesson(s). The content topic ( The Solution of Triangles) was interesting because of its relevance. The educators interviewed appreciated the introduction of the lesson topic. The learners were taken out of the classroom to the electricity pole inside the school premises where the introductory part took place. One of the educators cited that he/she has never thought of this. This then this actually showed that mathematics was not only meant to be within the classroom walls.

All the interviewees were mostly using S.A. (Strongly Agree) and A. (Agree) among the five point rating scale. The interviewees commended team-teaching because they say that if one has a problem it is easily addressed immediately. The classroom setting where

that it is time-consuming. Also all the respondents indicated that the learners were really enjoying the lesson(s) the way the content has been presented to them. Also, the method was interesting and enjoyable because whenever one had a problem it was addressed within a very short space of time. Educators indicated that this technique of instruction created opportunities for verbal and academic interaction between educators and learners.

In Appendix C, Ms Khumalo showed that the method was very good and interesting to her. The problems encountered were solved very quickly for both learners and educators. She further commended the classroom-based in-service workshop(s) because the individual educator's basic needs could be addressed in a relevant manner. She even pointed out that this kind of support be further extended to other colleagues in their school settings, but basically in their respective classroom-based situations.

The researcher also had post discussions with the educator interviewees. They critically looked at lesson(s) progress in totality. They appreciated the organisation of the programme and the relevance of the mathematics outside the classroom with respect to the example of the electricity pole used. The models produced by the researcher and learners were very important in easing understanding. During the lessons' progress learners were expected to produce models out of the information and guidance offered in their task-sheets.With the assistance offered by the educators, learners were able to produce the relevant models. The models made the understanding of the concepts more meaningfull. The models resembled ideas which could not be well observed in a textbook drawing. In actual fact, the models put some light to educators as well. One educator even mentioned that he never thought of this and he advocated the use of the models during

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## 4.6 Focus on the learners

In Appendix E, the learners commended group-work in all the sections of their mathematics education. They had the feeling that if this kind of approach be extended to all the subjects their learning will be made easier. Nevertheless, this extension is a difficult one because our teaching and learning is examination driven and the method itself is time-consuming. There is a prescribed amount of work to be taught so that the learners at the end of the year may write the examination and pass to the next grade. But this method per se is good because each member in a group had contributed to the learning process. As a result the comprehension of the lesson content was made easier. The recommendation is that whenever opportunity lends itself to the possibility of group-work, it should be pursued.

The learners were excited because it was the first of its kind in their life experiences to have the lesson(s) videotaped. The learners, therefore, participated fully because they

knew that this video would be watched by different people. The assistance the learners obtained from the researcher and the educator participants made them to be comfortable during the teaching-learning situations. Also Ms Khumalo observed that since our situations and the learners were not the same, the necessity to have school- or classroom-based in-service programmes where individual problems would be addressed, again arose.

Whilst the lessons progressed, the learners were expected to produce models out of the sketches they saw in the task sheets provided. The researcher decided to develop task sheets because the textbook happen to be a threat to other learners. The content was: **The Solution of Triangles (Application of the Sine Rule).**Therefore, the task-sheets helped change the tone of the teaching-learning practice. Moreover, the researcher tried to simplify the task sheets in such a way that it was easier for the learners to follow and comprehend. Because of the assistance each learner was offering in his/her group it was easier and faster for the learners to develop the models. Also the kind of introduction the researcher did made the process easier. The learners produced different sizes of the models yet they all observed that they are doing the same activity. Therefore, the size of the model did not bring about any confusion or misconceptions. The models themselves cleared the form of the sketches the learners observed in their textbooks. The models were extremely handy objects to ease the learners interpretation and managed comfortable to answer the entire question pertaining to each figure in their task sheets. Moreover, this kind of approach developed the sense of knowledge ownership to the learners.

During the lessons' progress the learners observed that mathematics was not always within the walls of the classroom, but it is even further observed or applicable even outside the classroom. There esists out-of-school mathematics. Some learners indicated that their fore-fathers, being mathematically illiterate, were able to apply mathematics in their manual work. The good example of this is when they were fencing the plots, the poles were erected vertically to the ground by means of supporting cable-wires. The angles at which the cables were fastened helped maintain the poles firmly erect (and ninety degrees) to the ground. This directly confirms Lave & Wenger (1991) in that much of what is learnt is specific to the situation in which it is learned, and that there should be a greater emphasis between what is learned in the classroom and what is needed outside the classroom.

The learners appreciation of this kind of approach was observed in the viewing of the video cassette. The learners worked collaboratively and comfortably. In Appendix E, the learners were assessing the lessons' progress by using five point Likert scale. The Likert scale has been chosen and used because it is not time consuming to complete. This was piloted with the learners, during another different lesson. The learners completed it easily. Rating scale afford the researcher the freedom to fuse measurement with opnion, quantity and quality (Cohen et al 2001,p.253). The following, Figure 1 indicated the actual number of learners that had used each particular scale:

| SA | A | N | D | SD |
|---|---|---|---|---|
| 34 | 37 | 26 | 22 | 7 |

Figure 1

Since S.A.(Strongly Agree) and A. (Agree) were more frequently used by the learners, it was an indication that the worksheet was an easy to use teaching resource. The kind of the approach used was very much appreciated by the learners. Moreover, the aim of the project lesson(s) and the researcher's predictions were achieved.

# CHAPTER 5

# DISCUSSION

## 5.1 Introduction

Studies are scheduled to be informed by or informs views by previous researches and theories.The expectations of each new study is to contribute to the existing knowledge base. Thus, this chapter sets out to discuss and connect models and theories with this study.

## 5.2 Connections with previous research

South Africa has a large number of underqualified mathematics educators, (Morar, 2002). This has resulted in educators with Primary Teachers Diploma teaching in high schools. Some other schools, especially those located in disadvantaged rural geographical areas are under-resourced. A well-resourced learning site is expected to promote effective learning and teaching. Tangible and visible aids help learners to draw connections more easily. Moreover, physical resources change abstract things to concrete. It is common knowledge that there is a critical shortage of educators in the areas of science and mathematics, (Bradfield, Odell & Nordberg, 1962). The DoE (2001) in its National Strategy for Mathematics, Science and Technology Education suggested that higher education institutions will have to play a far more active role in improving the knowledge and skills of educators currently in the system, as well as those of future trainees. The quality and relevance of the training programmes should be reviewed to ensure that when

trainees complete, they are competent in both subject content knowledge and teaching skills. The training programmes should reflect a strong discipline component balanced with a good understanding of what they are teaching, as well as how to teach. All in all, this is suggesting that in order to ensure that every classroom has a competent and qualified educator, the Strategy must first and foremost upgrade the knowledge, competences and skills of underqualified and unqualified educators already in the system. Therefore, there should be an on-going support for the educators.

Knowledge of the subject matter is basic in any teaching-learning situation. Educators need to be supported through in-service workshops. The researcher is of the opinion that classroom- or school-based in-service support programme for educators is of fundamental importance. This can be concluded from the following response to Question 21 in Appendix B:

The researcher (Q.21): What specific problems do you encounter when teaching mathematics to this group of learners?

Ms Khumalo: The learners are demotivated. Ipersonaly lack the techniques of dealing with that and even any other related matters.

This kind of support addresses the educator's specific problems. However, for the effectiveness of classroom- or school-based in-service support programme the mathematics educators must be the agents of change or development. If the educators resist change, this kind or any other type of support that might be offered will bear no fruits. Any improvement in the standards of mathematics in schools must come largely as

a result of the efforts of those educators who are already in posts, (Cockroft, 1982). These educators must receive all possible support to enable them to improve the effectiveness of their teaching. Nevertheless, this strategy confirmed that educators should be the agents of change. They must very strongly indicate the demand for the classroom- or rather school-based support programmes. This kind of support could be implemented if the educators show the basic need for that. Also mentor educators in charge of a cluster of schools have a challenge to upgrade educators' content knowledge.

There should be educators' support centres. Before 1994 there were a number of support centres in KwaZulu-Natal. Thus, the researcher had numerous observations which positively influenced the teaching of mathematics, some of which are:

- These support centres were effective in their nature because they offered the relevant support.
- Educators were offered opportunities to meet with other educators to discuss their problem areas in the mathematics teaching-learning situations.
- They also had numerous meetings with the advisory staff in the subject.
- Moreover, the educators were encouraged to join professional mathematical associations. These associations were important in the sense that during their conferences the educators met with other educators from all over the country and even educators from abroad. The different papers delivered by experts in the subject showed what research had to offer to the development of

mathematics teaching. So as a result the educators were motivated to become the agents of change.

- A number of educators registered with other institutions to further and/or improve their teaching qualifications. Although this had financial progressions it helped in their improvement of the content knowledge.

These days such incentives no longer exist, (ELRC, 2003) due to broadbanding of qualifications. Also in these support centres there were material resources, the educators were allowed to borrow them for the use during their classrooms teaching-learning situations.

## 5.3 Related theories

Learning must be seen as increasing participation in practices. The constructivists affirm that learners should be given ample opportunity to construct knowledge themselves. The knowledge constructed this way will remain indelible in the learners' minds. Constructivism is actually saying that educators should refrain from educator-centred approach during the teaching-learning situations. The most commended approach is the one that that is learner-centred. As a result learners will be more involved in practice rather than being passive beneficiaries of knowledge. Albeit this is said and advocated, it will never succeed without relevant resources. Inadequate supply of resources do not allow for a shift from educator-centred kind of approach. In the case of the learners there is nothing more frustrating than being forced to watch somebody else manipulate a resource when you want to explore it in your own way, (Delaney, 2001). Therefore, the

everlasting effects. The main problem that the mathematics educators are facing is that they have to teach for examination purposes, (Ntenza, 1991). As a result, from the word go, the learners are simple prepared to answer examination questions. Masingila (1993) noted that, schools place too much emphasis on the transmission of procedures, rather on the teaching of meanings. This discourages learners from bringing their intuitions to bear on school learning tasks.

They should be given opportunities to construct knowledge by using the resources even from their environments. The response to Question 4 in Appendix B aptly related this need for resources. The response:

The researcher (Q.4): How do you think the in-service workshops can help in improving the perfomance of learners in mathematics in your school?

Ms Khumalo: The in-service workshops can help where there is an inadequate supply of resources. A nnumber of avenues could be disclosed, for an example how to improvize?

The learners are the social beings, that is, they live with peers, parents and even other elder members of the community. Therefore, the personnel from the individuals' environment is a good human resource. According to the researcher, if the resources from the environment have been used properly, the construction of knowledge will be an easy target. However, during the teaching-learning situations the educator must ask himself/herself the question of how to make school learning more beneficial beyond the classroom, providing learners with general resources for reasoning both in and with the

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Ms Khumalo: Yes, they were familiar with materials used. It was very interesting because the learners were not aware that these materials can be used to teach and learn mathematics meaningfully.

## 5.4 The researcher's perception after data capture

In Mnambithi District (that is, researcher's district) some in-service workshops were organised and implemented for grade twelve educators only. But most of them happen to be fruitless because at times they offer repetitions in such a way that educators do not see any kind of development. The feedback from the educators is that this does not cater for their individual needs. At the beginning of the academic year orientation workshops are organised and implemented in all circuit management centres. Surprisingly the number of attendants is decreasing yearly. The response to Question 8 in Appendix C is:

The researcher (Q. 8): Is it necessary and proper to extend this kind of support to other colleagues ?

Ms Khumalo: Yes. This really caters for unique individual needs.

The reason for this is that the subject advisors orientate educators about the forms to be used in the subject assessment and also they relay to the educators the past performance using the results of the previous external examination.

There should be a shift away from this kind of practice. A classroom- or school-based support programme for educators is strongly recommended as indicated by the outcome of this study. The response to Question 7 in Appendix C is:

The researcher (Q. 8): Is it necessary and proper to extend this kind of support to other colleagues ?

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There should be a shift away from this kind of practice. A classroom- or school-based support programme for educators is strongly recommended as indicated by the outcome of this study. The response to Question 7 in Appendix C is:

The researcher (Q.7): If they (i.e. in-service workshops) are organised, do they address your basic needs ?

Ms Khumalo: Sometimes or not at all.

If the in-service workshops were organised and implemented in a neutral venue and followed by the classroom- or school-based support programmes, these will bear the desired fruits. Educators must improve their performances in the subject content teaching. But the question is how are they going to improve on this, being not supported according to their unique individual needs. In some schools in deep rural areas or in rural nucleated settlements the conditions are not conducive to good quality teaching, that is teaching for understanding and resourcefully. According to the researcher's perception material resources cannot replace the educator(s). The conditions in each particular school should be such that they allow the educator(s) to use whatever teaching method he/she wants. Therefore, good quality teaching can be accomplished.

Educators in different school conditions faced different constraints in their schools, with those in the most impoverished rural schools benefiting least (Adler, 2002). The subject advisors rarely visit the respective schools in the rural areas or rural nucleated settlement areas. Therefore the educators do not receive relevant support. Again this encourages th introduction of classroom- or school-based support programmes organised and implemented for educators with respect to their individual basic needs.

The mathematics curriculum should as well be restructured, if possible, in such a way that there will be a shift away from teaching for examination purposes. At most the educators only drill the learners on how to answer particular questions during the examination times. The prominent objective of mathematics education is not that learners produce correct solutions to mathematical problems but they do it insightfully and by reasonable thinking (Cobb, 1994).

Also in Appendix E, the learners advocated group-work approach in almost all their subjects. Also the interviewees in Question 5 in Appendix D advocated this kind of approach. The responses were as follows:

| | |
|---|---|
| The researcher (Q.5): | The group-work approach is of assistance in the teaching and learning of maathematics. |
| Responses: | Out of six interviewees, two strongly agreed and four agreed on that. |

It is difficult to exercise it, because in the researcher's area the classrooms are overcrowded. To the researcher's notion the method is good and it can definitely bear the desired fruits. This can only be a success if there are classroom- or school-based in-

service support programmes in place to address the individual educator's unique needs, so as to develop the educator to handle large classes.

The adequate supply of both human and material resources will bring about an improvement in the teaching and learning of mathematics. In chapter 4 it has been mentioned that if learners were given opportunities to manipulate things on their own, the lesson(s) progress was enjoyable and they could take the ownership of their discoveries. The constructivists advocate that the learners should construct knowledge themselves. This can only be maximally achieved if there are sufficient and relevant resources. According to Delaney (2001), for many learners, however, there needs to be a variety of experiences that support them in gradually making sense of a new situation. Working with a resource individually, in pairs or in groups allows more space for this. Therefore, according to the researcher, all the learning-teaching situations will be significant if educators do get relevant classroom-based support. It is imperative that educators teach mathematics resourcefully.

## 5.5 Some contributions

The researcher has found that many other researchers, like Adler (2002), Glover (1993) and Straus (1988) had concentrated on in-service programmes that take place outside the classroom settings. This the researcher felt did not actually address the specific problems that the particular educator might have. The learners' experiences are not taken into consideration. Cobb (1994) emphasizes the importance of learners' personal experiences by saying that, basically within constructivism, there is a generally accepted view that learners actively construct their mathematical ways of knowing by restoring coherence to

the worlds of their personal experience. The classroom activities undertaken in the researcher's project are in line with what Cobb has cited.

The researcher introduced the learners to his project study work by using the out-of-classroom resource(s). Around themselves in their communities there are so many other examples similar to this and in turn this enforces knowledge construction to the learners. von Glasersfeld (1989b) also acknowledges that the constructive activity occurs as an individual interacts with other members of a community. Therefore, group-approach in the classroom will instil in the learners that interaction with others help in the knowledge construction. Also this will be further extended to the interaction with any other member construction. In all the teaching-learning situations there should be a shift away from the educator-centred kind of approach to the learner-centred. Learners must be given opportunities to demonstrate their full potential in terms of knowledge, skills, values and attitudes. Learners should be involved actively using relevant knowledge in real-life contexts, (DoE, 2005). Also this will be further extended to the interaction with any other member of the community on the basis of knowledge construction. In all the teaching-learning situations there should be a shift away from the educator-centred kind of approach to the learner-centred. Outcomes Based Education is a mentor to this, since it places the learner and learning at the centre of all teaching and planning. Learners should be able to work as a team and understand that the world is a set of related systems. Outcomes-based assessment was introduced as a result of the adoption of outcomes-based education and training as a national policy in 1995. As the name indicates, outcomes-based education and training covers both classroom and workplace learning. The intention was to integrate theory and practice, or knowledge and application.

Therefore, there is no way into which out-of-school and "in-school" or "inside-the-classroom" experiences can be divorced from each other.

To the researcher, this kind of approach (where the learners are actively involved) will act as an eye-opener to the underqualified educator(s). Individuals can learn via engaging in activities within the prescribed contextual topic. Moreover, the relationship between "in- school" or "inside-the-classroom" and out-of-school mathematics is very important and this should always be emphasized. According to Lave (1988) and Lave & Wenger (1991), much of what is learned is specific to the situation in which it is learned, and there should be a greater emphasis between what is learned in the classroom and what is needed outside the classroom. Even in their homes, the learners should be able to associate the classroom-based experiences with the outside-the-classroom experiences, to show the relationship between the two experiences.

Although according to the interviewees the group-work approach is time-consuming, but they all advocated it. This method has been recommended by the educator colleagues in Appendix D, because the learners develop the sense of ownership with regards to the knowledge construction. Vytgotsky (1978) contends that students work with their peers in collaborative situations or do and complete tasks and/or activities with the educator as a facilitator. During the researcher's project in the classroom settings the educator respondents were moving around offering help to the learners in their respective groups. What was observed here was that, learner's specific questions were answered shortly and this allowed them further moves in the content knowledge assimilations. In Appendix C, Ms Khumalo advocated for the group-work approach in the teaching-learning situation

because any problems that might have been picked up are solved much quicker. Ms Khumalo further extended the necessity of the classroom-based support programmes and moreover, this should be fairly extended to all other mathematics educators.

# CHAPTER 6

# CONCLUSION

## 6.1 Introduction

This chapter looks at the implications and limitations of the study. It wishes to display the recent findings that enhance a positive input in its area of focus. The entire project focuses on the contributions it could make in mathematics education.

## 6.2 In-service workshops versus teaching for understanding

It has been previously cited in the preceding chapters that South Africa is presenting a case of underqualified educators. These educators were insufficiently trained to teach the subject content in the classes they are now teaching. According to the researcher, the Department of Education must no more employ educators with Primary Teachers Diploma to teach in secondary schools. These are only trained to teach learners in primary schools. The worst part of this employment is the promotion of these kinds of educators to the heads of department(s). In actual fact this kind of practice is not doing justice to the teaching of the subject meaningfully and for understanding.

According to the findings of this project the "Messiah" to this are the in-service workshops. There are so many benefiting factors in the in-service workshops, for instance, in-service workshops bridge the gap between what has been learned during the initial

educator training and the actual teaching practice. Above all the in-service workshops promote the professional growth of the educators. The in-service workshops are the ways in place to support the professional growth of educators once they are surrounded by their own learners. Teaching-learning situations differ from school to school and learners too, are different. Therefore, classroom- or school-based in-service workshops can then address all these differences in behaviour.

In the present National Department of Education the focus on the teaching of mathematics is only in one class, that is, grade 12. Learners in grade 12 need a good knowledge background and solid foundation. Educators who are teaching mathematics to all the lower classes tend to under-teach because there is no mechanism in force, which judges their performances. However, the extension of in-service workshops to all mathematics educators will change the tone of teaching and learning in the subject content. But these in-service workshops should be planned using the bottom-up strategies. The researcher is opting for the bottom-up strategy because this will really develop the educators' professionalism and content knowledge. The researcher is still emphasizing the classroom- or school-based support programmes. Also this was further suggested by Cockcroft (1982) in saying that, we are in no doubt that school-based in-service support for educators is of fundamental importance. The effectiveness of in-service support programmes depends upon the mathematics co-ordinators, heads of department and subject advisors. The subject advisors have all the necessary powers, so they can bring in any required change in the teaching-learning of the mathematics content knowledge.

## 6.3 The role of subject advisors

According to the researcher, all the subject advisors should be provided with all the relevant resources like, for an example, transport, so that they may be able to visit all the schools in their respective jurisdiction areas. It must be well known that the subject advisors contribute to the overall improvements in the teaching of the mathematics content knowledge. They themselves should receive the relevant training and support so that positive results will rail down to the educators.

The subject advisors should:

- monitor the quality of the mathematics teaching in the schools for which they are responsible.
- be aware of the strengths and weaknesses of the mathematics co-ordinators and heads of department.
- be concerned with the arrangement for the provision of in-service workshops.
- be aware of current developments in mathematics education as a whole.

Educators' education is often described as a continuum extending from pre-service through induction to ongoing in-service (Schaffer et al, 1992). This is saying that that ongoing in-service support cannot be divorced from teaching mathematics for understanding and resourcefully. The outcomes of this study advocates for the design and the implementation of the classroom- or school-based in-service support programmes.

The in-service workshops organised and implemented at neutral venues cannot be discarded. The subject educators should meet and share successes and failures. But these should be planned collaboratively with the educators concerned, so as to provide them with opportunities to innovate, to show problem-solving, self motivation and self confidence (Ntenza, 1991). The researcher's perception is that, for the success of mathematics teaching, there should be follow up to classroom settings after the in-service workshop(s) that have taken place at a neutral venue. The basic purpose of this follow up is:

- to refine and improve the support programme(s).
- to supplement the knowledge which the educators gained in in-service workshop.
- to give first hand assistance to educators with problems they encountered in their school context.

Since, according to Glover (1993) it seems likely that the in-service training of underqualified mathematics educators will remain an urgent need well into the future, it is imperative that there should be mechanism in place. There is no one who can negate the fact that there are mathematics educators who have scanty content knowledge. This is further emphasized by Ms Khumalo in Appendix A, (Question 1) where in her responses,she was not ashamed to say that with her PTD, she is somehow lacking in her teaching practice.The subject advisors should be aware of such educators so that relevant support may be offered. Educators with a very limited knowledge of mathematics need to first develop a base of mathematical knowledge. This is further emphasized by Adler

(2002), in saying that such educators need opportunity over a period of time to relearn mathematics, and in such a way that they can develop conceptually. The responses offered by Ms Khumalo in Appendix A,(Questions 5 – 10) clearly indicated that numerous in-service workshops should be organised and implemented. In questions 6 and 7, Ms Khumalo raised the concern that during in-service workshops at neutral venues, content knowledge is not covered in depth. Moreover, the time frame for such in-service workshops is limited, thus individual educator needs are not catered for. Therefore, it is imperative that the support programmes be organised and implemented. The support programmes should be classroom- or school-based, so that the individual educator's basic needs could be addressed immediately.

## 6.4 The educators' basic role

The study sees the need for educator-support in-service programmes so as to effectively motivate the educators. The researcher has the feeling that school visits by the subject advisor(s) can be a motivating factor if it is aiming at helping the struggling educator in his/her teaching-learning problems. This is further suggested by Cockroft (1982) in saying that we are in no doubt that school-based in-service support for educators is of fundamental importance. There should be a platform for educators to voice their existing unique problems. The need for educators to voice existing conceptions is very potent and possibly a prerequisite for changing conceptions about teaching (Henning, 1994). Educators are at the centre of the teaching-learning change in the subject teaching development. Their role in the subject teaching development cannot be looked down upon.

The learners can construct content knowledge themselves through the use of the activities. The beneficial use of the activities, calls for thorough planning and preparation by the subject educator(s). There are no ways into which the use of activities and materials in teaching mathematics can be underrated. In Appendices D and E the interviewees and learners recommended group-work approach. The educator respondents recommended group-work approach because the learners were enjoying the lessons.Learners were working co-operatively and quick responses were volunteered.One respondent further mentioned that the re-arrangement of a sitting plan itself motivated the learners. This approach has been recommended because the content knowledge assimilation was through active learner participation. The educators were providing consultation, support and challenge. The textbook itself may be a threat to the learners, but in some cases especially in the researcher's area there is an inadequate supply of textbooks. Therefore, it is extremely difficult for the educator to teach. The classroom settings and the material resources are the deciding factors about the method(s) to be used by the subject educator(s). According to Jaworski (1999) the situation in the classroom settings should be in such a way that it encourages learners own involvement and creativity, while allowing the educator's wider knowledge and experience to influence learning. The use of worksheets can change the tone during the teaching situation, they supplement the shortage of textbooks, the worksheets are smaller and user-friendly materials. The well structured worksheets ease the burden to the learners. The worksheets are an easy to work with classroom teaching materials.

During the research project the researcher has seen that the lessons can be more alive through the use of the worksheets. The worksheets call for the learners' participation as the lesson progresses. Albeit the approach may be time-consuming, the educator himself/herself must be determined. The educator must have extra classes if he/she wants to teach for understanding and meaningfully. The extra classes provide a room for direct assistance to the learners. The use of worksheets and extra classes motivate the learners to construct the knowledge themselves. According to Cornelius (1984) there are, unfortunately, too many poor educators who fail to inspire or excite and reduce mathematics to a monotonous piece of drudgery. Therefore, the educators and learners must talk together in order to create a shared knowledge. However, the researcher has observed that the way the educators were taught during their high school era and the training at colleges of education do have an influence on the approach during teaching-learning situations. Their schooling and training has emphasized the empty bucket model of teaching and learning where learners are viewed as empty vessels waiting to be filled with the wit and wisdom of others (Colyn, 1993). According to constructivism the learners should not be taken as "empty buckets", there should be created opportunities for the learners to construct knowledge themselves. The educator must take the role of being the facilitator in such way that the learner is more actively involved. As the lessons progressed the learners were more actively involved. During the post evaluation session the learners came out with the following ideas:

Happiness: I understand mathematics better if our educator is using group-work approach.

Sandile: Working in groups is more helpful because one's problem(s) are solved immediately.

Bongiwe: Group-work approach must be used in all the subjects. It keeps us all active throughout the lesson(s).

This had been also observed in the videorized lessons and in the learners' responses in Appendix E. The educator respondents including Ms Khumalo (the underqualified educator) were also actively involved, since they were moving around helping the learners where needs arose.

Other researchers have seen a need for the in-service programmes, but above all this study recommends a classroom-based in-service support programme for the struggling educators. The individual educators' problems are unique, the situation settings where they practice teaching are different. So even if there are in-service workshops organised and conducted at neutral venues there should be follow-ups to the actual classroom settings. Above all the underqualified educators should be assisted first. The school visits by the subject advisors can be an identifying factor, which will be a starting point with respect to the in-service programmes to be offered. Finally the teaching of mathematics meaningfully and resourcefully cannot be accomplished without classroom- or school-based in-service support programmes.

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# APPENDIX A

## SEMI-FORMAL INTERVIEW SCHEDULE (UNDERQUALIFIED

## MATHEMATICS EDUCATOR, i.e. Ms KHUMALO)

1. Did the college prepare you sufficiently for the realities of the school environment (Explain:- in what way(s)?)
2. Does your Department of Education organise in–service workshops; if there are any, how many per quarter/semester?
3. In what way(s) has these in-service workshops organised and implemented by the Department of Education answered your needs?
4. Describe an issue(s) if any, in which these workshops organised by the Department of Education did not answer your needs.
5. Do you attend the workshops organised by CASME (i.e. JULA PROJECT) which are in January and July holidays since 2002?
6. There are opinions that too much work is covered during the short time of the in-service workshops. What is your reaction to this?
7. Does this cover the sufficient amount of work relevant to your particular needs?
8. Chosen topics are not taught sufficiently in depth. What is your reaction to this claim? (Does it affect your teaching practice, how?)

9. Is there any follow up made by the tutors to your respective classes in school after the in-service workshops?
10. Do you commend follow up by the tutors. If your answer is yes, in what way would this be of any help to you and your learners? (Explain, in what way?)

## APPENDIX B

## FORMAL / STRUCTURED INTERVIEW SCHEDULE (UNDERQUALIFIED MATHEMATICS EDUCATOR i.e. Ms KHUMALO)

1. Learners perform very badly in mathematics. How is the situation in your school? Substantiate this with two or three reasons.
2. For the reasons in (1) above, if any, can you suggest a possible solution?
3. Do the in-service workshops you attended, address any of the problems mentioned in response to question (1) above. (Explain: how or why not?).
4. How do you think the in-service workshops can help in improving the performance of learners in mathematics in your school?
5. Do you strictly follow the work programme prescribed for the teaching of mathematics? (Explain:- why?)
6. Have you ever attended an in-service workshop(s) whereby the topics covered were the topics you had already taught in your class(es)?
7. If your answer is "Yes" to (6) above, were you happy with that in-service workshop? (Explain:- why?)
8. If your answer is "NO" to (6) above, in what way did that in-service workshop assisted you? (Explain: why?)
9. Who is responsible for determining topic(s) or aspect(s) of mathematics dealt with in a particular in – service workshop.

10. Do you have any input into this process of decision-making, (i.e. with respect to (9) above)?
11. In your own opinion, what do you think should be the role of the maths educators in the in-service workshops programme(s)?
12. Do you regularly attend mathematics in-service workshops organised by CASME (i.e. JULA PROJECT)? (Explain:- why?)
13. Have you ever attended a mathematics in –service workshop(s) organised by the Department of Education and Culture of KwaZulu-Natal.
14. If your answer is yes to (13) above, what do you think are the main differences between in-service workshops organised by the Department and those organised by CASME?
15. Also with respect with to your yes answer to (13) above, what are the main similarities?
16. What kind of follow up support do you get from the in-service workshops' tutors after attending?
17. If none to (16) above, are you really willing to get assistance by way of follow up school visits?
18. In what way do you think such follow up visits will help you and your learners ?
19. Some educators say that their training courses do not really prepare them for realities of the actual school environment. Do you believe in this ? (Explain:- why?)
20. What is the largest number of learners in any class in which you are teaching mathematics in Grades 10, 11 and 12 ?

21. What specific problems do you encounter when teaching mathematics to this group of learners?

22. Do you encourage any group work in your mathematics class, or do you prefer to let learners work individually for fear, for an example that only one learner will do everything and others might be copying?

## APPENDIX C

## QUESTIONNAIRE FOR Ms KHUMALO

Assist me in assessing the success or failure of the project lessons. Complete the questionnaire by writing answers to the spaces provided. An additional piece of paper may be used where necessary. For a "Yes/No" answer supplement that by writing any supporting statement(s).

1. Was enough time given to the treatment of the topic?

2. The learners were provided with materials to interact with. Was that easy?

3. In your own opinion is the group-work of help in the teaching and learning of mathematics?

4. In your own teaching – learning situation, can you use the same approach ?

5. Has the session(s) been relevant to your needs?

6. How often are the workshops organised for you as educators?

7. If they are organised, do they address your basic needs?

8. Is it necessary and proper to extend this kind of support to other colleagues?

9. Write down any further comments, suggestions or inputs about the programme as a whole .

# APPENDIX D

## QUESTIONNAIRE FOR EDUCATOR RESPONDENTS

Assist me in assessing the success or failure of the lesson(s) under the topic *SOLUTION OF TRIANGLES*, by completing this questionnaire. Complete the questionnaire by putting X where appropriate. The five point rating scale has been used, that is S.A. – Strongly Agree, A – Agree, N – Neutral, D – Disagree and S.D. – Strongly Disagree. Please, note that, it is not necessary to write your name.

| | S.A. | A. | N. | D. | S.D. |
|---|---|---|---|---|---|
| 1. Enough time was given to the treatment of the topic. | | | | | |
| 2. The learners were interacting freely with the materials provided. | | | | | |
| 3. The task-sheet for learners was well organised. | | | | | |
| 4. The topic is relevant and related to the learners environment. | | | | | |
| 5. The group-work approach is of assistance in the teaching and learning of mathematics. | | | | | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 6. The material resources and task-sheets must be used in the teaching and learning of mathematics in any other class. | | | | | |
| 7. Your input in the lesson(s) progress was relevant. | | | | | |
| 8. Team-teaching approach can be used in any teaching – learning situations. | | | | | |
| 9. The lesson(s) progressed very well. | | | | | |
| 10. The learners' understanding of the concepts was very good. | | | | | |

11. Supplement this by writing down any further comments:

## APPENDIX E

## QUESTIONNARE FOR LEARNERS

Assist me in assessing the success of my lesson(s), by completing this questionnaire. Complete the questionnaire by putting X where appropriate. The five point rating scale has been used, that is,

S.A. – Strongly Agree, A – Agree, N – Neutral, D-Disagree and

S.D. – Strongly Disagree.

Please, note that it is not necessary to write your name.

| | S.A. | A. | N. | D. | S.D. |
|---|---|---|---|---|---|
| 1. We are familiar with the materials used in the classroom. | | | | | |
| 2. Enough materials to be used, were provided. | | | | | |
| 3. We were provided with relevant materials to be used. | | | | | |
| 4. Time span to complete the assigned task has been enough. | | | | | |
| 5. The task-sheet was easy to use individually. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 6. The relevant assistance was offered by the educator(s) during the lesson(s)' progress | | | | | |
| 7. The group-work is of assistance to us as learners. | | | | | |
| 8. There is a relationship between the content knowledge acquired in the classroom and the outside classroom environment. | | | | | |
| 9. This section has been treated up to my understanding. | | | | | |
| 10. Working in groups allowed us to be more active | | | | | |
| 11. Group-work should be used in other sections of the subject. | | | | | |

12. Write down any further comments: