DEMOGRAPHIC PROFILE AND PERCEIVED IN-SERVICE EDUCATION AND TRAINING NEEDS OF SECONDARY MATHEMATICS TEACHERS IN THE LIMPOPO PROVINCE

by

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DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signed by candidate

05/09/2003

A.M. Rakumako **Date**

ABSTRACT

It is now generally acknowledged that effective and sustainable in-service education and training (INSET) programmes require, first, adequate information to be available on teachers' demographics and, second, for teachers' views on their professional development to be taken into consideration. Neither kind of information is currently available for Mathematics teachers in the Limpopo Province of South Africa in a reliable manner. Consequently, this study has as its objectives 1) to determine the demographic profile of secondary Mathematics teachers in the Limpopo Province, 2) to establish the perceived INSET needs of these teachers, and 3) to examine possible associations between demographic profiles and perceived INSET needs of secondary Mathematics teachers in the Limpopo Province.

Data were collected using a 'mixed-method' research design, in which both quantitative (questionnaires) and qualitative (interviews) methods were used to establish the trustworthiness of the findings. The survey instrument employed was developed from the *Science Teacher Inventory of Needs-3* (STIN-3) of Baird, Prather, Finson and Oliver (1994), as it was successfully used in a number of developing countries. STIN-3 was adapted and modified for use in the South African and Limpopo Province context in particular, resulting in the *Science Teacher Inventory of Needs in the Northern Province* (STIN-NP). STIN-NP was validated by 55 important stakeholders in mathematics education, and subsequently piloted on 60 secondary Mathematics teachers in the Limpopo Province. The final instrument contains 98 items in six sections. The alpha coefficient reliability for STIN-NP is 0.97 and the adjusted Guttman split-half reliability is 0.94. Questionnaires were sent to over 1 600 secondary schools in the Limpopo Province via District Managers, Curriculum Advisors, and principals, for distribution to appropriate teachers. Focus group interviews were held with 34 Mathematics teachers in four of the seven administrative regions in the Limpopo Province.

Five hundred and fifty-two Mathematics teachers from at least 324 schools in the Limpopo Province responded to this survey, yielding a response rate of 17%. Most Mathematics teachers who responded to this survey teach at rural schools and are predominantly male. Eighty percent of responding teachers are between 20 and 40 years old, and have four to ten years experience in teaching Mathematics. Standard 10 is the highest academic qualification of half of the teachers. The vast majority of teachers who responded are

qualified to teach Mathematics at secondary school level, with a matric plus three-year qualification as their highest professional qualification. Most teachers reported a class size of more than 50 learners with school enrolments of between 200 and 800. A large number of teachers reported that their schools had poor or very poor resources, with rural schools affected the most.

Responding teachers perceived teaching skills as their greatest professional need and lack of communication of INSET activities as their most serious impediment to increased INSET participation. Teachers indicated a statistically significant need in all the 38 INSET items included in the STIN-NP. The following INSET needs were rated to be among their most pressing needs: 1) using computers to teach and manage teaching, 2) motivating learners to learn Mathematics, 3) using audio-visual equipment, 4) identifying learning objectives which specify attitudes learners need to develop toward Mathematics, 5) applying mathematics to daily life of learners, and 6) updating knowledge of career opportunities related to mathematics. Teachers showed less interest in items dealing with the history of mathematics, developing lesson plans, and improving content knowledge. In general, Mathematics teachers wanted to learn more about geometry and calculus, as compared to algebra and trigonometry. Teachers reported the following as some of the problems in their classrooms: a lack of learner interest to learn Mathematics and a lack of career models, a lack or insufficient supply or of textbooks, and overcrowded classes. INSET needs determined through focus group interviews match needs established through the survey using STIN-NP, thereby providing evidence for the validity of the results of this study. No statistically significant associations between individual INSET need items and any demographic variables were found.

Implications of the results of this study are that INSET programmes for largely rural teachers with about 4 to 10 years teaching experience should focus on enabling teachers to motivate learners to learn Mathematics in a number of different ways, and to apply Mathematics to the daily life of learners. Such programmes should also address teachers' subject content knowledge and teaching skills in general, and should ideally lead to further professional qualifications.

KEYWORDS: In-service education and training (INSET), Interviews, Mathematics Teachers, Needs Assessment, Limpopo (Northern) Province, Rural Areas, Surveys, Teacher Characteristics, Test Construction.

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Chapter One

GENERAL INTRODUCTION

BACKGROUND AND RATIONALE

Mathematics is one of the critical subjects needed in preparing learners to meet society's basic needs (Department of Education, 2001a). The ability of learners to succeed in today's technologically orientated work environment is increasingly dependent on their understanding of mathematical and computational sciences, and their application in practical situations (Department of Education, 2001a). According to the South African government's *White Paper on Science and Technology* (Department of Arts, Culture, Science and Technology, 1996), adequate skills and knowledge of Mathematics, Science and Technology are believed to be a vital component of successful contemporary life. Moreover, adequate skills and knowledge of Mathematics, Science and Technology are a prerequisite for the nation's long-term economic prosperity (Department of Arts, Culture, Science and Technology, 1996; Mailula, 1995; Ngoepe, 1995).

It is widely known that Mathematics in South Africa in general, and in the Limpopo Province[1] in particular, is characterised by low enrolments in secondary school and poor matric results (Department of Education, 1995; Frost, 1995; Northern Province Department of Education, 2000; Steyn, 1998). Of these low enrolments, only about five percent of the students are Blacks[2]. It is also disturbing to find that only a few of these students (about 3 000) pass Mathematics at Higher Grade level every year (Department of Education, 2001a; Kahn, 2001). The national percentage pass of grade 12 students in Mathematics for the past four years was 42%, 43%, 45%, and 47% in 1998, 1999, 2000, and 2001, respectively (Department of Education, 1999; Department of Education, 2000; Department of Education, 2001b). Moreover, in the Third International Mathematics and Science Study (TIMSS), which assessed mathematics and science literacy, South African grade 12 students obtained a significantly lower average score in Mathematics than students in other participating countries (Howie & Hughes, 1998). The poor performance of

[1] The name of the province was changed from the Northern Province to the Limpopo Province in February 2002.

[2] The term "Blacks" is used in its historical sense referring to non-whites (i.e., Africans, Coloureds and Indians.

South African students suggest that their general understanding and skills in Mathematics are limited, falling short of literacy levels necessary for effective functioning in society.

Grade 12 students in the Limpopo Province writing the matric examination obtained a Mathematics percentage pass lower than the national percentage pass, and had the poorest results of all the nine South African provinces in the past years. For example, the Mathematics pass percentages in grade 12 examinations for 1998, 1999, 2000, and 2001 in the Limpopo Province were 22%, 30%, 25%, and 32%, respectively (Department of Education, 2001b). In addition, the Limpopo Province obtained the lowest score compared with other South African provinces in the TIMSS study, and thus scored below the national average (Howie & Hughes, 1998). It is therefore apparent that the poor state of mathematics education in the Limpopo Province calls for urgent and meaningful ways to address the problem.

The Limpopo Province is largely rural and poor. Eighty-five percent of the schools are situated in rural areas, which are under-resourced in both physical and human resources. The standard of social and public services is poor as compared to those in urban areas (Rakgokong, 1994: 77). In my experience as a Mathematics Curriculum Advisor in one of the districts in the Limpopo Province, schools always complained about a shortage of learning support materials, and often the quality of materials that are available is poor or the materials are outdated. Resources like libraries and laboratories are a luxury to only a few schools, a situation created by past apartheid laws (Arnott, Kubeka, Rice & Hall, 1997; Ashley & Mehl, 1987: 3).

Among many factors that influence achievement in Mathematics, the role of teachers' paedagogical knowledge and skills in their subject area is acknowledged to be key (Department of Arts, Culture, Science and Technology, 1996). Teachers' craft knowledge, that is, knowledge and beliefs regarding paedagogy, students, subject matter and curriculum (Van Driel, Verloop & De Vos, 1998) is related to teacher effectiveness (Darling-Hammond, 2000). Moreover, there is overriding evidence that teacher quality in terms of teacher preparation and qualification strongly influence students' achievement (Darling-Hammond, 2000; Darling-Hammond, Berry & Thoreson, 2001; Goldhaber & Brewer, 2000). However, subject content knowledge of Mathematics educators in Limpopo Province is poor and their current teaching methods are often inappropriate (Northern Province Department of Education, 2000). It is widely recognised that for historical reasons, the training of Mathematics teachers in rural areas such as the former

Department of Education in Lebowa, Venda and Gazankulu is of variable, and largely inadequate quality (Bot, 1986:1; Mailula, 1995; Ngoepe, 1995). As a result, Mathematics is largely taught by inadequately trained teachers, leading to failure in this subject more readily than in other subjects. An important initial response to the poor state of mathematics education in the Limpopo Province should therefore include the establishment of widely available in-service teacher education and training (INSET) programmes.

It is commonly presupposed that the effectiveness and success of INSET programmes depend among others on the following two important factors. Firstly, INSET programmes should expressly address the perceived needs of teachers (e.g., Mhlongo, 1995; Northern Province Department of Education, 2000). Lubben (1994) argues that INSET activities are usually structured on the basis of the observations of INSET providers and at the requests of educational administrators, without consulting teachers to identify their priority INSET needs. When teachers are not consulted about their work environments, and planners assume that they know what is best for teachers, teacher morale suffers, INSET programmes are poorly attended, and achievement is scarcely influenced (Mecca & Klindeist; in Baird & Rowsey, 1989). Moreover, Baird, Easterday, Rowsey, and Smith (1993) maintain that INSET programmes based on the expressed needs of teachers yield more positive responses from teachers. Smith and Haley (in Easterday & Smith, 1992) add that programmes that are relevant to teachers' classroom needs as opposed to programmes which are not can also boost workshop attendance.

Secondly, efficient and effective planning of INSET activities on a provincial basis requires that planners have at their disposal accurate demographic information of Mathematics teachers in the province. Unfortunately, this is not the case in the Limpopo Province. The current the Limpopo Province Department of Education was established in 1996 through the merger of seven different departments of the apartheid era: education departments from the former Venda, Lebowa, Gazankulu; the former Department of Education and Training; the former Transvaal Education Department; the former Department of Education and Culture: House of Representatives; and the former Department of Education and Culture: House of Delegates (Lee and Glover, 1995; Richard, 1995/96). The Mathematics teacher database of these departments is of varying quality and reliability, so that up-to-date, accurate and reliable demographic information specifically on Mathematics teachers for the whole province up to 1995 does not exist. Although data from annual surveys conducted from 1996 onwards are available, they are not useful for the following

reasons: the 1996 data are too old, the 1997 data are corrupted, 1998 data are bedevilled by redeployment issues and thus not reliable, the 1999 data are not yet cleaned (personal communication, N. Nghatsane, EMIS Directorate, Northern Province Department of Education), and data from 2000-2002 have not been captured (personal communication, M.A. Seopa, EMIS Directorate, Northern Province Department of Education).

STATEMENT OF THE PROBLEM

Performance in overall matric Mathematics examinations in the Limpopo Province is poor, and teachers are poorly qualified. This is an indication of the poor state of mathematics education in the province. INSET programmes can be one way of addressing the problem of inadequate teachers' qualifications. However, the success of these programmes relies on information regarding demographic profiles and perceived INSET needs of teachers. The Limpopo Province Department of Education does not have up-to-date information on demographic profiles and has no information at all on perceived INSET needs of Mathematics teachers in the province. This study intends to fill in this gap.

AIMS AND OBJECTIVES OF THE STUDY

The aim of this study is to contribute to crucial information on Mathematics teachers' demographic profile and perceived INSET needs. Such information is a prerequisite for planning effective, efficient and successful INSET activities, and its availability will thus hopefully contribute to the improvement of mathematics education in the Limpopo Province.

The study will address the following objectives, which have been formulated as key questions:

1. What is the demographic profile of secondary Mathematics teachers in the Limpopo Province?
2. What are the perceived INSET needs of secondary Mathematics teachers in the Limpopo Province?
3. What are possible associations between the demographic profile and perceived INSET needs of secondary Mathematics teachers in the Limpopo Province?

SIGNIFICANCE OF THE STUDY

The study will result in an accurate, reliable and up-to-date demographic profile of Mathematics teachers, as well as a reliable and valid list of perceived INSET needs and professional concerns of these teachers in the Limpopo Province. This information will help the Limpopo Province Department of Education and other INSET providers to know their target group and plan suitable INSET programmes for them. The project will thereby effectively facilitate and contribute to urgently needed initiatives to improve mathematics education in the Limpopo Province.

ASSUMPTIONS OF THE STUDY

It is assumed that Mathematics teachers have particular INSET needs which they wish INSET providers to address in their programmes or workshops. It is also assumed that teachers are aware of all of their needs, and what is expected of them according to the demands placed on them as Mathematics teachers because of, for example, curriculum innovations. The needs expressed by teachers are assumed to be real, that is, they are the actual needs experienced by teachers, and not mere wishes. It is also assumed that teachers' INSET needs are essentially related to academic and professional qualifications, years of teaching experience, type of school they teach at (i.e., rural, township, urban), grade(s) taught, class size, and school enrolment.

DEFINITION OF CONCEPTS

In-service education and training (INSET)

In-service training includes all activities that are aimed at improving the academic, professional and practical knowledge of teachers (i.e., craft knowledge) in order to improve their teaching performance, as well as enabling teachers to keep up with advances and trends in their profession (Cawood & Gibbon; in Mutshekwane, 1992:1). It refers to the updating of skills of teachers already employed by Limpopo Province Department of Education. The common goal of INSET activities is to improve the classroom practice of teachers, with the eventual consequence that student achievement in Mathematics will improve.

Perceived needs

Perceived needs refer to professional concerns and classroom problems experienced by teachers, with which they require help in order to improve their classroom practice (Lubben, 1994). Perceived needs are thus priority problems which teachers require INSET programmes to address in order to enable them to be better and more competent Mathematics teachers.

Mathematics teachers

Mathematics teachers refers to all individuals who teach Mathematics in grades 10 to 12 in secondary schools in the third term of 2000 in government schools in the Limpopo Province. Mathematics teachers are here defined as those teachers who spend most of the time teaching Mathematics as a proportion of all lessons taught per week.

Demographic profile

Demographic profile refers to characteristics of teachers such as age, sex, academic and professional qualifications, years of teaching experience, grade(s) taught, the type of school they teach at (e.g., rural, township, urban), and so forth.

LIMITATIONS

The National Department of Education has embarked on a process of rationalisation and redeployment of teachers in 1998, in line with education post provisioning norms as outlined in the National Education Policy Act of 1996 (Department of Education, 1998). Teachers who are considered to be in excess to the post establishment at their schools are redeployed to schools which have a shortage, in order to achieve equity in education staff provisioning (Department of Education, 1998). This is done according to the curriculum needs of the school. This process has not yet been completed in the Limpopo Province (personal communication, R. Sekole, Human Resource Directorate, Limpopo Province Department of Education), and it has consequently led to uncertainty on the part of teachers. As a result, responding to the survey conducted in this study might be a problem for teachers, as they might feel that they could be disadvantaged should it be found that they are not qualified to teach Mathematics.

OVERVIEW OF CHAPTERS

The theoretical framework of the study and its usefulness are described in Chapter 2. Reference is made to the international, South African and the Limpopo Province context regarding INSET provision, and INSET models used world-wide are outlined. The central importance of INSET needs as perceived by teachers is also highlighted.

The instrument design, choice, adaptation, modification and pilot testing of the instrument are outlined in Chapter 3. Processes leading to the final instrument used in the study are described, that is, the adaptation of the *Science Teacher Inventory of Needs-3* (STIN-3) leading to the development of the *Science Teacher Inventory of Needs in the Northern Province* (STIN-NP). The chapter also includes a description of how the instrument was administered, as well as a description of how focus group interviews were used in conjunction with the questionnaire. Data capture and analyses of both quantitative and qualitative data are outlined.

In Chapter 4, findings of the survey are described, as well as those of the interviews. Relevant tables are presented and associations between variables outlined. Results are presented in terms of demographic characteristics (e.g., qualifications, age, years of teaching experience in Mathematics, and so forth) and in terms of perceived INSET needs.

Results are discussed in Chapter 5, yielding a picture of the demographic profile and perceived INSET needs of secondary school Mathematics teachers in the Limpopo Province. The findings are compared with those of other, similar studies conducted locally, nationally, and internationally. Conclusions and recommendations based on the findings are outlined. The significance of the study and areas that need further research are also highlighted.

Chapter Two

LITERATURE REVIEW

INTRODUCTION

This chapter outlines broad bodies of literature that are relevant to the demographic profile and perceived INSET needs of Mathematics teachers in the Limpopo Province. INSET models and methodologies used elsewhere are also described. The theoretical framework of the study is discussed, and the lack of a prior study of this nature specifically in the Limpopo Province is highlighted.

It is widely believed that improved educational opportunities can foster new generations dedicated to, and capable of, reconstructing and improving societal conditions in developing countries (Abu Bakar, Rubba, Tomera, & Zurub, 1988). The ever-increasing complexity of classroom teaching and increasing demands placed on schools put pressure on teachers. They are required not only to be conversant with the latest developments on content-related and didactical principles, but also need to be adaptive to the ever-changing conditions of schools and society (Cooney & Krainer, 1996: 1166). However, new developments should be based on teachers' practical concerns, for otherwise their rejection by teachers who are targeted is virtually assured. Eraut (1995) points out that many countries are increasingly recognising the crucial role of INSET activities in improving the quality of education. INSET is meant for human resource development, with the purpose of improving the professional knowledge, skills and attitudes of teachers (Eraut, 1995).

INSET in developed countries focuses on issues like technology, assessment, and how mathematics can be related to the real world as it is assumed that there are reasonable resources (Nesbre; in Cooney & Krainer, 1996: 1166). On the other hand, INSET in developing countries focuses on more fundamental problems such as, for example, providing teachers with resources (e.g., teaching and learning support materials), helping them to develop a reasonable mathematical background, and so forth (Nesbre; in Cooney & Krainer, 1996: 1166).

Although Weiss, Boyd and Hessling (in Cooney & Krainer, 1996: 1155) observed that teachers' mathematical competence can be improved through INSET programmes, Cooney and Krainer

(1996: 1166) indicate that teachers are more concerned with "how" rather than the content *per se*. However, Cooney and Krainer (1996: 1166) argue further that mathematics content and paedagogy should be integrated in order to have a positive impact in the classroom. Beeby (1980) also points out that INSET can be ineffective if it focuses only on professional concerns of teachers, that is, paedagogic tricks can be of little value if teachers are still struggling with their own poor content knowledge. The importance of content knowledge is also indicated in Kachelhoffer's (1995) report on the lack of content knowledge of under-qualified mathematics and science teachers in KwaNdebele (a homeland in the former South African regime prior to 1994). Moreover, confidence building in content is a good way to start INSET for under-qualified teachers (Rogan & Mcdonald, 1985). Therefore, a combination of paedagogical content knowledge and skills is necessary for INSET activities that will help teachers to be more competent in their classroom responsibilities (Shulman, 1987).

INSET MODELS

There are several approaches to INSET provision world-wide. Cantrell (1995) describes three different approaches, that is, school-based INSET, school-focused INSET, and distance teaching/learning. School-based INSET proposes whole school participation, that is, school governing bodies, parents, school management teams, teachers and learners. School-focused INSET is where the teacher receives training outside school hours (i.e., after hours/ part-time/ during holidays) away from the school. The advantage of this approach is that the teachers get the opportunity to immediately implement the new knowledge and skills gained when they go back to the classroom situation, and also no valuable teaching and learning time is lost (Cantrell, 1995). Crossley and Guthrie (1987) go further by distinguishing between school-based and school-focused INSET.

In school-based INSET, the school itself is responsible for developing its own INSET programmes based on their own identified needs and problems, and for using its own resources and staff (Crossley & Guthrie, 1987). On the other hand, school-focused INSET is based on the needs of the school, but is conducted by an outside institution away from school, providing additional resources, finance, staff and input. School-focused INSET therefore combines the strengths of school-based INSET initiatives with those of externally conducted workshops, whilst reducing the weaknesses of both (Crossley & Guthrie, 1987). The distance teaching/learning

approach provides teachers with knowledge and skills without taking them away from the classroom (Cantrell, 1995).

Peacock (1993) proposes seven possible strategies for INSET, that is, full-time training, cascade dissemination, mentorship schemes, experts, diffusion by workshops and distance learning. However, he points out further that these strategies should be integrated in order to be effective. On the other hand, Joyce and Showers (in Eraut, 1995) propose a model which identifies five essential components of successful INSET. They point out that theory should be combined with other elements of training, followed by demonstration of skills, practice under simulated conditions, feedback about performance and, lastly, coaching for application. Interaction between theory and practice should be there throughout the programme. Shommo (1995) also points out that activities that will change teachers' paedagogical content knowledge are best carried out by demonstration and coaching, and teachers need to practice actions they are required to change.

There is some agreement for the view that INSET should not be viewed in isolation, but that it should form part of a continuous process of professional development where there is initial training, followed by induction into the school, which is then followed by in-service education and training (Crossley & Guthrie, 1987; Ashley & Mehl, 1987:7). Any INSET plan will be very limited in what it can achieve without an improvement in the quality of initial teacher training (Ashley & Mehl, 1987: 8). Moreover, the single longest INSET that all teachers undergo is their own experience learning as student teachers (Maher, 1995).

THE IMPORTANCE OF TEACHER NEEDS

Although INSET is crucial for upgrading teachers, there usually is a mismatch between the needs of teachers and the content of the courses offered (Henderson & Penny; in Ashley & Mehl, 1987: 22). Most INSET programmes are based on what INSET providers think is good for teachers, and INSET planners tend to overlook the central influence of the teacher for the success or failure of these programmes. According to Cooney and Krainer (1996: 1155), INSET depends on teacher needs, and teachers are more likely to be interested in addressing issues perceived relevant to their particular situation, that is, they are more concerned in improving their local conditions. Moreover, Baird, Easterday, Rowsey and Smith (1993) stress the importance of the congruency of INSET activities with what teachers really need in order to do their jobs well. This implies that

teachers will actively participate in and be committed to INSET programmes only if they feel that the programmes address the immediate problems in their working environments.

Whatever model of INSET is used by INSET providers, a thorough needs analysis will help to address teachers' problems. For example, in Jordan and Malaysia, it has been found that the lack of a comprehensive database on the professional needs of teachers hampered effective implementation of INSET programmes (Abu Bakar et al., 1988). According to Cantrell (1995), Glover (1995), Bagwandeen (1993:61), and de Feiter and Thijs (1996), if INSET programmes are to be successful, teachers should be involved in determining their own needs to ensure that INSET activities are relevant to their problems. Thus determining teachers' INSET needs should be a matter of concern when planning and delivering INSET programmes. Moreover, teachers need different experiences from INSET at different times in their personal development (Monk, 1998). Dillon, Osborne, Fairbrother and Kurina (2000), in their study of professional views and needs of Science teachers in England, found that teachers complained that they have little say in the INSET workshops they attend. This stresses the fact that in order to obtain significant positive results, INSET activities should be based on teachers' expressed classroom and school needs.

Wallace, Nesbit and Miller (1999) argue that past and present methods of INSET for teachers have not produced the desired results, as teachers attended workshops based on INSET providers' assumptions and not on actual teacher needs. Lubben's report (1994) on in-service education and training for secondary mathematics and physics teachers in Swaziland points out how specialist trainers can be blind to the needs of non-specialist trainees. If the present trend of planning INSET activities that are irrelevant to teacher needs continues, it is likely that INSET providers will continue to obtain poor results. Kahn's (1990) study of Botswana Mathematics and Science education officers and classroom teachers indicates that people in different positions will have different concerns, that is, people's concerns are congruent to their positions. This implies that what INSET providers view as teacher needs can be very different from what the teachers themselves perceive to be their needs.

Esu (1991) points out that for INSET to be successful, teachers should decide their own needs. When contexts are provided for teachers to engage in professional dialogues about problems they deem important, INSET programmes are generally well received (Cooney & Krainer, 1996: 1166). Bax (1995) also stresses that teachers should decide what is important, and INSET

providers should provide the form and not the content of INSET programmes. Moreover, when INSET programmes fail to consider the circumstances and beliefs of teachers, they ensure that their effect will be essentially random, significantly diminishing any potential impact (Cooney & Krainer, 1996: 1166). The involvement of teachers in designing their own INSET programmes is therefore important, if INSET activities are to be successful (Cantrell, 1995; Kahn, 1990). Wallace et al. (1999) also stress that teachers' perspectives of classroom needs are key to successful INSET practice. Moreover, they argue that engaging teachers in INSET activities which are not congruent to their needs is a wasteful exercise for both INSET providers and teachers. Listening to teachers' concerns thus honours teachers and provides the opportunity for both INSET providers and teachers to promote mutual respect, understanding, and concomitantly, the professional development of all (Cooney & Krainer, 1996: 1184).

INSET IN SOUTH AFRICA

INSET models followed in South Africa prior to 1994 fall into two categories: the career profile approach which was meant for well-qualified teachers (mainly Whites), and the target population approach (Ashley and Mehl, 1987: 4). The latter model is used in less developed countries and in South Africa was meant for unqualified and under-qualified teachers (mainly Blacks). It was the responsibility of the Department of Education to identify these teachers and provide INSET programmes. In the former model, the teacher usually takes the responsibility of attending INSET courses, and it was meant for career advancement, promotion and salary increase.

Before the establishment of the democratic government in 1994, INSET in the apartheid era was based on the separate, exclusive nature of the formal education system, which was racially based (Hartshone; in Ashley and Mehl 1987: 1; Arnott et al., 1997). Each of the nineteen former departments of the apartheid era (education departments from the former Lebowa, Gazankulu, Venda, Transkei, Ciskei, Bophuthatswana, KwaZulu, KwaNdebele, KaNgwane, Qwaqwa, the former Department of Education and Training, the former Transvaal Education Department, the former Natal Education Department, the former Cape Education Department, the former Orange Free State Education Department, the former Department of Education and Culture: House of Delegates, and the former Department of Education and Culture House of Representatives) comprising the current National Department of Education provided INSET programmes for its own teachers (Bot, 1986: 134). According to a Human Sciences Research Council report of 1985

(Hartshone; in Ashley & Mehl, 1987: 1), most of the INSET programmes were concentrated in the education departments for whites, and as such were not often accessible to teachers who needed them most (Hartshone; in Ashley & Mehl, 1987: 1). Inequality that existed in educational provision compromised quality education and created backlogs in qualifications, education and training of Black teachers (Department of Education, 2001a).

Education and training in South Africa during the apartheid era were characterised by the underdevelopment of human potential, especially that of Blacks (Arnott, 1997). Educational opportunities were not easily accessible to Blacks, and the extent of exclusion was much greater in the teaching and learning of mathematics and science (Ashley & Mehl, 1987:1; Department of Education, 2001a). Many Non-Governmental Organisations (NGOs) became involved in INSET programmes in a bid to make a contribution, in order to alleviate problems such as, for example, unqualified/under-qualified teachers, overcrowded classes, under-financing, lack of resources, and so forth in Black schools (Bot, 1986: 1). These NGOs were offering all types of INSET, with emphasis on competence and professional motivation. Examples of NGOs which made a contribution to Mathematics education are the *Formal In-Service Training for Mathematics and Science Teachers, Teacher Opportunity Programmes, Centre for the Advancement of Science and Mathematics Education, Institute for Science and Mathematics Education, Research and Development in Mathematics, Science and Technology Education, Mathematics Education Project,* and so forth (Levy, 1994: 210-367). These efforts were complemented by institutions of higher education.

INSET IN THE LIMPOPO PROVINCE

Prior to 1994, INSET programmes for Mathematics teachers in the Limpopo Province in particular, were provided by the different departments of education, NGOs (e.g., *Science Education Project [SEP], the Palabora Foundation, Mathematics Education Project [MEP], Project Mathematics, Teacher Opportunity Programmes [TOPS]*, and so forth), and higher education institutions (Bot, 1986:5; Levy, 1994: 210-367; Mailula, 1995). The University of the North has offered an INSET programme (University of the North In-service Training [UNIST]) for Mathematics and Science teachers from 1994 to 1996 (Mailula, 1995). Provision of INSET on the part of the departments of education in the former Lebowa, Venda and Gazankulu was in the form of the Lebowa In-service Training Centre, the Ramano Mbulaheni Training Centre, and the

Giyani Science Centre, respectively. Joint ventures between the departments of education of the former three homelands in the Limpopo Province and other institutions also existed (Mailula, 1995). Examples of these joint initiatives are the Mathematics Subject Support Programme and Funda Center, Mathematics and Science In-service training Projects and the University of Orange Free State's Research Institute for Education Planning (RIEP). In addition, about 50 Mathematics and Science advisors rendered support services to all teachers offering Mathematics, Biology and Physical Science in secondary schools (Mailula, 1995).

After the democratically elected government took over in 1994, the former INSET centres in the Limpopo Province were decreased (Northern Province Department of Education, 2000). In order to fill this gap, the Limpopo Province Department of Education has recently established thirteen Multi-Purpose Centres to provide, among others, INSET for Mathematics teachers in the province (personal communication, M. Segabutla, Institutional Development Directorate, Limpopo Province Department of Education). The University of the North is presently providing INSET for Mathematics and Science teachers in grade 4-9, in line with the National Strategy for Mathematics, Science and Technology Education (Department of Education, 2001c).

Although there has been a change in the education system and the provision of education in South Africa, disparities still remain (Kahn, 2001). The National Department of Education has taken the initiative to address the problem through the National Strategy for Mathematics, Science and Technology Education (Department of Education, 2001a). The realisation of the objectives of this initiative depends on the successful implementation of INSET programmes. Moreover, a new Outcomes-Based Education curriculum has been introduced in South African schools as from 1998, in order to change the face of education and training (Department of Education, 1997). This curriculum emphasises learner-centred methods which engage learners as the main participants in the learning process (Department of Education, 2002). Teachers are seen as facilitators and mediators of learning, researchers and life-long learners, and innovative designers of learning programmes and teaching materials (Department of Education, 2002). Therefore, INSET programmes should—in the first instance—be based on what teachers perceive to be their needs.

Studies on INSET needs of Science and Mathematics teachers have been conducted in several countries such as, for example, in the United States (Baird et al., 1993; Baird, Prather, Finson & Oliver, 1994), Lebanon (Jbeily & Barufaldi, 1985), Jordan (Zurub & Rubba, 1983), Malaysia

(Abu Bakar & Rubba, 1985), England (Dillon et al., 2000), and Swaziland (Lubben, 1994). All of these studies used a survey methodology, involving questionnaires. However, most studies mentioned above focused on perceived INSET needs of Science teachers. Almost no research has been conducted regarding Mathematics teacher needs, with the exception of the survey of Mathematics teacher needs in the state of Alabama, USA, conducted by Easterday and Smith (1992), and another one comparing Science and Mathematics teachers' demographics and perceived needs in the same state by Baird et al. (1993).

In South Africa, despite several indications of the necessity for a study on Mathematics teachers' needs, such a study has not been conducted (Ashley & Mehl, 1987: 26; Bagwandeen, 1993; Cantrell, 1995; de Feiter & Thijs, 1996). Although three different studies have been conducted in South Africa, they focused on different aspects: Arnott, Kubeka, Rice and Hall's (1997) study conducted in 1995 focused on the demand, utilisation, supply and training of secondary mathematics and science teachers in South Africa, Howie's (2001) study of the *Third International Mathematics and Science Study-Repeat* (TIMSS-R) of 1999 focused on the performance of South African grade 8 learners in mathematics and science, and Grayson, Ono, Ngoepe and Kinta's (2001) study compared mathematics and science high school teachers' attitude in Japan and South Africa. Their findings are therefore of limited use in terms of planning effective and successful INSET activities for Mathematics teachers in the Limpopo Province as their studies were not specific to the Limpopo Province or Mathematics teacher needs. This study fills this obvious gap in knowledge about secondary school Mathematics teachers in the Limpopo Province.

SUMMARY

This chapter outlined different existing models of INSET and described INSET provision in South Africa and in Limpopo Province from a historical perspective. The central importance of identifying teacher needs for INSET programmes to succeed was highlighted. Ongoing professional development in the form of INSET activities is necessary in order to help teachers adapt to the ever-changing conditions of schools and society. However, these INSET programmes should be relevant to what teachers perceive to be their classroom problems or needs, or else their effectiveness will be limited. In the next chapter, the methods used to collect data on INSET needs of Mathematics teachers in the Limpopo Province are discussed.

Chapter Three
METHODOLOGY

RESEARCH DESIGN

This study is designed as a snap survey of demographic profiles and perceived INSET needs of secondary Mathematics teachers in the Limpopo Province in the third term of 2000. However, the researcher wished to avoid as much as possible any bias in responses due to the nature of the topic to be researched. A quantitative methodology using a paper-and-pencil instrument was used as surveys are an efficient and cost effective way of obtaining information from a large group of individuals and can ensure anonymity (Macmillan & Schumacher, 1993). As the issue of the 'trustworthiness' of findings is an important methodological consideration (Cresswell, 2003), 'triangulation' (Denzin, 1989) of the questionnaire findings was conducted. In other words, a different source and mode of evidence to the questionnaire responses (Miles & Huberman, 1994) was used to double-check the questionnaire findings.

Wiersma (1991: 190) asserts that the interview is a more effective method of conducting a survey than using questionnaires, but is more costly in terms of time and effort. Moreover, the interview provides an opportunity for in-depth probing and elaboration as well as clarification of questions if they are not understood by the respondents. Focus group interviews can be used for triangulation and are quite common in survey research (Fontana & Frey, 1998), and thus focus group interviews with Mathematics teachers were carried out. The interviews were also meant to allow teachers to describe needs not included in the instrument. Overall, therefore, the research approach in this study was to employ both quantitative and qualitative methods, that is, so-called 'mixed methods' (Cresswell, 2003; Zeller, 1997: 829). This was done in a sequential manner in order to maximise the trustworthiness of the findings.

As appropriate financial resources were available, the researcher wished to reach all Mathematics teachers in the Limpopo Province, and therefore opted for a census approach (Rosier, 1997: 155). The entire population of Mathematics teachers (as defined in Chapter 1, page 6) was thus requested to respond, that is, all secondary schools in the Limpopo Province were to be used to establish the demographic profile and perceived INSET needs of Mathematics teachers.

SURVEY INSTRUMENT

The survey instrument used in this study was developed from the *Science Teacher Inventory of Needs* (STIN-3) of Baird et al. (1994), which in turn evolved from the STIN developed by Zurub and Rubba (1983). STIN-3 was purposely chosen as it was developed specifically to assess perceived needs of science teachers in developing countries, to provide the necessary data for the planning of effective INSET activities (Zurub & Rubba, 1983; Abu Bakar & Rubba, 1985). STIN has been successfully used in a number of developing countries such as for example, Jordan (Zurub, 1982), Malaysia (Abu Bakar, 1986), and Lebanon (Jbeily & Barufaldi, 1985). South Africa is regarded as a developing country, and STIN was believed to be the most relevant instrument to be used in a study of demographic profile and perceived INSET needs of Mathematics teachers, particularly in the Limpopo Province.

The original STIN

The original STIN contained 76 items organised into seven categories of teachers' needs: 1) specifying objectives for instruction, 2) diagnosing and evaluating learning, 3) planning instruction, 4) delivering instruction, 5) managing instruction, 6) administering instructional facilities and equipment, and 7) improving personal competence. The seven categories embody basic skills of a good teacher. Each item describes a task that a teacher may be called upon to perform, followed by a five-point scale to assess the level of need: a) not familiar, b) no need, c) little need, d) moderate need and e) great need (Zurub & Rubba, 1983). STIN allowed open-ended responses to each item and additional spaces were provided for teachers to write in needs not listed in the questionnaire.

STIN was revised by Baird and Rowsey (1989) for the survey of secondary science teachers' needs in Alabama, USA, and then again by Easterday and Smith (1992) for the survey of mathematics teacher needs in the same state. STIN was later revised by Baird et al. (1994) in their comparison of perceptions among rural versus non-rural secondary science teachers in a number of states in the USA. The resulting STIN-3 contained a total of 100 items, divided into four sections. The first 52 items assess needs in the above seven categories and offer response options ranging from "not familiar" to "great need." These are followed by 26 items that use forced-

choice options to determine demographic information about teachers and their schools. The next nine items assess frequency of use of teaching strategies, offering a response ranging from "never use" to "weekly use." Finally, 13 items described problems that confront teachers, using a five-point response option from "not a significant problem" to "a serious problem" (Baird et al., 1994). In order to allow for machine scoring through optical mark reading, open-ended response options were eliminated. A blank page at the end of the questionnaire was provided for teachers to write down needs not included in STIN-3.

Modifications to STIN-3

Although the original STIN was found to be reliable and valid in other countries, its use in a different educational context demanded that its validity be determined with respect to perceived INSET needs of Mathematics teachers in the Limpopo Province. Modifications involved four stages, that is, initial modifications by the researcher, validation of needs by stakeholders, pilot testing of the instrument on a sample of Mathematics teachers, and the final modifications of the instrument.

Initial modifications to STIN-3

The STIN-3 instrument was initially adapted and modified for use in the South African and the Limpopo Province context in particular, and was called the *Science Teacher Inventory of Needs in the Northern Province* (STIN-NP)[3]. The researcher modified STIN-3 by, firstly, rephrasing the instructions to simplify the language for Mathematics teachers in the Limpopo Province, as the majority are English Second Language speakers. For example, the instruction "In responding to this item you are asked to use a #2 pencil to bubble in the one letter that best designates the degree to which you feel a need for help with that task" was changed to "In responding to this item, you are asked to shade in on the answer sheet the one letter that best describes the degree to which you feel a need for help with that task". Secondly, terms not used in South Africa were replaced (e.g., "certification" replaced by "qualification", "miles" replaced by "kilometres", etc.). Lastly, three items were removed that were not relevant to the South African context (e.g., "What

[3] The name of the province was changed after the development and administration of the instrument. The new name is thus not reflected in the instrument's name.

is the average per-pupil expenditure in your district?"). The questionnaire was then edited for clarity.

Validation by stakeholders

According to Cronbach and Mehl (in Zeller 1997: 822), it is important to establish the validity of an instrument before administering it. To find out whether the questionnaire measured what it was supposed to measure, the researcher sought content-related evidence (Ary et al., 1990: 410; Zeller, 1997: 824). Content validity focuses on the extent to which the content of an indicant corresponds to the concept it is designed to measure (Zeller, 1997: 824), and deals therefore with how well for example a questionnaire succeeds in covering the concept with which it is concerned. Content validity is achieved when the instrument is checked item-by-item to decide whether all aspects of the concept under investigation are covered by the items, and when after consultation with experts in the field a decision can be taken as to whether certain items should be omitted or added in order to produce an instrument with appropriate content (Mulder, 1986: 217).

In order to ensure that the INSET needs mentioned in the instrument reflected relevant needs appropriate to Mathematics teachers in the Northern Province, important stakeholders (n = 55) in mathematics education were invited to scrutinise the questionnaire and were requested to give a rationale for their possible suggestions for improvement. Participating individuals were selected because of their interest and/or expertise in mathematics education, and were drawn from seven categories of stakeholders at provincial and national levels. The categories consisted of provincial Department of Education officials stationed at the Provincial Head Office (i.e., Chief Education Specialists and Curriculum Developers in the Curriculum Support Services Directorate), academics, examiners, teacher unions (i.e., South African Democratic Teachers' Union [SADTU], Professional Educators' Union [PEU] and Suid Afrkaanse Onderwysers Unie [SAOU]), professional associations (i.e., Association of Mathematics Educators for South Africa [AMESA] and Southern African Association for Research in Mathematics, Science and Technology Education [SAARMSTE]), Mathematics Curriculum Advisors from the seven Limpopo Province regions stationed at District Offices, and NGOs working in mathematics education in a number of provinces, including the Limpopo Province (i.e., Mathematics Centre for Professional Teachers [MCPT], Palabora Foundation, Centre for the Advancement of Science and Mathematics Education [CASME], and Project for Mathematics [PROMAT]).

The seven categories were purposefully selected to ensure that all possible important stakeholders in mathematics education were represented. Officials from the Department of Education, especially in the Curriculum Support Directorate, are important INSET providers. They know problems that teachers might require help with, that is, understand the type of INSET activities teachers would benefit from. Academics in mathematics education are best positioned to ensure the relevance of INSET needs to Mathematics teachers. Examiners set and mark grade 12 end-of-year Mathematics examination papers, and interact with teachers during the marking session. Through these activities they become aware of areas in which teachers require assistance and for which INSET activities should therefore be planned for them. The validation of the instrument also involved the participation of teachers who are members of various unions. Teacher unions ensure that their members' best interests are served. Individuals from all categories of stakeholders belong to professional associations of mathematics. Conferences of these associations are held at regional, provincial, national and international levels, and contributions from individuals linked to such associations can thus help in developing a suitable instrument which will identify valid INSET needs of Mathematics teachers. Curriculum Advisors are directly involved with teachers by supporting them through school visits and holding subject meetings as well as workshops. Advisors therefore know areas in which teachers would benefit from INSET workshops. NGOs are major INSET providers involved directly with teachers and Curriculum Advisors. As such, they know teachers' problem areas and hence have important insights into teachers' possible INSET needs.

Instructions to stakeholders

The stakeholders were requested to first read through all the instructions in the questionnaire carefully and to decide whether the instructions were clear and unambiguous (Appendix A, page 73). If the instructions were not clear and unambiguous, they were asked to suggest changes in wording. Secondly, they were asked to read each item in the questionnaire carefully and decide whether the item was clear and relevant to Mathematics teachers in the Limpopo Province. If the item was not clear and relevant, they were also asked to suggest changes in wording or to write a brief justification for the exclusion of an item. Thirdly, they were asked to give possible additional needs, which were not covered in the questionnaire, and to provide a brief justification of why the item(s) (i.e., needs) should be included. Lastly, they were asked to decide whether the language used is clear and appropriate for English Second Language users. If the language was

not clear and appropriate, they were asked to suggest changes in wording. A blank sheet was provided for writing all comments and suggestions. The questionnaire, accompanied by a cover letter outlining the nature and purpose of the study, was posted to 55 stakeholders together with a self-addressed and stamped envelope for convenient return of their responses (Appendix A, page 74).

The researcher phoned stakeholders a week after the deadline for return of their responses, in order to urge them to reply. Further follow-up phone calls were made two and three weeks later. Some of the stakeholders explained that they had misplaced or lost the questionnaires, and new ones were mailed. Other individuals were on leave and hence could not be reached, whereas some said they were too busy with their work and therefore could not find time to look at the questionnaire. Thirty-five responses (i.e., 64%) were returned. The return rate of responses for different categories of stakeholders are presented in Table 3.1.

Table 3.1. Return rate of stakeholders' responses with respect to validating the instrument

Validation category	No. sent out	No. returned	Response rate (%)
Provincial Department of Education officials	2	2	100
Provincial examiners	4	3	75
Provincial teacher union officials	3	3	100
Members of professional mathematics education associations	2	2	100
Mathematics education academics	16	9	56
District Curriculum Advisors	22	13	59
NGO staff	5	2	40
Total	55	35	64

Analysis of stakeholders' responses and modification of items

Analysis of stakeholders' responses involved the comparison of suggested items, as well as the identification of patterns of suggested changes and the reasons for the changes. Responses for each item were then placed into categories such as, for example, "accept as is", "delete", "change content" and "modify language". Thereafter, appropriate modification of items took place in the

light of stakeholders' responses. The frequency of items in the different categories, as well as the stakeholders' suggestions and rationale, were used to decide on the modifications to be made. These modifications are detailed below.

Seven items related to computer use in the classroom were removed as it was felt that most schools in the Limpopo Province do not have electricity and thus cannot use computers (e.g., "Select and order software for microcomputers in your school" and "Set up a laboratory supply order with a storage and retrieval system"). Outcomes-Based-Education (OBE) terminology was also used as OBE is currently being implemented in South Africa (Department of Education, 1997). For example, "learners" was used instead of "students", "learning activities" was substituted for "instructional activities", "outcomes" was put in brackets to clarify "objectives", and so forth.

Based on the INSET needs of teachers as perceived by stakeholders new items were added (e.g., "Apply concepts taught in Mathematics to daily life of learners", "Employ teaching approaches for teaching large classes", etc.). Two new items were also added at the beginning of the questionnaire, to identify the subjects the teacher was teaching in the third term of 2000 ("Which of the following subjects do you teach this year?" and "In which of the following subjects do you teach the most lessons per week this year?"). As the researcher is a Curriculum Advisor, it was realised that Mathematics teachers also taught Physical Science and/ or Biology. Therefore teachers' responses to the two questions would help the researcher to identify a Mathematics teacher, that is, someone who spends most of the weekly allocated lessons teaching Mathematics (Chapter 1, page 6).

Some of the items were modified and clarified by providing examples in brackets, to ensure that language was not a limiting factor, as the majority of teachers in the Limpopo Province are almost exclusively English Second Language speakers. For example, "Select commercially prepared instructional materials" was modified to "Select commercially prepared teaching materials (e.g., textbooks, charts, models)", "Update your knowledge of science related societal issues" was modified to "Update your knowledge of issues in the society related to mathematics (e.g., economics, electrification, HIV/AIDS, etc.)".

The particular type of demographic information elicited from teachers on the STIN-NP was established in collaboration with the Limpopo Province Department of Education (e.g., teachers'

professional qualifications, years of teaching experience in Mathematics, highest academic qualification in Mathematics, etc.). Eleven items related to the teachers' demographics (e.g., "What is the population of the community in which your school is situated?", "What is the approximate average annual income of families sending students to your school?", etc.) that are irrelevant to the South African and the Limpopo Province study were removed and replaced by eleven relevant items (e.g., "Number of learners in your largest mathematics class this year", "Highest professional [i.e., teaching] qualification you hold", etc.).

Thereafter, an English Second Language expert was requested to modify the language so that it is appropriate for English Second Language speakers in the Limpopo Province. This individual was engaged by virtue of his expertise and experience in writing textbooks for Northern Sotho first language speakers, the dominant language group in the Limpopo Province. He was asked to read through the instructions and guidelines of the STIN-NP questionnaire carefully and to underline any word(s) or phrase(s) or sentence(s) that are ambiguous, and suggest changes in wording. He was also asked to read each item in the questionnaire carefully and decide whether the item is clear. If the item was not clear, he was asked to underline the word(s) or phrase(s) or sentence(s), and suggest changes in wording.

General changes to STIN-NP

General changes were made to the whole instrument in order to make it easy for teachers to complete the questionnaire and to adhere to instructions. In order to focus teachers' attention, instructions for each section were written in bold or italics, and key words or phrases were underlined. This study was part of a broader study involving also Physical Science and Biology teachers, and one instrument for all the three subject teachers was developed as most Mathematics teachers also teach Physical Science and/ or Biology. On the top of each page, teachers were thus reminded to answer the questionnaire with respect to the professional needs of either a Mathematics or a Physical Science or a Biology teacher, depending on the answer they have provided in item 2. Lastly, key words in items were underlined to draw teachers' attention to the main focus of the item (e.g., "Improve your content knowledge", "Apply concepts taught in Mathematics/Physical Science/Biology to daily life of learners [i.e., to real-life situations]", "Develop lesson plans [i.e., learning activities] which integrate Mathematics/Physical Science/Biology with other subjects"). The scales A, B, C, D, and E for the response options were

written in bold and the answer options were written in italics to highlight them. The last part of the option "not familiar or no tools" in STIN-3 was removed to read "not familiar" in STIN-NP, as teachers might have tools but find that they are not familiar with such tools.

The sequence of items was changed, in order to motivate teachers to complete the questionnaire. Answering a questionnaire requires time and effort and, after a while, respondents may get tired, possibly leading to careless mistakes or inaccurate responses (Wolf, 1997: 422). It was assumed that when answering item 2, teachers would have read instructions carefully, as this item is at the beginning of the questionnaire and there is likely to be maximum concentration. The last category (improving personal competence) was made the first, as it is interesting and simple to respond to (e.g., "Update your knowledge of effective teaching approaches [i.e., methods] in Mathematics/Physical Science/Biology", "Update your knowledge of career opportunities for learners related to Mathematics/Physical Science/Biology"). The section on problems was placed after the demographic items, as the problems teachers encounter in their teaching environments are closely associated with their needs, and were therefore believed to be more appealing to respond to. The category of teaching strategies was placed last.

Modifications were thus made in all sections of the questionnaire, that is, in 48 out of the 52 need items, in 23 out of the 26 demographic items, in nine out of the 13 items describing problems confronting teachers, and in eight out of the nine items relating to the frequency of using particular teaching strategies. Out of the 100 original STIN-3 items 22 were deleted, 14 were used unchanged, 64 were changed or modified, and 20 new items were added to yield STIN-NP. Instructions were also modified in order to help teachers to complete the questionnaire with ease. As in STIN-3, teachers were given the opportunity to list needs not covered in the instrument on a blank page at the end of the questionnaire itself.

Pilot study

Before preparing the final form of any questionnaire, the questionnaire should be tried out with a small group of respondents from the target population in order to identify possible misunderstandings and ambiguities, as well as to uncover possible difficulties with the instructions for completing the questionnaire (Wiersma, 1991: 177-178). Piloting also provides the opportunity to revise the structure of the instrument, to make it more appropriate for its

designed purpose, to ensure that questions yield the information sought, and generally to ensure adequate reliability and validity of the instrument (Rosier, 1997: 157). The validated STIN-NP was thus pilot-tested for these reasons on a sample of 60 Mathematics teachers in three districts in the Limpopo Province. The three districts were chosen to facilitate convenient administration of the questionnaire, as the researcher is a Curriculum Advisor in one of the administrative regions in the Limpopo Province and could therefore personally make follow-ups to speed up the process of completing the pilot questionnaire. It was assumed that the major variable for differences in the demographic profile and INSET needs of teachers would be the type of school they taught at rather than language (see assumptions, Chapter 1, page 5), as teachers are almost all exclusively English Second Language speakers. Hence, the selection of teachers in the pilot study was based on the type of schools they were teaching at (e.g., rural, township, urban).

In order to find out if teachers understood the instructions, statements (i.e., items) and answer options, the pilot-test teachers were asked to firstly read the instructions of the questionnaire, and underline any word(s) or phrase(s) or sentence(s) they did not understand (Appendix B, page 81). Secondly, they were asked to read each item in the questionnaire carefully and underline any word(s) or phrase(s) or sentence(s) they did not understand. If the item was ambiguous, they were asked to circle the item number and suggest changes in wording, or suggest different or additional answer options. Lastly, they were asked if they understood the instructions in the shaded box following item number 2. Teachers were then requested to write yes if they understood the instructions or no if they did not understand the instructions next to item number 2.

The questionnaires were given to teachers either individually or via their principal in July 2000, and were returned to the researcher via the same route (Appendix B, page 82). The teachers were given two weeks to return the questionnaires. Fifty questionnaires were returned, yielding a return rate of 80%. According to the teachers' responses, the cover letter, the instructions, and the items in the questionnaire were completely clear and unambiguous.

Final STIN-NP

The final STIN-NP contains 98 items divided into six sections (Appendix C page 92). The first section contains two items that identify teachers in terms of the subject they teach, using three forced-choice options, (i.e., Mathematics, Physical Science or Biology) and the subject in which they teach the most lessons per week. The teachers' attention is drawn to an instruction under item 2, which helps them to be focused as either a Mathematics or Physical Science or Biology teacher in answering the questionnaire (Appendix C page 96).

The second section consists of 47 items that assess teachers' INSET needs in the seven original categories of STIN, that is, a) improving personal competence (6 items), b) specifying objectives for instruction (2 items), c) diagnosing and evaluating learning (3 items), d) planning instruction (14 items), e) delivering instruction (5 items), f) managing instruction (7 items), and g) administering instructional facilities and equipment (10 items). In the 47 items, response options range from "not familiar" to "great need ".

The third section contains 26 items that use forced-choice options to determine demographic information about teachers and their schools (e.g., type of school, highest professional qualification, age group, etc.). The 14 items in section four describe problems that confront teachers, with a five-point answer option ranging from "not a significant problem" to "a serious problem". This section was included in the original STIN and maintained in STIN-NP in order to identify problems confronting teachers in their classrooms that they may require assistance with in addressing. Finally, eight items in section five assess the frequency of use of particular teaching strategies, offering responses from "never use" to "use weekly". Again, this section was included in the original STIN and maintained in STIN-NP in order to establish how often teachers use the mentioned teaching strategies. As some need items are linked to certain teaching strategies (e.g., "Use an inquiry/discovery teaching approach"), the frequency with which a particular strategy was used would indicate whether assistance with that need is required or not. The single item in section six asks for the unique Education Management Information System (EMIS) number of the teachers' school (a reference number). This item was included in order to help the researcher in calculating the proportion of schools covered in the survey. As in STIN-3, teachers were given the opportunity to list needs not covered in the instrument, and to give explanations for items that require details (i.e., items 50, 63, 70) on a blank page of the questionnaire. In order to ensure a high response rate, the total number of items was kept to less

than 100. The questionnaire did not request the name of the respondent in order to preserve anonymity.

Internal consistency of the questionnaire can be checked by building some redundancy into the questionnaire (Ary et al., 1990: 434). This was done by rephrasing and repeating items on the same topic in the questionnaire, but in a different section ("e.g., Motivate learners to learn Mathematics" in section B and "Lack of learner interest in Mathematics [a serious problem, ...]" in section D, "Employ teaching approaches [i.e., methods] where you are able to concentrate on teaching individuals rather than the whole class" in section B and frequency of using "Teaching approaches where you are able to concentrate on teaching individuals rather than the whole class" in section E). Information on the reliability of STIN-NP was obtained by determining the items' alpha coefficient and the instrument's Guttman split-half reliability coefficient after the instrument had been administered. The alpha coefficient reliability for this instrument was 0.97 and the adjusted Guttman split-half reliability was 0.94.

Administration of the instrument

A cover letter was attached to the questionnaire to explain the purpose and potential value of the study to teachers, as well as to introduce them to the questionnaire and to indicate the importance of their participation (Appendix C, page 92), in line with what is recommended by Wolf (1997: 423). It therefore served as a general mechanism of motivating teachers to respond, with the implied reward that respondents were being consulted on issues of importance to them (Wiersma, 1991: 179). The letter was on the letterhead of the university (an institution teachers know), and contained the names of the researcher and her supervisor (Appendix C, page 92). Teachers were also assured anonymity and confidentiality of their responses, in order to try to allay possible fears of their responses to the questionnaire being used to their disadvantage.

STIN-NP was administered with the help of the Limpopo Province Department of Education, following approval of the study from the Superintendent-General of the Department. The questionnaires were distributed to, and collected from, principals of all secondary schools in Limpopo Province offering Mathematics, via the District Offices of the Department. Questionnaires were accompanied by letters to District Managers and Curriculum Advisors, as well as the approval letter from the Superintendent-General requesting cooperation and assistance from all individuals involved in the study (Appendix C, page 92). The researcher had also

personally requested Curriculum Advisors during a provincial Mathematics workshop to help with the administration of the questionnaires. Principals and Mathematics Curriculum Advisors were requested to oversee the completion of the questionnaires by the relevant teachers.

It was assumed that each school had an average of two Mathematics teachers, as Mathematics is compulsory from grade eight to ten. The reasonableness of this assumption was confirmed by two senior Limpopo Province Department of Education officials. The total number of secondary schools in the Limpopo Province was established with the assistance of the provincial Department of Education. A total of 3 258 questionnaires were thus distributed to 1 629 secondary schools in the Limpopo Province in July and August 2000. The questionnaires were couriered to District Offices, and then distributed during principals' and teachers' meetings and workshops. In districts where no Mathematics Curriculum Advisors were available, the administration of the instrument was handled by other District Office staff.

The researcher tried to maximise the response rate by, firstly, having a straightforward, attractive questionnaire with items ordered in a logical sequence. Secondly, the cover letter expressed appreciation to the teachers for responding, and stressed the value of their participation. Thirdly, a letter of approval from the Superintendent-General of the Limpopo Province Department of Education was sent to advisors and principals to motivate teachers to complete the questionnaires. Fourthly, District Managers and Curriculum Advisors were informed in advance of the distribution of the questionnaires, and were phoned a week after their distribution in order to find out if they had received them. Where possible, additional questionnaires were sent to districts which had misplaced, or had not received, the questionnaires. Lastly, follow-up phone calls were made in weekly intervals to the District Manager or other district officials tasked with the collection of the questionnaires. These phone calls were made from one week after the return deadline specified on the questionnaire (September 2000) and continued until November when it became obvious that no more completed questionnaires were forthcoming. It was then assumed that all completed questionnaires had been collected.

FOCUS GROUP INTERVIEWS

Teachers were purposefully selected for focus group interviews from six districts in four of the seven regions in the Limpopo Province. The selection of the districts was based on the type of

schools teachers taught at (i.e., rural, township, urban), as it was assumed that the school type might have a major impact on INSET needs of teachers (see assumption, Chapter 1, page 5). A total of 51 teachers in groups of three to ten were interviewed in September 2000. These groups were organised with the help of principals, Curriculum Advisors and District Managers. The researcher phoned the district officials requesting them to invite teachers to interview sessions at a venue and time that would be convenient for the teachers. This was followed by formal letters of request (Appendix E, page 100). All interviews were held over an 11-day period in September 2000, that is, within the data collection period using the STIN-NP. Seven interview sessions were held with four groups of only Mathematics teachers (27), and three groups of mixed teachers (24), that is, Mathematics, Physical Science and Biology teachers in one group. The mixed focus group interviews were conducted jointly in order to maximise logistical efficiency at district level. The seven interview sessions by type of school, district, composition of subject group, and the number of teachers by gender (M: male, F: female) are displayed in Table 3.2. Out of a total of 51 teachers who were interviewed, 34 were Mathematics teachers.

Table 3.2. Number of Mathematics teachers interviewed by type of school, district, and gender (M: male, F: female).

Session	Type of school	District	Type of group	No. of teachers	
1	Rural	Bochum	Maths	10	(5M, 5F)
2	Township	Polokwane	Maths	7	(6M, 1F)
3	Urban	Polokwane	Mixed	1	(F)
4	4 Rural, 2 township	Mogodumo	Maths	6	(2M, 4F)
5	Rural	Hlanganani	Mixed	2	(M)
6	Rural	Vuwani	Mixed	2	(M)
7	Township	Mahwelereng	Maths	6	(M)
				34	(23M, 11F)

Semi-structured interviews were used, as key questions relating to the research objectives were prepared prior to the interview. The interview questions were designed to elicit perceived INSET needs of Mathematics teachers and included questions such as, for example, "What are your greatest professional needs as a Mathematics teacher?", "Which further skills would you like to acquire in order to be an effective Mathematics teacher?", and "What topics/ themes would you like to see included in INSET workshops?" (Appendix E, page 101). In addition, questions were asked regarding the type of schools teachers taught at, the subjects teachers taught, the number of

learners in their classes, and the enrolment of the teachers' schools. The interviews lasted about 45 minutes on average.

Wiersma (1991: 193) argues that it is important for the interviewer to establish a good rapport with the respondents in order to put them at ease, as this is a "social encounter". The researcher therefore started the interviews by introducing herself in a friendly way, and then briefly explained the purpose of the interview. The teachers were made aware that the interview would be anonymous, and thereafter the researcher requested permission to record the interview using a tape recorder. This practice is in line with ethical demands required for recording interviews (Ary et al., 1990: 420; Kvale, 1996: 113). Thereafter, teachers were asked general questions about their classes, and subjects in order to provide a contextual background of their responses but also to provide an icebreaker to get the discussion going. Teachers were allocated numbers (i.e., T1, T2, T3, etc.) in order to help the researcher identify them during the transcription and analysis of the interviews. The researcher concluded each interview session by thanking the teachers for their time and effort, and also by highlighting the importance and value of their contributions.

DATA CAPTURE

STIN-NP (Questionnaires)

Raw data from the completed questionnaires were captured on a PC in the following manner. Firstly, the returned questionnaires were sorted according to teachers' responses to item 2 ("In which of the following subjects do you teach the most lessons per week?"), which was the main deciding factor regarding whether the respondent was considered a Mathematics or a Physical Science or a Biology teacher. If a teacher indicated more than one option, items 42-49 (answered by Physical Science/Biology teachers only) were then used to identify the teacher's subject according to the researcher's definition (see Chapter 1, page 6). If teachers did not answer these questions, it was concluded that they were Mathematics teachers. Furthermore, items 53-55 asked for the proportion of total teaching time (i.e., number of lessons) per week teachers spent teaching Mathematics/Physical Science/Biology, which would again identify the teacher's particular subject. If this still did not help to identify the teacher's subject, then the questionnaire was considered spoilt.

Data from STIN-NP was then machine read with an optical mark-reading scanner, and subsequently captured in a SSPS file on a PC. According to Bailey (in Ary, 1990: 339) data cleaning refers to a method of checking for clerical errors. When the data were machine read, any item with two responses gave an error message. All questionnaires with error messages were then individually checked by the researcher to ascertain whether one response was possibly crossed out (i.e., a response was cancelled and another substituted). The correct (i.e., intended) response was then manually captured in the SPSS file. The intended response could be identified for all items yielding an error message. Questionnaires with comments in the free-response section were put aside. The original wording of comments was captured in a table according to the questionnaire number (see Appendix D, page 97).

Focus group interviews

Interviews were captured by recording the interviews on a tape recorder. In line with recommendations by Kvale (1996:163), the interviews were first transcribed verbatim into written texts by the researcher herself, thereby ensuring that all data were captured. The part of interviews that dealt with subjects and grades taught, school enrolment, and type of school teachers taught at was summarised and included as part of introduction to interviews. According to Krueger (1998), transcriptions should then be transformed into a more formal, written style through editing. Such editing was done by eliminating pauses, repetitions, "uh" and "umm", and changing the responses (interviewees' oral style) into a formal written style. According to Kvale (1996: 170), interviews transcribed in this manner would facilitate analysis of the general meaning of what was said by the interviewees. All interview questions were boldfaced, in order to make them easy to find. The final interview transcripts are presented in Appendix E, (page 101).

SUMMARY

In this chapter, the rationale for the research design was outlined and methods used to collect data were described. A "mixed-method" research methodology (i.e., quantitative and qualitative methods) was used to maximise trustworthiness of the findings of this study. The instrument used to collect quantitative data on the demographic profile and perceived INSET needs of secondary

school Mathematics teachers was developed from the *Science Teacher Inventory of Needs* of Baird et al. (1994). STIN-3 was adapted and modified for use in the South African and the Limpopo Province context in particular.

The survey instrument was validated by 55 important stakeholders in mathematics education. Modifications were then made in the light of stakeholders' comments and suggestions. The validated instrument was pilot-tested on a sample of 60 Mathematics teachers in the Limpopo Province. Final modifications were then made, resulting in the *Science Teacher Inventory of Needs in the Northern Province (STIN-NP).*

Questionnaires were distributed to Mathematics teachers during principals' and teachers' meetings and workshops with the help of Curriculum Advisors at District Offices. Completed questionnaires were collected from District Offices. Focus group interviews were used to collect qualitative data on secondary Mathematics teachers' needs. Seven interview sessions were held with a total of 34 Mathematics teachers. The purpose of focus the group interviews was to cross-validate responses from questionnaires, as well as to give teachers an opportunity to expand on their responses on STIN-NP.

In the next chapter, the results of the survey are described. The demographic profiles and perceived INSET needs as expressed by teachers in the questionnaires and interviews are outlined.

Chapter Four

RESULTS

INTRODUCTION

In this chapter results of the study are described, using tables to display summaries. Firstly, quantitative data from STIN-NP were analysed by establishing frequency tables of demographics using descriptive statistics. Nonparametric analyses using contingency tables were also performed to establish a possible relationship between certain variables such as, for example, type of school and professional qualification, age and experience in teaching mathematics, class size and grades taught, and so forth. For INSET need items, chi-square analyses were performed to measure the degree of interest in each need item. INSET need items were then rank-ordered by mean score and results presented in a table. Secondly, qualitative data from interviews were analysed by identifying quotations which described INSET needs and then presented in a table according to the frequency with which needs were mentioned.

QUANTITATIVE DATA (STIN-NP)

The sample consisted of 552 Mathematics (grade 8-12) teachers who responded to the STIN-NP questionnaire, yielding a response rate of 17%. Specific individual analyses were performed on items in which variables of interest were all responded to. As some questionnaires had missing responses, the total number of teachers in the sample therefore varies between 552 and 511. Respondents were from at least 324 schools in the seven administrative regions of the Limpopo Province, indicating that Mathematics teachers in at least 20% of all secondary schools in the Limpopo Province were surveyed. The total number of schools covered is more than 324 as a number of respondents either did not fill in the school's EMIS number, or the number was incomplete (in other cases, schools could not be identified).

Almost nine out of ten teachers who responded were qualified to teach Mathematics. Given the researcher's knowledge and experience of the educational context of the Limpopo Province, such a high proportion of qualified teachers in the secondary Mathematics teaching corps is extremely unlikely. It is therefore concluded that it would appear as if all teachers did not feel free to complete the questionnaire, even though teachers were requested to complete the questionnaire

anonymously. This may be due to fear of being disadvantaged in the rationalisation and redeployment process by their responses, if it was found that their qualifications were not relevant to the subjects they taught (personal communication with some principals and Curriculum Advisors). In addition, some principals and teachers felt that in completing the questionnaire they would be helping the researcher to obtain a qualification whereas they stood to gain nothing. Some of the teachers also lost or misplaced the questionnaires, or their principals forgot to issue them out.

Demographic profile

An overwhelming majority of teachers who responded came from rural schools (85%; n = 456), few from township schools (10%; n = 52) and very few from urban schools (5%; n = 25). The number of urban teachers in the sample is very small and therefore trends identified with respect to this group of Mathematics teachers need to be treated with caution. Most teachers (86%) held permanent posts, and the remaining teachers held temporary ones.

Gender, age and experience in teaching Mathematics

A summary of selected demographic characteristics (i.e., sex, age, and teaching experience) of Mathematics teachers according to the type of school they teach at is displayed in Table 4.1.

Table 4.1. Teachers' sex, age and years of experience in teaching Mathematics by type of school (items 58-60 of STIN-NP)

Variable	Category	Percent of rural (n = 456)	Percent of township (n = 52)	Percent of urban (n = 25)	Percent of total (n = 541)
Sex	Male	72	71	48	70
	Female	28	29	52	30
Age	24 and younger	2	2	0	2
	25-30	23	25	8	22
	31-40	59	38	28	56
	41-50	14	29	32	16
	Over 50	2	6	32	4
Years of experience in teaching Maths	3 or less	6	13	12	7
	4-10	58	58	21	56
	11-20	30	19	38	29
	21-30	6	6	21	7
	Over 30	0	4	8	1

The vast majority of responding Mathematics teachers were male. It is interesting to note that this trend was common in both rural (72%) and township (71%) schools but different in urban schools where female teachers slightly outnumbered their male counterparts (Table 4.1). Seventy-eight percent of Mathematics teachers were aged between 25 and 40 years. Most teachers were 31 to 40 years old, and older teachers only made up one-fifth of teachers who responded. A larger proportion of urban than non-urban teachers were older than 40 years (Table 4.1).

Most teachers who responded had been teaching Mathematics for up to 10 years and about a third of teachers had 11 to 20 years teaching experience in this subject. A higher proportion of teachers at urban schools had substantial teaching experience of more than 20 years as compared to those who taught at non-urban ones (Table 4.1).

Qualifications

As was mentioned earlier, the vast majority of teachers (87%) who responded to this survey were professionally qualified to teach Mathematics, and only a few were unqualified (13%). This trend is the same across different types of schools (i.e., rural, township, urban), with the number of qualified teachers varying between 80% and 90%. However, further analysis revealed that most unqualified teachers (84%) taught in rural areas.

Table 4.2. Teacher qualifications by type of school (items 62 & 63 of STIN-NP)

Variable	Category	Percent of rural (n = 456)	Percent of township (n = 52)	Percent of urban (n = 25)	Percent of total (n = 541)
Highest academic level in Maths	< Std. 10	5	4	0	5
	Std. 10	59	36	8	54
	1st year university	16	16	24	17
	2nd year university	8	6	48	9
	3rd year university	10	30	16	12
	honours and higher	2	8	4	3
Highest professional qualification	M + 2	6	7	4	6
	M + 3	70	51	29	67
	M + 4	20	36	67	24
	Other	4	6	0	4

Data with respect to the academic and professional qualifications of teachers according to the type of school they are teaching at are displayed in Table 4.2. Very few teachers across all types of schools had less than standard 10 as their highest academic level in mathematics. Overall, more than half of the teachers had only standard 10 as their highest academic level in mathematics, about one in six had first-year university mathematics, and about a quarter had second-year or higher level university mathematics. Most urban schoolteachers (68%) had second-year or higher level university mathematics as compared to their rural and township counterparts where only 20% and 44%, respectively, were at this level (Table 4.2). Further analysis revealed that ninety-three percent of all teachers with only standard 10 as their highest academic qualification taught in rural schools. However, the vast majority of all Mathematics teachers (82%) reported that they had "a lot of confidence" in teaching grade 11 and 12.

As can be seen in Table 4.2, very few responding teachers held matric plus a two-year qualification (M + 2). Two-thirds of Mathematics teachers held matric plus a three-year qualification (M + 3), and only about a quarter held matric plus a four-year qualification (M + 4)[4].

When looking at professional qualifications with respect to type of school, it seemed that very few responding teachers across all school types held a M + 2 qualification. The majority of teachers at rural and township schools held a M + 3 qualification, whereas most of those at urban schools held a M + 4 qualification (Table 4.2).

From further analysis, it became apparent that Secondary Teachers' Diploma (STD), a matric plus three-year qualification was the most common professional qualification (51%). Other M + 3 qualifications were Primary Teachers' Diploma ([PTD] 10%), Secondary Education Diploma ([SED] 5%), and Senior Secondary Teachers' Certificate ([SSTC] 1%). Examples of Matric plus four-year qualifications were Higher Education Diploma ([HED] 14%), BAEd/ BScEd (8%), and University Education Diploma ([UED] 2%). Teachers with M + 2 qualifications held a Junior Secondary Teachers' Certificate ([JSTC] 5%), and a Secondary Education Certificate ([SEC] 1%).

[4] In terms of the Norms and Standards for Educators (Republic of South Africa, 2000), which requires M+4 as a minimum initial qualification for teachers starting their training in 2004, an even smaller proportion of teachers has a professional qualification.

More than half (56%) of the unqualified teachers taught junior secondary grades (grades 8 & 9), whereas senior secondary grades (grades 10-12) were generally taught by qualified teachers. Ninety-two percent of teachers in grades 11 and 12 were qualified to teach Mathematics as compared to 68% in grades 8 and 9. Fifty-two percent of the teachers taught grades mixed grades (i.e., a combination of grades 8-12), 14% of them taught junior grades (grades 8 & 9), and 34% taught senior grades (grades 10-12).

School demographics

Teachers who responded to this survey came from various types of schools. Maximum class size, school enrolment and resources with respect to different types of school are presented in Table 4.3.

Table 4.3. Class size, school enrolment, and resources by type of school (items 65, 66 & 73 of STIN-NP)

Variable	Category	Percent of rural (n=456)	Percent of township (n=53)	Percent of urban (n=25)	Percent of total (n=541)
Maximum class size	Less than 21	10	0	0	8
	21-30	8	13	16	9
	31-50	25	27	56	27
	51-70	29	32	20	29
	More than 70	28	28	8	27
School Enrolment	Less than 200	12	2	4	10
	201-500	39	28	36	38
	501-800	30	38	24	31
	801-1 000	13	15	24	14
	More than 1 00	6	17	12	7
Teacher-rated resources at school	Very inadequate	48	34	27	46
	Poor	43	44	18	42
	Adequate	7	16	41	9
	Very adequate or Exceptional	2	6	14	3

Fifty-six percent of the teachers reported that on average they had more than 50 learners per class, more than a quarter of teachers (27%) indicated a maximum class size of 31 to 50 learners, and only 17% indicated that they had 30 or less learners per class (Table 4.3). When looking at different types of schools a different picture emerges. Most rural (57%) and township (60%) school teachers reported that they had more than 50 learners maximally per class as compared to

just over a quarter (28%) of their urban colleagues. Similarly, a higher proportion of urban than non-urban teachers reported to have maximum class sizes of between 31 and 50 learners per class (Table 4.3).

The majority of responding teachers' schools (69%) had enrolments of between 201 and 800, 21% had more than 800 learners, and very few schools had enrolments of less than 200. However, a higher proportion of rural than township and urban schoolteachers reported school enrolments of between 201 and 800 (Table 4.3).

Most teachers reported that their schools had poor or very inadequate resources, the overwhelming majority of them being in rural (91%) and township (78%) areas (Table 4.3). Only 12% of the teachers indicated that their schools had adequate or very adequate/exceptional resources. The majority of these schools (54%) were in urban areas.

The majority of responding teachers (54%) indicated that their schools had 1 to 4 Mathematics/Physical Science/Biology teachers, 30% had 5 to 7 such teachers, and the remaining 16% had more than seven. Most Mathematics teachers did not teach Mathematics only, but also taught other subjects such as, for example, Biology (21%) and Physical Science (44%).

INSET-related issues

When respondents were asked to indicate their greatest professional need, 40% identified teaching skills, followed by content knowledge (24%) and class discipline (21%), with assessing learners being rated last (12%) (Table 4.4).

Table 4.4. Teachers' greatest perceived need by type of school (item 70 of STIN-NP)

Greatest professional need	Percent of rural (n=438)	Percent of township (n=51)	Percent of urban (n=22)	Percent of total (n=511)
Teaching skills	42	25	50	40
Content knowledge	24	20	18	24
Classroom organisation/discipline	20	33	14	21
Assessing learners' work	12	18	9	12
Other	2	4	9	3

It is interesting to note that two in five and one in two rural and urban mathematics schoolteachers respectively, expressed an interest in improving their teaching skills. In comparison, only between one in four and one in five teachers expressed interest in improving their content knowledge. Improving their knowledge of assessing learners' work had even lower levels of interest among all teachers. In comparison to their colleagues in other school contexts, township schoolteachers showed highest levels of interest in improving their classroom organisation and discipline skills (Table 4.4).

Most teachers who responded (65%) reported that they did not attend any INSET workshops between January and September 2000. About 25% of teachers indicated that they attended one or two workshops, and only 10% indicated that they attended three or more INSET workshops during this period. Half of the teachers preferred workshops to be held during school holidays, about a third (32%) preferred holding workshops in the afternoons or on schooldays, and only 18% preferred weekends.

Table 4.5. Barriers preventing teachers from greater INSET participation by type of school (item 50 of STIN-NP)

Barrier	Percent of rural (n = 437)	Percent of township (n = 51)	Percent of urban (n = 24)	Percent of total (n = 512)
Lack of information	47	41	46	46
Poor quality of workshops	24	21	4	23
Workshops fail to meet needs	7	20	13	9
Inconvenient time	7	8	21	8
Inconvenient location	9	6	8	9
Lack of motivation	2	0	4	2
Other	4	4	4	4

Perceived barriers that prevented teachers from participating in INSET activities are presented in Table 4.5 according to the type of school teachers are teaching at. Almost half of the responding teachers felt that lack of information was the greatest barrier preventing them from attending INSET workshops, followed by perceived poor quality of workshops, workshops that fail to meet needs and inconvenient location. Inconvenient time and lack of motivation did not seem to be major barriers (Table 4.5).

As can be seen from Table 4.5, teachers from different types of schools tended to agree about lack of information as their greatest barrier to INSET participation, but disagreed with respect to

how they rated other barriers. Rural and township school teachers rated poor quality of workshops second whereas urban school teachers rated inconvenient time second. However, the latter group agreed with township teachers on the third barrier, that is, workshops that failed to meet their needs. Rural schoolteachers indicated inconvenient location as their third barrier. Teachers from various types of schools also agreed about lack of motivation as a less serious impediment to greater INSET participation.

INSET needs

Raw data consisted of numbers of teachers responding to each of the items, using the five- option answers. However, item 11 was excluded and analysed separately as it had different answer options (A = Geometry, B = Algebra, C = Calculus, D = Trigonometry, E = not applicable [see Appendix C, page 96]). Ninety-nine percent of teachers responded to all need items on the STIN-NP. Analysis of the INSET need items was performed according to the approach used by Baird et al. (1993). All need items were classified into dichotomous groups of those perceived as needs, and those not perceived as needs. In order to facilitate this classification, the response "not familiar" was added to the response "great need". As the majority of teachers in the Limpopo Province are ill-prepared to teach Mathematics (Department of Education, 2001a), "not familiar" was taken to mean "great need" rather than "no need". The selection of answer option A ("not familiar with this need") exceeded 5% on only five items, that is, for items dealing with computers, constructivist teaching approach, process skills, and hands-on methods. The weighting for each response was defined by 1 = no need, 2 = little need, 3 = moderate need, and 4 = great need.

The categories of "no need" and "little need" were collapsed into a single category of "no need", and the categories of "moderate need" and "great need" were collapsed into a single category of "need". Using these new categories, and assuming expected frequencies for each response category to be 50% of the statistical responding teachers, goodness-of-fit chi-square analyses were performed to measure significance of the degree of need in each item. Criterion values of chi-square with two degrees of freedom determined which needs were statistically significant, either above or below expected frequencies. The need was considered to be statistically significant at $\alpha = 0.05$. Using this procedure, Mathematics teachers indicated a need for all items at the $p < 0.001$ level. The item "Use a computer to help manage teaching" was identified as a

need by 89% of the teachers (being the highest percent), and the need "Update your knowledge of the history of mathematics" was identified as a need by 64% (being the lowest percent).

Results of the 38 need items rank-ordered by mean score are presented in Table 4.6. These results are displayed according to rank, item number on STIN-NP, the need category from the seven assessed by the STIN-3 (Baird et al., 1994), mean score, standard deviation of the mean score, and percent. Percent here indicates the combined percent of teachers who responded that the item was a moderate need, great need and not a familiar need.

Table 4.6. Ranked needs of all Mathematics teachers by need category, mean, standard deviation and percent. All needs were statistically significant at the $p < 0.001$ level.

Rank	Item no.	Need description	Category	Mean	Std Dev.	Percent
1	n38	Use a computer to help manage teaching	5	3.61	0.79	89
2	n35	Use computers to teach	4	3.58	0.77	89
3	n24	Motivate learners to learn Maths	4	3.57	0.86	87
4	n34	Use audio-visual equipment to facilitate teaching in Maths	4	3.53	0.82	87
5	n14	Identify learning objectives which specify attitudes learners need to develop toward Maths	1	3.47	0.79	88
6	n41	Select supportive materials for teaching Maths	6	3.47	0.86	85
7	n20	Use various forms of assessment to identify learning difficulties in Maths	2	3.47	0.82	86
8	n7	Update your knowledge of the way in which learners learn in a Maths in a multicultural society	7	3.46	0.80	88
9	n4	Update your knowledge of career opportunities for learners related to Maths	7	3.46	0.82	87
10	n29	Apply concepts taught in Maths to daily life of learners	4	3.45	0.90	83
11	n15	Identifying learning objectives which specify skills needed by learners in Maths	4	3.44	0.80	87
12	n33	Employ teaching approaches that make learners teach each other (i.e. peer tutoring)	4	3.44	0.85	86
13	n30	Conduct a field trip to help learners learn Maths better	4	3.43	0.86	85
14	n16	Identify learning objectives which are appropriate for promoting multicultural ways of learning in Maths	4	3.42	0.79	88

Rank	Item no.	Need description	Category	Mean	Std. Dev.	Percent
15	n3	Develop skills in recognising and correcting common misconceptions in Maths	7	3.42	0.90	84
16	n37	Evaluate your own teaching effectiveness as a Maths teacher	5	3.42	0.87	84
17	n6	Update your knowledge of issues in society related to Maths	7	3.41	0.83	85
18	n8	Update your knowledge of learning to include a constructivist approach	7	3.40	0.78	85
19	n18	Develop lesson plans which integrate Maths with other subjects	6	3.39	0.86	85
20	n40	Identify sources of free and locally available teaching materials for Maths	6	3.39	0.83	85
21	n5	Update your knowledge of effective teaching approaches	7	3.34	0.87	82
22	n25	Use an inquiry/discovery teaching approach	4	3.33	0.85	82
23	n19	Design assessment items which assess achievement of learning objectives	2	3.32	0.91	82
24	n31	Employ teaching approaches where you are able to concentrate on teaching individuals	4	3.31	0.91	82
25	n13	Identify learning objectives which specify knowledge needed by learners in Maths	1	3.31	0.89	80
26	n22	Select commercially prepared teaching materials	3	3.28	0.95	80
27	n26	Use hands-on teaching methods	4	3.27	0.96	79
28	n32	Employ teaching approaches for teaching large classes	4	3.26	1.01	78
29	n36	Maintain learner discipline in your Maths class	5	3.26	1.06	77
30	n23	Develop own teaching materials	3	3.21	0.91	78
31	n28	Demonstrate manipulative skills	4	3.20	0.98	75
32	n10	Update your knowledge of how Maths is used in society	7	3.18	0.95	77
33	n21	Develop lesson plans	3	3.10	1.02	74
34	n9	Improve your content knowledge	7	3.10	1.02	72
35	n39	Organise and manage physical space in class	5	3.06	1.04	72
36	n27	Demonstrate process skills	4	3.06	1.03	72
37	n17	Develop lesson plans which incorporate the history of maths	1	3.00	1.02	68
38	n12	Update your knowledge of the history of maths	7	2.89	1.05	64

The need category refers to the seven categories assessed by the STIN-3 (Baird et. al., 1994). Needs which enjoyed greater importance were those dealing with acquisition of skills to use computers (i.e., delivering and managing instruction [categories 4 and 5]), motivating learners ([category 4] either through developing a positive attitude, or awareness of mathematics related career opportunities), using audio-visual equipments and application of mathematics in daily life (both from delivering instruction [category 4]). The least support was indicated for among others needs with the history of mathematics, improving content knowledge, how mathematics is used in society and teaching large classes (Table 4.6).

Possible associations between different teacher variables (e.g., age, sex, teaching experience, academic and professional qualifications, type of school) and each need were investigated by chi-square analysis. However, no statistically significant association between teachers' individual INSET need items and any demographic variables were found, except with respect to type of school at which teachers taught at. Top-ranked needs of teachers are displayed according to the type of school in Table 4.7.

Table 4.7. Ten top-ranked INSET needs by type of school at which teachers taught at. The lettered numbers before each need description indicate the need item number.

Rank	Rural (n=460)	Township (n=53)	Urban (n=25)	All (n=541)
1	n35 Use computers to teach (category 4)	n20 Use various forms of assessment to identify learning difficulties in Maths (category 2)	n23 Develop own teaching materials (category 3)	n38 Use a computer to help manage teaching (category 5)
2	n38 Use a computer to help manage teaching (category 5)	n24 Motivate learners to learn Maths (category 4)	n14 Identify learning objectives which specify attitudes learners need to develop toward Maths (category 1)	n35 Use computers to teach (category 4)
3	n16 Identify learning objectives which are appropriate for promoting multicultural ways of learning in Maths (category 4)	n29 Apply concepts taught in Maths to daily life of learners (category 4)	n15 Identifying learning objectives which specify skills needed by learners in Maths (category 4)	n24 Motivate learners to learn Maths (category 4)
4	n4 Update your knowledge of career opportunities for learners related to	n8 Update your knowledge of learning to include a constructivist approach	n20 Use various forms of assessment to identify learning difficulties in Maths	n34 Use audio-visual equipment to facilitate teaching in Maths (category 4)

	Maths (category 4)	(category 7)	(category 2)	
Rank	**Rural(n=460)**	**Township (n=53)**	**Urban**	**All (n=541)**
5	n7 Update your knowledge of the way in which learners learn in a Maths in a multicultural society (category 7)	n40 Identify sources of free and locally available teaching materials for Maths (category 6)	n32 Employ teaching approaches for teaching large classes (category 4)	n14 Identify learning objectives which specify attitudes learners need to develop toward Maths (category 1)
6	n24 Motivate learners to learn Maths (category 4)	n7 Update your knowledge of the way in which learners learn in a Maths in a multicultural society (category 7)	n16 Identify learning objectives which are appropriate for promoting multicultural ways of learning in Maths (category 4)	n41 Select supportive materials for teaching Maths (category 6)
7	n33 Employ teaching approaches that make learners teach each other (i.e. peer tutoring) (category 4)	n13 Identify learning objectives which specify knowledge needed by learners in Maths (category 1)	n5 Update your knowledge of effective teaching approaches (category 7)	n20 Use various forms of assessment to identify learning difficulties in Maths (category 2)
8	n34 Use audio-visual equipment to facilitate teaching in Maths (category 4)	n15 Identifying learning objectives which specify skills needed by learners in Maths (category 4)	n18 Develop lesson plans which integrate Maths with other subjects (category 6)	n4 Update your knowledge of career opportunities for learners related to Maths (category 7)
9	n14 Identify learning objectives which specify attitudes learners need to develop toward Maths (category 1)	n14 Identify learning objectives which specify attitudes learners need to develop toward Maths (category 1)	n19 Design assessment items which assess achievement of learning objectives (category 2)	n7 Update your knowledge of the way in which learners learn in a Maths in a multicultural society (category 7)
10	n15 Identifying learning objectives which specify skills needed by learners in Maths (category 4)	n31Employ teaching approaches where you are able to concentrate on teaching individuals (category 4)	n37 Evaluate your own teaching effectiveness as a Maths teacher (category 5)	n29 Apply concepts taught in Maths to daily life of learners (category 4)

Overall, forty percent of the top-10 ranked needs come from delivering instruction (category 4), 20% from improving personal competence (category 7) and 10% each from specifying objectives (category 1), diagnosing and evaluating learners (category 2), managing instruction (category 5) and administering instructional facilities and equipment (category 6).

There is a wide difference among teachers from various types of schools with respect to how they ranked their highest needs (Table 4.7). All three types of schoolteachers have identifying attitude and skills objectives, both in category 4, among their top-10 ranked needs. Four of the top-10 needs of rural schoolteachers (motivating learners, identifying attitude and skills objectives, and

how learners learn in a multicultural society) correspond with those of township schoolteachers. Only three of the top-10 ranked needs of rural schoolteachers (identifying learning objectives that promote multicultural ways of learning, identifying attitude and skills objectives) correspond with those of their urban colleagues. Again, both urban and township schoolteachers also have three common top-10 ranked needs, namely, using various forms of assessment to identify learning difficulties, identifying attitude, and skills objectives.

As can be seen from Table 4.8, 30% of the 10 bottom ranking needs come from delivering instruction (category 4), another 30% from improving personal competence (category 7), 20% from planning instruction (category 3) and 10% is equally shared between specifying objectives (category 1) and managing instruction (category 5).

Table 4.8. Ten bottom-ranked needs by type of school at which teachers taught at. The lettered numbers before each need description indicate the need item number.

Rank	Rural (n=460)	Township (n=53)	Urban (n=25)	All (n=541)
1	n23 Develop own teaching materials (category 3)	n32 Employ teaching approaches for teaching large classes (category 4)	n39 Organise and manage physical space in class (category 5)	n32 Employ teaching approaches for teaching large classes (category 4)
2	n32 Employ teaching approaches for teaching large classes (category 4)	n17 Develop lesson plans which incorporate the history of maths (category 1)	n17 Develop lesson plans which incorporate the history of Maths (category 1)	n23 Develop own teaching materials (category 3)
3	n36 Maintain learner discipline in your Maths class (category 5)	n21 Develop lesson plans (category 3)	n9 Improve your content knowledge (category 7)	n28 Demonstrate manipulative skills (category 4)
4	n28 Demonstrate manipulative skills (category 4)	n23 Develop own teaching materials (category 3)	n34 Use audio-visual equipment to facilitate teaching in Maths (category 4)	n10 Update your knowledge of how Maths is used in society (category 7
5	n21 Develop lesson plans (category 3)	n25 Use an inquiry/discovery teaching approach (category 4)	n36 Maintain learner discipline in your Maths class (category 5)	n9 Improve your content knowledge (category 7)
6	n9 Improve your content knowledge (category 7)	n27 Demonstrate process skills (category 4)	n27 Demonstrate process skills (category 4)	n21 Develop lesson plans (category 3)
7	27 Demonstrate process skills (category 4)	n28 Demonstrate manipulative skills (category 4)	n10 Update your knowledge of how Maths is used in society (category 7)	n39 Organise and manage physical space in class (category 5)

Rank	Rural (n=460)	Township (n=53)	Urban (n=25)	All (n=541)
8	n39 Organise and manage physical space in class (category 5)	n39 Organise and manage physical space in class (category 5)	n21 Develop lesson plans (category 4)	n27 Demonstrate process skills (category 4)
9	n17 Develop lesson plans which incorporate the history of maths (category 1)	n12 Update your knowledge of the history of maths (category 7)	n3 Develop skills in recognising and correcting common misconceptions in Maths (category 7)	n17 Develop lesson plans which incorporate the history of maths (category 1)
10	n12 Update your knowledge of the history of maths (category 7)	n9 Improve your content knowledge (category 7)	n12 Update your knowledge of the history of Maths (category 7)	n12 Update your knowledge of the history of maths (category 7)

Teachers from various types of school tend to agree more with respect to their 10-bottom ranked needs (Table 4.8). Six of the ten bottom-ranked needs are the same for all the three types of schools (i.e., develop lesson plans, improve content knowledge, manage physical space in class, develop lesson plans which incorporate the history of mathematics, and update knowledge of the history of mathematics). Rural and township school teachers identified the same 10-bottom ranked needs, that is, develop own teaching materials, maintain learner discipline, demonstrate manipulate and process skills, develop lesson plans, improve content knowledge, organise and manage physical space, develop lesson plans incorporating the history of mathematics, and update knowledge of the history of mathematics (Table 4.8). One of these needs (updating knowledge of the history of maths) received much less support (29%) from urban teachers than from other teachers. It is also important to note that one of the bottom-10 ranking needs of urban schoolteachers (use audio-visual equipment) feature in the top-10 needs of rural schoolteachers.

Knowledge and skills in the different sections of mathematics

When looking at the different sections of mathematics (i.e., need item no. 11), it was found that the majority of responding teachers (84%) indicated a need to improve their knowledge and skills in various content sections of mathematics. As can be seen from Table 4.9, teachers stated that they were interested in learning more about geometry and calculus. However, they were not interested in learning more about trigonometry and algebra. Sixteen percent of teachers indicated that they did not need help in any section of mathematics. The trend is the same for rural and urban school teachers (Table 4.9). However, a higher percentage of teachers at township schools than at other schools required help in calculus.

Table 4.9. Knowledge and skills in different sections of mathematics according to type of school

Section of mathematics	Percent of rural (n=450)	Percent of township (n=53)	Percent of urban (n=25)	Percent of total (n=528)
Geometry	43	38	40	42
Algebra	5	2	4	5
Calculus	28	40	28	29
Trigonometry	8	6	12	8
None	16	15	16	16

Problems confronting teachers and teaching strategies used (Section D and E of STIN-NP)

When responding teachers were asked to indicate problems confronting them in their classrooms, 69% indicated that learner interest was often or a serious problem. Seventy-two percent of the teachers perceived lack of career models as a serious problem. Although seventy-three percent of teachers regarded insufficient problem solving skills as a serious problem, 70% of these teachers said they used the problem solving approach weekly or every two weeks. Forty-six percent of responding teachers regarded many lesson preparations as a serious problem. Only 24% of the teachers reported that many lesson preparations was only sometimes a problem, and 30% said it was hardly or not really a problem. Fifty-nine percent of the teachers considered large class size as a problem, and about half of the teachers said they used individualised teaching weekly or every two weeks. Sixty-one percent of the teachers regarded insufficient textbooks as a serious problem, whereas 52% considered outdated textbooks as a problem.

Comments from the "free response" section of STIN-NP

Teachers were given an opportunity to expand on responses to the questionnaire that needed explanations, as well as to state needs that were not captured in the questionnaire (see page 14 of STIN-NP, Appendix C, page 92). Fifty-seven Mathematics teachers wrote comments on the page provided in the questionnaire, but only 42 teachers' comments contained statements related to INSET needs. Comments describing INSET needs were identified by reading what teachers wrote on the provided page. The identified needs were then checked against the STIN-NP need items. A summary of teachers' comments related to INSET needs is presented in Table 4.9. The comments are available in Appendix D (page 97).

Table 4.10. Need items from the "free response" section of STIN-NP matched to those of the questionnaire and the frequency of teachers' responses.

Item no.	Need description	No. of teachers who commented
n24	Motivating learners to learn	11
n5	Update knowledge of effective teaching approaches	9
n11	Update knowledge and skills	4
n9	Improve content knowledge	3
n29	Application of mathematics in daily life	3
n36	Maintain learner discipline	3
n32	Teaching large classes	2
n34	Use audio-visual equipment	2
n35	Use computers to teach	2
n4	Update knowledge of career opportunities	1
n33	Employ peer tutoring	1
n40	Identify free and locally available teaching materials	1
Total		42

Teachers' comments only emphasised some of the INSET needs already listed in the STIN-NP questionnaire. It was thus clear teachers who responded to the questionnaire did not wish any additional needs to be addressed.

QUALITATIVE DATA (INTERVIEWS)

In general, teachers were very eager to highlight their perceived needs and to share their problems with the interviewer, with the explicit hope that their concerns would be addressed in future INSET workshops. Urban teachers were very reluctant to respond to interview questions, claiming that they were "better off" than rural teachers. They explained that they were better qualified and also had all the necessary resources to help them carry out their classroom responsibilities better than their rural counterparts, whom they claimed did not have books, electricity, and so forth. Teachers at urban schools therefore felt that they did not need any help, unless new teaching technologies were introduced.

Subjects and grades taught

Focus group interviews with teachers revealed that most Mathematics teachers did not teach Mathematics only, but also taught other subjects (e.g., Biology, General Science, Physical Science, Agricultural science, or even languages). This was particularly common in small schools of enrolments of less than 400 where teachers taught many subjects across all grades. Teachers who were interviewed taught Mathematics in grade 8 and 9, grade 9-12, grade 8-10, grade 8-12, grade 10-12, and grade 11 and 12.

INSET needs

As already explained in Chapter 3 (page 29), interview transcripts were analysed by first identifying quotations describing INSET needs for each focus group and highlighting them in italics. The STIN-NP need item number was then written in brackets next to the identified quotation. Thereafter, quotations were listed in a table, together with the determined frequency and extensiveness with which each need item was mentioned. According to Krueger (1998), extensiveness indicates how many different respondents talked about a particular issue, and extensiveness is therefore a measure of validity. In this way, 19 needs were identified and then ranked in a combined table for all focus groups in descending order according to the needs' frequency (Table 4.11).

As is clear from Table 4.11, all needs from focus group interviews match those which were stated in the STIN-NP. Moreover, six of the 19 interview needs appear in the top-10 ranked needs obtained through the STIN-NP, namely, apply mathematics concepts to daily life, motivate learners, identify attitude objectives, use audio-visual equipment, use computers to teach and update knowledge of career opportunities. Three of the highest-ranking interview needs also feature in the overall top-10 ranked needs determined from STIN-NP data, namely, application of mathematics to daily life, motivating learners, and identifying attitude objectives (Table 4.11). Four of the bottom-ranking needs from interviews also feature in the bottom-10 ranked needs obtained from STIN-NP data (i.e., improve content knowledge, update knowledge of how mathematics is used in society, develop lesson plans, and organise and manage physical space).

Table 4.11. Ranked needs obtained from interviews and listed by need category, frequency, and extensiveness

Rank	Item no.	Need description	Category	Frequency	Extensiveness
1	n5	Update your knowledge of effective teaching approaches (i.e., methods) in Mathematics/Physical Science/Biology	7	33	17
2	n36	Maintain learner discipline in your Mathematics/Physical science/Biology classes.	5	28	12
3	n23	Develop own teaching materials for Mathematics/Physical Science/Biology.	3	22	12
4	n29	Apply concepts taught in Mathematics/Physical Science/Biology to daily life of learners (i.e., to real life situations).	4	12	9
5	n32	Employ teaching approaches (i.e., methods) for teaching large classes in Mathematics/Physical Science/Biology.	4	8	8
6	n24	Motivate learners to learn Mathematics/Physical Science /Biology	4	14	7
7	n22	Select commercially prepared teaching materials (e.g., textbooks, charts, models, etc.) for Mathematics/Physical Science/Biology.	3	6	6
8	n19	Designing assessment items (e.g. questions or tasks) which assess achievement of learning objectives.	2	7	5
9	n40	Identify sources of free and locally available teaching materials for Mathematics/Physical Science/Biology.	6	4	4
10	n14	Identify learning objectives (i.e., outcomes) which specify attitudes learners need to develop toward Mathematics/Physical Science/Biology.	1	5	3
11	n34	Use audio-visual equipment (e.g., overhead projector, cassette or video recorder) to facilitate teaching in Mathematics/Physical Science/Biology.	4	7	2
12	n35	Use computers to teach Mathematics/Physical Science/Biology.	4	4	2
13	n9	Improve your content knowledge of Mathematics/Physical Science/Biology.	7	3	2
13	n10	Update your knowledge of how Mathematics/Physical Science/Biology is used in the society.	7	3	2
15	n4	Update your knowledge of career opportunities	7	1	1
15	n21	Developing lesson plans (i.e., learning activities)	3	1	1

Rank	Item no.	Need description	Category	Frequency	Extensiveness
15	n25	Use an inquiry/discovery teaching approach	4	1	1
15	n31	Employ teaching approaches where you are able to concentrate on teaching individuals	4	1	1
15	n39	Organise and manage physical space	5	1	1

Teachers in focus group interviews emphasised the need to update knowledge of effective teaching approaches (rank 1, item 5). Typical quotations supporting this conclusion are "The problem is the method we use," "Maybe if they can come up with a method, I think the method that they used to train us was not okay," and "We don't have another method to help them." Teachers also stressed the need to maintain learner discipline (rank 2, item 36), for example, "Learners are not disciplined," "They do not do their homeworks and classworks," and "Lack of discipline, and this issue goes hand-in-hand with corporal punishment."

Developing one's own teaching materials was also identified as an important need (rank 3, item 23). Typical responses are "We are running short of materials, these new textbooks, and so on," "We don't even have one textbook for grade 11," "If there was an alternative of improvising, things will be fine." Teachers also further indicated a need to be helped with teaching larger classes (rank 5, item 32). Typical quotations are "My problem is overcrowding of classes," "I would like to be helped with skills of teaching larger classes," and "My main concern is that one of overcrowded classes."

Most teachers viewed application of mathematics concepts in the daily life of learners as an important need (rank 4, item 29). Typical quotations supporting this conclusion are: "How do we integrate the content to life in general?," "Being able to relate that to real life situations," and "Being able to relate maths content to situations in which students live."

In general, needs identified through interviews correspond with INSET needs identified from questionnaire responses, as significant support was shown for all STIN-NP need items. Trends identified from interviews also match those identified from the STIN-NP.

SUMMARY

Findings of the study related to the demographic profiles and perceived INSET needs of Mathematics teachers in Limpopo Province are presented. Five hundred and fifty-two teachers from at least 324 schools responded to this survey, with a response rate of 17%. The vast majority of teachers who responded (85%) taught at rural schools, and 70% of them were male. Eighty percent of these teachers were aged between 25 and 40 years and had been teaching Mathematics for four to ten years.

More than half (54%) of responding teachers had only standard 10 as their highest academic qualification, and 5% had less than standard 10. A larger proportion of urban than non-urban teachers had second-year or higher level university mathematics. The vast majority of teachers (87%) were qualified to teach Mathematics. Most of these teachers (67%) held a matric plus three-year qualification (M + 3) as their highest professional qualification. Again here teachers at urban schools seemed to be better qualified than their non-urban colleagues.

Fifty-six percent of teachers who responded reported a maximum class size of more than 50 learners. Most schools (69%) where responding teachers taught at had enrolments of between 200 and 800. The majority of teachers (88%) reported that resources at their schools were poor or very inadequate, most of them who did so taught in rural (91%) or township (78%) areas.

Almost half of the responding teachers identified teaching skills as their greatest professional need, and lack of information as their greatest barrier to participate in INSET activities. Teachers indicated an interest in all INSET need items listed in the STIN-NP. However, teachers indicated greater interest for certain needs, such as for example, using computers, motivating learners to learn Mathematics, using audio-visual equipments, applying mathematics to the daily life of learners, and so forth (i.e., the top-10 ranked needs) as opposed to others such as needs dealing with the history of mathematics, developing lesson plans, improving content knowledge, and so forth (i.e., the bottom-10 ranked needs). There is a lot of agreement between the top-10 and bottom-10 ranked needs of rural and township schoolteachers. Urban schoolteachers tended to differ with their non-urban colleagues regarding the bottom-10 ranked needs, with two needs

(updating knowledge of the history of mathematics and correcting common misconceptions) registering very little interest.

There is no statistically significant association between teachers' individual INSET need items and any demographic variable categories, except with respect to type of school. Comments from the "free-response" section of the STIN-NP indicated that no additional needs were mentioned by teachers. Nineteen INSET needs were identified in interviews, of which six (e.g., application of mathematics, motivating learners, using audio-visual equipments, and so forth) were among the top-10 ranked needs identified from STIN-NP data. Needs mentioned in the focus group interviews matched those stated in the STIN-NP. In the next chapter, findings of the study are discussed and implications are considered.

Chapter Five
DISCUSSION

INTRODUCTION

Mathematics is among subjects considered to contribute toward what is regarded as successful schooling, as well as a preparation for socio-economic life and further study (Department of Education, 2001a). However, Mathematics in South Africa in general, and in the Limpopo Province in particular, is characterised by low enrolments in secondary school and poor performance in the Senior Certificate examinations (Chapter 1, page 1). These features suggest a need for well-trained Mathematics teachers to help learners with this subject in order for them to acquire vital skills necessary to make a meaningful contribution to the nation's economic prosperity (Department of Arts, Culture and Technology, 1996). This need calls for ongoing professional development to upgrade and improve the Mathematics teaching corps in order to meet the challenge of producing mathematically literate learners.

Research studies indicate that the planning and development of successful and effective INSET programmes depend on, among others, accurate demographic data and perceived INSET needs of active teachers (Chapter 1, page 3). Unfortunately, there is no such information available on Mathematics teachers in the Limpopo Province. This study was undertaken to fill the gap in knowledge about secondary Mathematics teachers in the Limpopo Province, in order to enable INSET service providers to make informed decisions about the type of INSET activities necessary for these teachers. The following research questions are addressed: 1) What is the demographic profile of secondary Mathematics teachers in the Limpopo Province? 2) What are the perceived INSET needs of secondary Mathematics teachers in the Limpopo Province?, and 3) What are the possible associations between demographic profiles and perceived INSET needs of Mathematics teachers in the Limpopo Province?

The previous chapter outlined results of the study from both quantitative (i.e., STIN-NP derived) and qualitative (focus group interviews) data. In this chapter, the results are discussed and their implications for delivery of appropriate INSET programmes considered. Firstly, demographic profiles of Mathematics teachers who responded to this survey are discussed. This is followed by

a discussion of teachers' perceived INSET needs, as well as the implications thereof for efficient planning and delivery of INSET programmes.

The findings will be compared to findings of other similar research, but not identical studies conducted in South Africa, namely, Arnott, Kubeka, Rice and Hall (1997), Grayson, Ono, Ngoepe and Kita (2001), and Howie (2001) as already outlined in Chapter 2 (page 15). Further comparisons will be made with respect to other studies internationally, that is, Easterday and Smith's (1992) survey of mathematics teacher needs in the USA; Baird, Easterday, Rowsey and Smith's (1993) comparison of secondary science and mathematics teachers; and Weiss, Banilower, McMahon and Smith's (2001) survey of science and mathematics education, both studies in the USA.

Results indicate that most unqualified teachers did not take part in the survey, in all likelihood for fear of victimisation in the rationalisation and redeployment process. The results therefore represent the perceived INSET needs and demographic profiles of qualified Mathematics teachers in the Limpopo Province, most of whom taught at rural schools and held permanent posts.

DEMOGRAPHIC PROFILE

Demographic data of Mathematics teachers in the Limpopo Province are important for INSET providers, as the availability of such data will enable them to know their target group, which in turn will help them in planning and delivering more appropriate INSET programmes for these teachers.

Gender

Most Mathematics teachers who responded to this survey were male. The greater number of male than female Mathematics teachers is also evident in both rural and township schools. Although urban female teachers slightly outnumbered their male colleagues, this apparent trend needs to be treated with caution as urban teachers constituted only 5% of the sample. The male domination of Mathematics teaching is likely to reflect the historical trend in South Africa where more boys enrolled in Mathematics than girls (Arnott et al., 1997). Moreover, between 1986 and 1990, 55% of all standard 10 Mathematics pupils were male, and research studies in South Africa have

indicated that more boys are likely to pass matric Mathematics than girls (Arnott et al., 1997). Unfortunately, matric Mathematics results in recent years reflect that this trend still continues (Kahn, 2001). The findings in this study imply that the teaching of Mathematics in the Limpopo Province is dominated by male teachers, and that this gender bias is unlikely to change for several years to come. However the findings are not surprising as most secondary school teachers are male (Northern Province Department of Education, 2000).

Arnott et al. (1997) also reported more male than female Mathematics teachers in South Africa. Howie (2001) and Grayson et al. (2001) similarly reported percentages of Mathematics teachers of 61% and 58%, respectively. However, these findings are in contrast with the findings of US-based studies in which Baird et al. (1993) and Weiss et al. (2001), reported that 71 % and 55% of Mathematics teachers in the USA were female. The comparison of South African and international contexts suggests that South Africa is lagging behind with respect to gender equity in the teaching of Mathematics. An implication of this trend is that South African girls are unlikely to have role models as Mathematics teachers.

Age and experience

The majority of teachers who responded to this survey were aged between 25 and 40 years, and had less than 10 years teaching experience in Mathematics. This indicates that Mathematics taught by qualified subject teachers in the Limpopo Province is done so largely by young and comparatively less experienced teachers. As the majority of this Mathematics teaching corps in the province is likely to remain in the education system for another 15 to 20 years given their age, provided the Department of Education retains them, INSET programmes should be targeted at this group. However, the fairly young teaching corps might also mean that the Limpopo Province does not retain its Mathematics teachers well. Arnott et al. (1997) reported an annual attrition rate of 15% of Mathematics teachers in South Africa. Attrition might arise from the lack of incentives for the teaching profession in South Africa and, as a result, Mathematics teachers may opt out of teaching and enter other more attractive and rewarding job markets. Another contributing factor to attrition might be the process of redeployment and rationalisation. Some older and more experienced teachers might have taken severance packages or resigned in the face of uncertainty brought about by the process of rationalisation and redeployment (personal experience), which

commenced in 1998. Again here, urban teachers appeared to be older and more experienced than their non-urban counterparts.

Howie (2001) in the TIMSS Repeat study of 1999 found that only 16% of Mathematics teachers in South Africa were older than 40 years. Grayson et al. (2001) reported that only about 21% of Mathematics teachers in South Africa were older than 40 years, and that only 31% had been teaching mathematics for more than 14 years. However, the situation is different in other countries such as, for example, in Japan for which Grayson et al. (2001) reported that 53% of Mathematics teachers had more than 14 years teaching experience. Weiss et al. (2001) reported that 59% of Mathematics teachers in the USA were older than 40 years, and that 58% had more than 10 years experience. The difference in the age and teaching experience of Mathematics teachers in South Africa in general, and the Limpopo Province in particular, shows that Mathematics teachers in South Africa are younger and less experienced than their counterparts in other countries. The implication of this trend is that South African teachers might find teaching Mathematics less rewarding than other careers.

Professional and academic qualifications

Although most teachers who responded to this survey are qualified to teach Mathematics at secondary school level, the majority holds matric plus a three-year qualification (M+3) as their highest professional qualification. In most cases the matric plus three-year qualification is a Secondary Teachers' Diploma most probably obtained at historically black colleges of education. But this three-year diploma tends to be inadequate for teaching at the senior secondary level, particularly at the grade 12 level (Arnott et al., 1997). It is common knowledge that the content level covered in three years at historically black colleges of education colleges in South Africa is not much above the grade 12 level, and very rarely up to first year university level (Grayson et al., 2001). It is also disturbing to note that standard 10 is the highest academic qualification for so many Mathematics teachers. The low professional and academic qualifications of most Mathematics teachers in the Limpopo Province imply that they are academically under-qualified and professionally ill-prepared for their classroom responsibilities.

The findings of this study correspond with those of Arnott et al. (1997) of their study on mathematics and science teachers' demand, utilisation, supply and training, in which 51% of

Mathematics teachers in the Limpopo Province held a three-year qualification. Grayson et al. (2001) also reported that 60% of South African Mathematics teachers held matric plus a three-year qualification. By contrast, only 6% and 3% of teachers in the USA and Japan, respectively, held less than a four-year qualification in Mathematics (Grayson, et al., 2001; Weiss, et al., 2001). South African learners' poor performance in international achievement comparisons such as, for example, in TIMSS is not surprising (Howie & Hughes, 1998), as Mathematics teachers in other countries like the USA and Japan (Baird, et al., 1993; Grayson, et al., 2001; Weiss, et al., 2001) are better qualified than their counterparts in South Africa.

Research studies conducted in other countries (e.g., England, Australia, Japan) indicate that learners take Mathematics at school and follow Mathematics and Science careers if they are taught by well qualified and experienced teachers (Arnott et al., 1997). Moreover, teacher quality affects learner achievement in Mathematics (Darling-Hammond, 2000; Howie & Grayson, 2002). Teachers who are well qualified can inspire and motivate learners better, as they can bring to learners a breadth, depth, and scope of the subject, that could otherwise be impossible for an unqualified or under qualified counterpart to achieve. Teacher quality in South Africa in general and in the Limpopo Province in particular, is therefore likely to be a central part of the explanation of low Mathematics enrolment levels and high failure rate. INSET providers should target Mathematics teachers with standard 10 as their highest academic level and matric plus a three-year qualification, and develop appropriate programmes that will help them upgrade their academic content and professional aspects of teaching Mathematics.

School resources

The vast majority of Mathematics teachers who responded to this survey reported that their schools were under-resourced in terms of facilities, textbooks, personnel and classrooms, most of those teachers being in rural and township areas (Table 4.3). As a result of very poor resources and inadequate provision of textbooks, teachers are often the pupils' only resource to learning. Most of these teachers are overloaded with work as they teach three or more grades and also teach other subjects, for example, Biology, Physical Science or even languages (Chapter 4, pages 38 & 49). Moreover, majority of teachers who responded reported that they had more than 50 learners per class.

This poor state of provisioning is characteristic of South Africa's apartheid legacy, where Black education was under-financed (Hartshone; in Ashley & Mehl, 1987: 2). This trend of lack of resources in the Limpopo Province schools is similar to the findings of Howie (2001 and Grayson et al. (2001), who both reported that 45% of schools in South Africa experienced a shortage of instructional materials and lacked facilities and resources. This implies that INSET programmes should focus on helping teachers on how to develop their own teaching materials as well as how to identify free and locally available teaching materials. INSET programmes alone will not guarantee improvement in mathematics teaching and learning if problems of lack or shortage of resources are not addressed. Knowing "fancy" activities for learners is of little value if there are no materials to support such activities (Peacock, 1992). Resources at hand therefore limit what teachers can do in their classrooms. The Department of Education should provide human resources and work together with the private sector, and NGOs to provide physical resources.

INSET-related issues

Two in five Mathematics teachers who responded to this survey regarded teaching skills as their greatest professional need, followed by content knowledge (one in four teachers) and class discipline (one in five teachers) (Table 4.4). The high level of interest in teaching skills might be influenced by the demand for learner-centred teaching approaches, as required by the recent introduction of OBE. These ratings imply that INSET providers should focus on teaching skills as a matter of priority. It is important to note that rural and urban school teachers held similar views regarding the rating of their greatest professional need (Table 4.4). However, township school teachers rated classroom discipline first, followed by teaching skills and content knowledge. This difference of opinion might be as a result of township schools generally having larger enrolments (Table 4.3).

It is disturbing to find that about two-thirds of teachers who responded reported that they did not attend any INSET workshops between January and September 2000 (Chapter 4, page 39). However, designing suitable INSET programmes will not guarantee greater teacher participation, if barriers that prevent them from attending these workshops are not addressed. About half of the responding teachers indicated poor communication of planned INSET activities as their greatest barrier to increased INSET participation (Table 4.5) INSET providers should therefore inform teachers well in advance about their planned activities, if they want maximum participation from teachers. The programmes should also be of appropriate quality and meet teachers' needs. INSET

workshops should also be held during school holidays, as half of the teachers preferred workshops to be held during this time.

A closer look at the different school contexts with respect to barriers preventing teachers from INSET participation paints a slightly different picture. Teachers across different school types agreed about lack of communication as the most serious impediment to greater INSET participation, but differed in rating other barriers (Table 4.5). Rural and township schoolteachers rated poor quality of workshops second, whereas urban schoolteachers rated inconvenient time second. Inconvenient location of INSET workshops implies that workshops should be held at a venue that is nearer to the teachers' work, especially for rural teachers.

The findings of the overall rating of barriers to INSET participation differ from that of Easterday and Smith (1992) and from Baird et al. (1993). Teachers in their respective studies identified inconvenient time and location as their greatest barrier to participation, followed by programmes that fail to meet their needs. Lack of information was also a problem, with poor quality of programmes as their least significant barrier to in-service participation.

PERCEIVED INSET NEEDS

Teachers in this survey are most interested in using computers to teach and manage teaching, motivating learners to learn Mathematics, using audio-visual equipment, identifying learning objectives which specify attitudes learners need to develop towards Mathematics (e.g., a spirit of curiosity, appreciation and a love for Mathematics), updating knowledge of career opportunities, and applying mathematics concepts in daily life (Table 4.6).

Motivating learners to learn Mathematics

Motivating learners to learn Mathematics, and identifying learning objectives which specify attitudes learners need to develop towards Mathematics, correspond with about 69% of teachers who regarded lack of learner interest in Mathematics as often a problem or a serious problem. The primary need here is that of motivating learners to learn Mathematics, but other needs and problems may serve to emphasise the extensiveness of this need. The morale of teachers (Mathematics teachers included) in the Limpopo Province is generally low (Northern Province Department of Education, 2000). Mathematics teachers who responded might therefore find it

difficult to be enthusiastic about their work or be creative in such a way that their learners are motivated. In addition, they find themselves in a difficult situation in terms of disciplining learners who do not do their work, as corporal punishment has been abolished in South African schools since 1997 (Department of Education, 1996).

Teachers' frustrations are expressed in focus group interviews, such as, for example, when teachers comment that "You give them work, they do not do, you give them tests, they do not write". The fact that learners simply do not do their work may be due to their lack of interest and motivation. If teachers can be able to motivate learners to learn, then learners are likely to be encouraged to work hard and do their work without much persuasion from teachers. The fact that responding teachers are challenged in terms of motivating learners and maintaining learner discipline is not surprising, as these teachers are a product of a system that discouraged creativity and innovation and encouraged passiveness, rote learning and obedience to authority (Arnott et al., 1997). The burden of their classroom responsibilities is also made heavier by having to contend with the challenges of poor resources and lack of or inadequate supply of textbooks (Table 4.3 and Chapter 4, page 38).

The need to motivate learners is re-emphasised in teachers' responses from the "free response section" of STIN-NP (Table 4.9). INSET need items in the top-nine ranked needs such as for example, career opportunities in mathematics, attitude objectives, application of mathematics, learning in a multicultural society, and using computers (Table 4.6) may be seen as needs which may help in addressing teachers' desire to motivate learners to learn. A Mathematics teacher who knows how to motivate his learners will be able to instill a love for mathematics in learners, show learners how mathematics can be applied to everyday life, and consequently learners can be inspired to study further and follow various careers in this subject field. This implies that INSET providers should design programmes that will address the dire need of teachers to motivate learners.

The importance of the need to motivate learners corresponds with the findings of Easterday and Smith (1992). The most significant need was motivating learners, with updating knowledge of careers in mathematics, application of mathematics to daily life of learners, and using computers to deliver and manage instruction as supporting needs. Baird, Easterday, Rowsey and Smith

(1993) also had similar findings. It seems that Mathematics teachers world-wide regard motivating learners to learn Mathematics as an important need.

The need to update knowledge of career opportunities corresponds with the finding that seven out of 10 teachers regard lack of career models as problematic (Chapter 4, page 47). The inadequate knowledge of career opportunities in mathematics might be a consequence of the past apartheid policies that limited access to educational opportunities for Blacks (Arnott et. al., 1997; Ashley & Mehl, 1987; Department of Education, 2001a). The exclusion was much greater in the fields of mathematics and science than in languages, history, the arts and music (Arnott et al., 1997; Department of Education, 2001a). As a result, Mathematics teachers may feel that they do not have relevant career models in mathematics, and also lack knowledge of various career opportunities they can encourage learners to embark on in mathematics. INSET programmes should therefore expose teachers to various career opportunities and cite relevant career models where applicable. This implication once again underpins the need to motivate learners, because if learners are exposed to relevant career models and different career opportunities they are likely to appreciate mathematics, start developing positive attitudes toward mathematics, and study hard in order to follow a particular career in mathematics.

Relating Mathematics to the daily life of learners is an important need that can help Mathematics teachers to inspire and motivate learners. For example, ethno-mathematics was not given any attention in the curriculum offered by colleges. As a result, Mathematics is taught in a decontextualised way, with no relevance to the local community and everyday life (Arnott et al., 1997). Moreover, Black teacher education was isolated from the latest developments in mathematics education (Arnott et al., 1997). The need to know how learners learn mathematics in a multicultural society is related to the need of applying concepts taught in mathematics to daily life of learners. If the latter is addressed, then the former is likely to be catered for. The implication here for INSET providers is to include ways in which the relevance of mathematics to daily life can be made clear and used in a learner-centred way.

Using computers and audio-visual equipment

Acquisition of skills to use computers to teach and manage teaching also rank highly, and such a need may be expressed with the hope that computers may well reduce clerical tasks and make

things easier, as about 68% of the respondents regard large class size as a problem. In addition, the use of computers in teaching might also help to motivate learners to learn mathematics, as learners could be taking responsibility for their own learning through computer-aided lessons (Department of Education, 2001a). This implies that INSET programmes should expose teachers to different ways in which a computer can be used to teach as well as to manage teaching. Most unfortunately, many schools in the Limpopo Province do not have electricity, and as such using computers in classroom practice may remain only a pipe dream for most Mathematics teachers. Addressing the need to use audio-visual equipments (e.g., overhead projectors and video recorders) may also be limited by the lack of electricity. Knowing how to use these equipments without electricity being available at school may not help teachers in improving their classroom practice in the immediate future.

Learning and teaching support materials

Mathematics teachers who responded also want to learn how to select supportive teaching materials (e.g., library and reference books, videos, models, and so forth) and how to use various assessment forms to identify learning problems. The need to learn how to select supportive teaching materials may well result from lack of or inadequate supply of textbooks. This implies that INSET programmes should be aimed at exposing teachers to a variety of supportive teaching materials as well as methods and strategies that will help teachers to choose such materials for use in their own teaching and learning situations.

Selecting commercially prepared teaching materials (e.g., textbooks, charts, models) arises from the problem of irrelevant and outdated textbooks. The need to identify sources of free and locally available teaching materials arises from the problem of poor or inadequate resources, which is experienced by 88% of the teachers. INSET programmes should thus include exposing teachers to the use of free and locally available teaching materials (e.g., matchboxes, matchsticks, cardboard boxes, bottle tops, rubber bands, etc.) to help them in identifying and using these materials on their own. Again, the need to develop own teaching materials arises from the problem of outdated and a lack or insufficient supply of textbooks, which is experienced by five to six out of ten teachers respectively.

There is a need to improvise with the little that is available to the teacher. Improvisation may become too heavy a burden for teachers, given their limited content knowledge. INSET providers should therefore focus on helping teachers to develop their own teaching materials using commonly available resources. Design of their own learning support materials will possibly go a long way in helping teachers to improve their classroom practice, and thus may ultimately also improve learner achievement. Moreover, the OBE-linked National Curriculum Statement requires the teacher to assume various roles such as, for example, that of a researcher, a designer of teaching and learning materials, and a life-long learner (Department of Education, 2002).

Effective teaching approaches

As OBE emphasises learner-centred approaches (Department of Education, 1997), the importance of teachers' need of updating effective teaching methods can possibly be attributed to the introduction of OBE. Teachers in focus group interviews felt that the teaching methods which they were taught at college or university were outdated and failed them in the current situation. This is evident in this quotation "... I think the method that they used to train us was not okay". These teachers have been taught teacher-centred approaches that have been accepted and practiced as the norm (Arnott et al., 1997). Moreover, teachers generally tend to teach as they were taught (Maher, 1995). Now that they are expected to use learner-centred approaches, they feel lost and "wanting" regarding effective teaching methods for the new educational paradigm.

One of the most crippling aspects of education in South Africa is that it failed to equip teachers with skills of adapting their knowledge to different situations (Arnott et al, 1997). It thus disempowered teachers and undermined their professional status and abilities, with rural teachers suffering the most. Teachers have been confined to the role of a simple purveyor of information (doing an example from an irrelevant or outdated textbook), and an implementor of instruction (Ashley & Mehl, 1987: 40). As a result teachers adopted an authoritarian stance in the classroom, seeing themselves as the only providers of knowledge (Grayson et al., 2001; Howie, 2001). Now that learner-centred approaches are required, teachers find that they do not have adequate knowledge of effective teaching methods suited to the new requirements.

Using various assessment forms to identify learning difficulties and designing assessment items are related to the need to update effective teaching approaches. Assessment is an integral part of teaching and learning (Department of Education, 2002), and the updating of effective teaching

approaches should therefore necessarily incorporate assessment. INSET providers should thus include assessment in programmes addressing the need to update effective teaching methods.

Subject content knowledge

It is disturbing to note that responding teachers did not show much interest in improving content knowledge, though 59% of them have only standard 10 or less as their highest academic level. Although this need is among the 10-bottom ranked needs, it should not be overlooked as it goes hand in hand with teachers' greatest professional need of teaching skills. Moreover, for teachers to know how to teach well, they should have a good understanding of *what* they are teaching (Department of Education, 2001a). Subject content knowledge is thus an important condition for effective teaching (Darling-Hammond 2000). Possessing a combination of paedagogic content knowledge and skills is therefore necessary, and INSET that ignores this interaction is likely to produce short-lived changes (Shulman, 1987). When addressing content knowledge and teaching skills, INSET providers should note that most teachers would like to learn more about geometry and calculus, but not about trigonometry and algebra. The fact that responding teachers need help with geometry more than any other section of mathematics reflects the poor performance of learners in Mathematics Paper 2 in the Senior Certificate examinations (personal communication, M.A. Seopa, Mathematics Paper 2 Examiner, Limpopo Province).

The little importance attached to improving content knowledge might indicate that teachers are satisfied with their academic level or that they do not see the reason why they should improve, as there are no longer incentives. Naturally, teachers expect some return for the energy and time put into upgrading and INSET courses, in terms of both salary and position (Ashley & Mehl, 1987: 8). The Department of Education should look into incentives that will motivate teachers to study further. INSET programmes should be accredited in terms of being part of fulfilling requirements of a qualification and teachers should be rewarded for obtaining a qualification (Cantrell, 1995).

Comparison of needs according to type of school

When comparing responding teachers' perceived INSET needs according to type of school, it becomes evident that the ranking of these needs differ across the three types of schools (Table 4.7 and Table 4.8). There is a general agreement on only two items in the 10-top ranked needs

(identifying learning objectives which specify attitudes learners need to develop toward Mathematics, and identifying objectives which specify skills learners need to develop in Mathematics [e.g., problem solving and investigation]). Urban teachers differ greatly from non-urban teachers in ranking the bottom-10 ranking needs. It is worth noting that one of the bottom-10 ranked needs (using audio-visual equipment) of urban schoolteachers is ranked eighth by teachers at rural schools. This difference in perceived importance of INSET needs is not surprising, as the problem of poor resources is severely experienced by teachers at rural schools (Table 4.3). This implies that INSET programmes aimed at rural and township school teachers should be different from those meant for urban schoolteachers in order to address their differing needs.

Teachers showed less interest in learning more about the history of mathematics, process and manipulative skills, developing lesson plans, improving content knowledge, how mathematics is used in society, developing own teaching materials and how to teach large classes. These findings are almost the same (except how mathematics is used in society) for both rural and township school teachers. The lack of interest in teaching large classes may point to the fact that there are few learners doing mathematics in grade 11 and 12, as overcrowded classes are a general feature of lower grades (Arnott et al., 1997). This need should, however be prioritised when designing INSET programmes for Mathematics teachers of lower grades, as well as for urban teachers who ranked teaching large classes fifth.

The correspondence between the trends identified in the results of STIN-NP and focus group interviews implies that the findings of this study are trustworthy. No new needs were elicited through the "free response" section of STIN-NP. Interviews yielded similar needs to those of STIN-NP and, again, no additional ones. There is correspondence between the top-ranked STIN-NP needs and those from focus group interviews. There is thus similar evidence from two different independent sources and methods of elicitation with respect to emphasis placed by teachers on particular INSET needs. Convergence of evidence shows that a) needs listed in STIN-NP are important and valid, and b) top-ranked needs elicited from both STIN-NP and interviews are indeed those of high priority to Mathematics teachers in the Limpopo Province.

Other researchers are invited to use STIN-NP to determine perceived INSET needs of Mathematics teachers in other provinces of South Africa, and results can be compared across the

nine provinces in order to determine the similarities and differences among teachers in different contexts. Moreover, such studies can also help in establishing the demographic profile and perceived INSET needs of Mathematics teachers in South Africa in general. This information can be useful for policymakers and INSET providers in order to plan effective, efficient, and sustainable future INSET programmes for Mathematics teachers.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The improvement of learner achievement in mathematics is largely dependent on the existence of a competent teaching corps. Therefore effective teaching and learning of this subject can only be achieved with well-qualified and prepared teachers. The best place to start addressing the problem of under-qualified and ill-prepared teachers is through well-planned INSET programmes. The lack of reliable data on the demographic profile and perceived needs of mathematics teachers in the Limpopo Province might result in programmes that are irrelevant to what teachers perceive to be their most pressing needs. This study has attempted to give a picture of the demographic profile and perceived INSET needs of Mathematics teachers in the Limpopo Province. This important information should be considered in any initiative taken to address the poor state of mathematics education in this province. Thus, in order to ensure success of INSET initiatives, INSET programmes should be designed according to teachers' perceived INSET needs. However, as teachers might not always be aware of all of their professional needs due to lack of knowledge or exposure to latest curriculum developments, their perceived needs should be incorporated into broader INSET programmes or be used as a point of departure.

Findings of this study suggest that most Mathematics teachers who responded are poorly qualified and teach in rural schools which are under-resourced. These teachers are less than 40 years old with comparatively limited experience in teaching the subject. As a result, they might find themselves in a difficult position to carry out their classroom responsibilities. INSET programmes should target this group of teachers as they are likely to remain in the system for 15 to 20 years, provided the Department of Education retains them.

An area of great concern is the academic and professional qualifications of Mathematics teachers who responded to this survey. Most teachers are academically under-qualified and professionally ill-prepared for their classroom responsibilities as they have standard 10 as their highest academic qualification with a three-year diploma. In addition, these teachers have to contend with poor resources and inadequate supply of textbooks. INSET programmes should aim at empowering these teachers by specifically upgrading their content knowledge and teaching skills (their greatest professional need).

Many teachers who responded to this survey did not attend any INSET workshops between January and September 2000. There are probably many reasons why these teachers did not attend such workshops during this period. Poor communication of INSET activities was reported to be the greatest barrier to INSET participation. This implies that teachers should be informed well in advance for planned INSET activities in order to ensure maximum participation. INSET programmes should therefore be well-publicised, be of high quality, and also be held at a convenient location and time. The provision of relevant INSET programmes will help to rekindle the enthusiasm of teachers who will then be motivated to teach Mathematics in a meaningful way. INSET programmes should also be accredited as part of fulfilling a particular qualification to motivate teachers to participate in them.

Teachers who responded to this survey perceive that they require help in all INSET need items listed on STIN-NP. However, motivating learners emerged to be their most important need. INSET programmes should therefore be designed around helping teachers to motivate learners to learn Mathematics along with other identified important needs (i.e., top-10 ranked needs), as well as around their greatest professional need (i.e., teaching skills). Although the content of INSET programmes is decided by INSET providers, classroom teachers are important stakeholders with important opinions about regarding what kind of INSET they require to become more competent teachers. They are directly involved in classroom practice and thus experience teaching and learning problems first hand. Therefore, unless needs that teachers consider more important are met first, even the best-designed high quality INSET programmes may fail to attract them.

As was already mentioned earlier, findings from STIN-NP match those from focus group interviews, and therefore provide evidence of the validity of the results. This needs assessment can serve as a guideline for the designing and planning of INSET activities in the Limpopo

Province. Although responding teachers indicated that they needed help with all need items, important needs such as for example, motivating learners, updating knowledge of effective teaching approaches, applying mathematics to daily life of learners, and so forth, should be given priority when designing INSET programmes. Also, given the low academic level of teachers, improving content knowledge should be prioritised as a matter of urgency, though it features among the bottom-10 ranked needs.

Recommendations

The findings of this study should be of interest to INSET providers such as NGOs, and institutions of higher education throughout the country, and in particular to both the national and provincial departments of education as the employers of teachers. Moreover, some INSET needs rely upon the provisioning of resources by the department. Recommendations that follow are offered in the spirit of designing and planning more appropriate, sustainable, and effective INSET programmes for Mathematics teachers in the Limpopo Province.

Teacher development

Intensive INSET programmes should be developed in order to establish a more competent, qualified Mathematics teaching corps in the Limpopo Province. These programmes should include both subject content knowledge and teaching skills. Different ways of motivating learners to learn Mathematics should be a matter of priority when designing INSET programmes. Application of mathematics to the daily life of learners and its relevance to the local community should be emphasised, and ethno-mathematics should be given attention. Various teaching approaches (e.g., constructivist and problem solving approaches) should also be encouraged. NGOs and the University of the North should continue their good work in this area, in collaboration with the Limpopo Province Department of Education. INSET programmes should be guided by the perceived teacher needs of Mathematics as identified in this study.

The use of mentors in the form of teachers who produce good results in the Limpopo Province schools should be explored. These teachers can be used during INSET workshops to help their peers to improve their classroom practice. In addition, role models in the form of high profile individuals involved in particular careers in mathematics can be used to motivate both teachers and learners.

Incentives

INSET programmes should be accredited, so that teachers do not view them as a waste of time and energy. Strong incentives should be used to encourage teachers to attend INSET programmes, as many teachers are demotivated by lack of incentives. Rewards in the form of salary notches, promotions, and so forth, instead of a once-off bonus payment that is presently offered are likely to go a long way in motivating teachers to participate in INSET programmes. In addition, bursaries should be made available to encourage teachers to upgrade their qualifications. Various financial incentives should also be explored in order to retain well-trained teachers in the system. Good Mathematics teachers are always lost to the private sector as it offers better financial rewards (Department of Education, 2001).

Resources

Resources are a major constraint regarding what teachers can do in their classrooms in terms of what they have gained from INSET workshops (Crossley & Guthrie, 1987). INSET programmes should help teachers to design and develop their own teaching and learning support materials from locally and freely available materials. Teachers should be in a position to improvise on the little that is available to them.

Further research

Studies of this nature should perhaps be conducted in 5-year intervals to identify shifts or differences. However, a study of INSET needs for unqualified Mathematics teachers in the Limpopo Province would be a useful direction for further research as these teachers are likely to have different needs from those of qualified teachers. Another study of INSET needs for Mathematics teachers teaching at urban schools may be necessary as these teachers had obvious differences with non-urban school teachers but their sample size was too small to establish conclusive findings.

Concluding remarks

This study was undertaken to fill an obvious gap in mathematics education in the Limpopo Province and in South Africa in general. Although the findings are not representative of all Mathematics teachers in the Limpopo Province, they nevertheless provide a useful indication of the demographic profile and perceived INSET needs of a large group of Mathematics teachers in this province. It is therefore hoped that INSET providers will make use of this information so that effective and sustainable INSET programmes for Mathematics teachers become a reality.

APPENDIX A

30 Kigelia Street
FloraPark
Pietersburg
0699
14 May 2000

Sir/ Madam

Improving Mathematics teaching in the Northern Province

I am a M.Ed student at the University of the North, and am involved in conducting research to determine the "perceived in-service training (INSET) needs of secondary Mathematics teachers in the Northern Province".

The result of this research will be used to provide education planners with an accurate and reliable list of INSET needs of Mathematics teachers in the Northern Province, as well as with an up-to-date and reliable demographic database of these teachers. The results are thus anticipated to have a positive impact on efficient and effective planning of INSET activities in Mathematics in the Northern Province.

The research will be conducted in part by sending questionnaires through Curriculum Advisors to Mathematics teachers in all districts of the Department of Education in the Northern Province. Although the questionnaire I intend to utilise was designed and successfully used abroad in countries like the USA, Jordan, and Malaysia, I now need to make the questionnaire relevant to the South African educational context in general and to the Northern Province one in particular.

You are therefore kindly requested to go through the questionnaire, and make a contribution towards validating it in order for me to use it appropriately in the Northern Province. Attached is the questionnaire, as well as instructions on how to validate it. **Kindly return your comments and suggestions in the stamped and self-addressed envelope provided to reach me on or before 14 June 2000.**

Should you have any queries, please contact me on the following numbers: 015 296 1555 (H), 015 633 5050 (W), and 082 851 9939 (mobile).

Thank you for contributing to my study!

Yours faithfully,

A.M. Rakumako

Dr RC Laugksch
(Supervisor)

Science Teachers Inventory of Needs in the Northern Province (STIN-NP)

INSTRUCTIONS FOR VALIDATING THE QUESTIONNAIRE

Step 1. Please read through the instructions of the questionnaire carefully.

(a) Decide whether the instructions are clear and unambiguous.

(b) If the instructions are not clear and unambiguous, kindly suggest changes in wording.

Step 2. Please read item no 1.

(a) Decide whether the need described is appropriate and relevant to Science teachers in the Northern Province.

(i) If not, kindly justify your decision with a brief explanation.

(ii) If the item is relevant, is the need clearly and unambiguously stated?

(iii) If the need is not clear and unambiguously stated, please suggest changes in wording.

(b) Is the language used clear and appropriate for English Second Language users?

(i) If yes, please proceed to step no. 3

(ii) If the language is not clear and appropriate, please suggest changes in wording.

Step 3. Now please read items 2-47, and repeat tasks in Step 2 above.

Step 4. Please suggest some additional items (i.e., needs) which are not covered in items 1-47 of the questionnaire, and briefly justify why the items should be included.

Step5. Now please read items 48-93 and decide for each statement, whether the language used is clear and appropriate for English Second language users. If not, please suggest changes in wording for each applicable item.

Step 6. Please write all your comments, explanations and suggestions on a separate sheet and also label the number of the item(s) concerned.

- Please return the separate sheet with your comments and suggestions in the self-addressed and stamped envelope provided. Kindly return your comments to reach me on or before *14 June 2000.*

Thank you for your time!

MATHEMATICS TEACHER INVENTORY OF NEEDS (MTIN)

This questionnaire has been designed to allow you to express your needs as a classroom teacher of mathematics. Each item is composed of statements and a scale on which to mark your reaction to the statement. The statements describe tasks which a mathematics teacher may be called upon to perform. Following each item number on the scan sheet is a scale marked A B C D E. Use this scale for items in the first section of the survey:

A= not familiar or no tools
B= no need
C= little need
D= moderate need
E= great need

Here is a sample item:
Employ a learner-centred approach to teach mathematics

In responding to this item you are asked to use an HB pencil to shade in the scan sheet, the one letter that best designates the degree to which you feel a need for help with that task. If you are not familiar with the learner-centred approach, you shade in response A for this item. If you already use the learner-centred approach, or do not wish to learn how to better perform this task, you should mark B. If you wish to improve your skill in using the learner-centred approach, you should mark C or D. If you would really like to use the learner-centred approach, and feel you would use it more if you received help with it, you should mark E. Thus, B represents the absence of need, while C, D, and E represent increasing levels of need for assistance in improving your skill on the item.

You do not need to sign your name. Return only the scan sheet, not this questionnaire. Results from this survey of teacher needs will be used to design effective and sustainable INSET programmes which we hope will ultimately improve mathematics education in the Northern Province. Please take the 25 minutes necessary to complete this survey carefully. **Please respond to all items.**

PLEASE RESPOND TO EACH OF THE ITEMS ON THE FOLLOWING PAGES YOU MUST USE AN HB PENCIL. THE BLANK PAGE IS FOR YOUR RESPONSES TO ITEMS THAT ASK FOR COMMENTS

1.	Write learning objectives which specify mathematics knowledge needed by learners *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
2.	Write learning objectives which specify attitudes learners need to develop toward mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
3.	Write learning objectives which specify skills learners need to develop in mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
4.	Write learning objectives which are appropriate for multicultural learning styles and needs in mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
5.	Write lesson plans which incorporate the history of mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
6.	Write lesson plans (or objectives) that integrate mathematics with other subjects that I'm expected to teach *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
7.	Design measurement items which assess mathematics instructional objectives *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
8.	Use test results to diagnose mathematics learning difficulties *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
9.	Construct and use a data bank of mathematics test-items *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
10.	Utilise learner assessment results in grading their performance *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
11.	Develop a lesson plan for a unit of mathematics instruction *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
12.	Select commercially prepared instructional materials for mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
13.	Prepare teacher-made teaching materials for mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
14.	Motivate students to want to learn mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
15.	Use an inquiry teaching strategy (i.e. method) in teaching mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*

16.	Use hands-on teaching methods in the mathematics classroom *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
17.	Demonstrate a mathematics concept *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
18.	Demonstrate a mathematics process skill *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
19.	Demonstrate a mathematics manipulative skill *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
20.	Direct a field trip to help students learn mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
21.	Employ individualised teaching strategies in teaching mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
22.	Employ peer tutoring in mathematics teaching *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
23.	Use audio-visual equipment to improve mathematics teaching *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
24.	Use computers to deliver mathematics instruction *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
25.	Manage a mathematics instructional budget *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
26.	Maintain student discipline in mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
27.	Evaluate your own teaching effectiveness as a mathematics teacher *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
28.	Use a computer to help manage teaching in mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
29.	Organise a mathematics room *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
30.	Set up a mathematics equipment order with a storage and retrieval system *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
31	Maintain mathematics equipment *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
32.	Construct mathematics teaching equipment *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*

33.	Select and order mathematics teaching equipment *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
34.	Select and order mathematics software for microcomputers in your school *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
35.	Identify sources of free and inexpensive mathematics instructional materials *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
36.	Select supportive materials (e.g., library books, films, etc.) for mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
37.	Update your knowledge of human utilisation of mathematics/technology *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
38.	Update your knowledge of mathematics related career opportunities for learners *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
39.	Update your knowledge of mathematics related issues in society *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
40.	Update your knowledge of multicultural mathematics education as it relates to student learning styles *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
41.	Develop skills in recognising and correcting common misconceptions in mathematics among your students *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
42.	Update your knowledge of cognitive development & learning to include constructivist concepts of learning *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
43.	Work toward a post-graduate diploma or degree in mathematics education *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
44.	Update your knowledge of the history of mathematics *A = not familiar or no tools; B = no need; C = little need; D = moderate need; E = great need*
Now please answer the following questions about yourself by making the sheet	
45.	The major barrier which prevents you from greater participation in in-service training programmes in mathematics the Northern Province *A = lack of information; B= inconvenient time or location; C= poor quality of programmes offered; D= programmes fail to meet your needs; E= lack of personal energy or motivation*
46.	You teach in grades *A= 8; B= 9; C= 10; D= 11; E= 12* *Please shade all applicable grades*
47.	Your primary subject specialisation is *A= Biology; B= Mathematics; C= General Science; D= Physical science; E= Agricultural science*
48.	Your sex *A= female; B= male*

49.	Your age group is *A= 24 or younger; B= 25-30; C= 31-40; D= 41-50; E= over 50*
50.	Years of classroom teaching experience *A= 3 or less; B= 4-10; C= 11-20; D= 21-30; E= over 30*
51.	Number of different daily teaching preparations you have this year *A= one or two; B= three; C= four; D= five; E= more than five*
52.	Level of your highest **academic** qualification *A= less than std 10; B= std 10; C= diploma level; D= bachelor level; E= honours level*
53.	What is your highest **professional** qualification? *A= PTC; B= JSTC; C= PTD; D= STD; E= FDE; F= UED; G= HED; H= B.Sc.; I= B.A.Ed./ B.A.Paed.*
54.	Your main teaching subject this year *A= Mathematics; B = General Science; C= Biology; D= Physical science; E= Agricultural Science*
55.	Type of school in which you teach now *A= rural; B= township; C= urban*
56.	Student enrolment in your school this year *A= 200 or less; B= 201-500; C= 501-800; D= 801-1000; E= more than 1000*
57.	Grade range in your school this year *A=8 or 8-9; B= 8-10; C= 8-11; D= 8-12*
58.	Is mathematics offered in grade 11 and 12 at your high school? *A= yes, every year; B= yes, every other year; C= no*
59.	How many microcomputers are available to you for classroom use? *A= none; B= 1-2; C= 3-4; D= 5-10; E= more than 10*
60.	Frequency with which your mathematics learners use computers in your class *A= less than once a month; B= about once a month; C= every two weeks; D= weekly; E= more often*
61.	Frequency with which you personally use computers *A= less than once a month; B= about once a month; C= every two weeks; D= weekly; E= more often*
62.	For what primary purpose do you use computers for mathematics work *A= don't use computers; B= word processing; C= record management; D= instruction; E= other*
63.	What do you feel is your greatest need as a mathematics teacher? *A= better quality in-service training; B= improved administrative support for* mathematics *teaching; C= more money for equipment supplies, etc. D= greater learner and parental interest in learning mathematics; E= other [please explain briefly on a separate page]*
64.	What is the approximate number of teaching resources available to you outside school (e.g. construction site) within 100km? *A= 0; B= 1-3; C= 4-6; D= 7-10; E= 10*
65.	How would you describe the resources you have available for teaching mathematics at your school? *A= very inadequate; B= poor; C= adequate; D= very adequate; E= exceptional*
	In your opinion, how much of a problem to mathematics education in your school is caused by each of the following?
66.	Belief that mathematics is less important than other subjects *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
67.	Insufficient funds for purchasing equipment and supplies *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*

68.	Outdated teaching materials *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
69.	Lack of learner interest in mathematics *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
70.	Teachers inadequately prepared to teach mathematics *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
71.	Class size too large *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
72.	Too many class preparations per day *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
73.	Lack of colleagues with whom to discuss mathematics teaching problems *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
74.	Insufficient learner problem solving skills *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
75.	Lack of mathematics career role models in your community *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= A serious problem*
76.	Poor learner reading ability *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
77.	Insufficient number of textbooks *A= not a significant problem; B= rarely a problem; C= occasionally a problem; D= frequently a problem; E= a serious problem*
How often do you use the following activities for mathematics instruction?	
78.	Activities in which almost all learners get to manipulate objects. *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*
79.	Field trips outside school for mathematics objectives. *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*
80.	Peer teaching in which learners teach mathematics during your class time. *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*
81.	Cooperative learning- small teams of students working together on directed task with each having a role *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*
82.	Microcomputer activities in mathematics class *A= never; B= less than once a month; C= once a month; D= every two weeks; E weekly*
83.	Teacher demonstrations in mathematics *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*
84.	Teacher lectures in mathematics A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly
85.	Inquiry teaching strategies for mathematics teaching *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*
86.	Individualised teaching strategies for mathematics teaching *A= never; B= less than once a month; C= once a month; D= every two weeks; E= weekly*

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE.

Validation: Suggestions and comments Name:.....

APPENDIX B

Please do not *answer* the questionnaire, but only comment on the items of the questionnaire! See *instructions* below...

INSTRUCTIONS FOR COMMENTING ON THE STIN-NP QUESTIONNAIRE

Step 1. Please read through the **cover sheet** of the questionnaire carefully, and underline ***any word(s) or phrase(s) or sentence(s)*** you do not understand.

Step 2. Please read through the **instructions and guidelines** of the STIN-NP questionnaire carefully, and underline any ***word(s) or phrase(s) or sentence(s)*** you do not understand.

Step 3. Please read item no. 1 of the questionnaire.

(a) Do you understand the statement in item 1? If not, please underline any word(s) or phrase(s) or sentence you do not understand.

(b) If the item is ambiguous (i.e., it has more than *one* meaning), please circle the item number and suggest changes in wording on the questionnaire *next to the item concerned.*

Step 4. Now please read items 2 to 49, and repeat tasks (a) and (b) in Step 3 above.

Step 5. Now please read the answer options to items 50-70, and decide whether the options are clear. If not, please suggest different answer options or additional options on the questionnaire next to the item(s) concerned.

Step 6. Did you understand the instructions in the shaded box following item no. 2? Please write "yes" or "no" next to item no. 2 on the questionnaire.

Please remember to write all your comments and suggestions *on the questionnaire next to the item(s) or option(s) concerned.*

Step 7. PLEASE RETURN THE QUESTIONNAIRE WITH YOUR COMMENTS AND SUGGESTIONS IN THE ENVELOPE PROVIDED TO THE SUBJECT ADVISOR VIA YOUR PRINCIPAL. **KINDLY RETURN YOUR COMMENTS AS SOON AS POSSIBLE, BUT TO REACH ME NOT LATER THAN *24 JULY 2000*.**

Thank you very much for your assistance!

Please do not *answer* the questionnaire, but only comment on the items of the questionnaire! See *instructions* above...

SCIENCE TEACHER INVENTORY OF NEEDS – NORTHERN PROVINCE (STIN-NP)

INSTRUCTIONS AND GUIDELINES

This questionnaire has been designed to help you to express your needs as a classroom teacher of Mathematics / Physical Science / Biology. Each item is composed of statements and a scale on which to shade your reaction to the statement. The statements describe tasks which a teacher of Mathematics / Physical Science / Biology may be called upon to perform. Following each item number on the answer sheet is a scale marked **A**, **B**, **C**, **D**, and **E**. Use this scale for items in **Section A** of the questionnaire:

A = not familiar
B = no need
C = little need
D = moderate need
E = great need

Here is an example of an item (i.e., professional need):

Employ a learner-centred approach to teaching

In responding to this item, you are asked to shade in on the answer sheet the **one** letter that best describes the degree to which you feel a need for help with that task. (Please use only a **black or blue** pen!) If you are not familiar with the learner-centred approach, you shade in response **A** for this item. **B** represents the absence of need, while **C**, **D**, and **E** represent increasing levels of need for assistance in improving your skill on the task.

Do not write your name on the answer sheet – this survey is anonymous and in the results no individual or school will be identified!

Please respond to all items. When you are finished, place the answer sheet in the envelope provided, and return it to your Curriculum Advisor via your Principal. (If you would like to suggest additional item/s that you feel are of great need, please write them on the last page of the questionnaire. In that case, please return the last page of the questionnaire together with the answer sheet.)

Please return the completed answer sheet to your Principal as soon as possible, but not later than *X September 2000*!

Let's begin then...

REMEMBER please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

Please start here (and kindly respond to all questions):

1.	Which of the following subjects do you teach this year? (*If all options apply, please mark all three!*) ***A** = Mathematics; **B** = Physical Science; **C** = Biology*
2.	In which of the following subjects do you teach the most lessons per week this year? (Please mark only **one** option!) ***A** = Mathematics; **B** = Physical Science; **C** = Biology;* **IMPORTANT** **Please note that you should complete this questionnaire with respect to the professional needs of EITHER a Mathematics teacher, OR a Physical Science teacher, OR a Biology teacher, *depending on the subject in which you teach the most lessons per week this year* (i.e., depending on your answer to question 2)!** Hence, • if you have marked option **A** in Question 2 above, please regard yourself as a **Mathematics** teacher for purposes of filling in this questionnaire; • if you have marked option **B** in Question 2 above, please regard yourself as a **Physical Science** teacher for purposes of filling in this questionnaire, and • if you have marked option **C** in Question 2 above, please regard yourself as a **Biology** teacher for purposes of filling in this questionnaire.

SECTION A

The following items relate to your professional needs as a teacher of Mathematics OR Physical Science OR Biology. Please respond to each item. (*Mark your answers on the answer sheet provided*).

Is there a need for you to:

3.	Develop skills in recognising and correcting common misconceptions in Mathematics / Physical Science / Biology among your learners ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
4.	Update your knowledge of career opportunities for learners related to Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
5.	Update your knowledge of effective teaching approaches (i.e., methods) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
6.	Update your knowledge of issues in society related to Mathematics / Physical Science / Biology (e.g., economics, electrification, HIV/AIDS, etc.) ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
7.	Update your knowledge of the way in which learners learn Mathematics / Physical Science / Biology in a multicultural society ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

8.	Update your knowledge of learning to include a constructivist approach to learning Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
9.	Improve your content knowledge of Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
10.	Update your knowledge of how Mathematics / the physical sciences / Biology is used in society ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
11.	Update your knowledge and skills in ***A** = Geometry; **B** = Algebra; **C** = Calculus; **D** = Trigonometry; **E** = not applicable (Physical Science / Biology teacher)*
12.	Update your knowledge of the history of Mathematics / the physical sciences / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
13.	Identify learning objectives (i.e., outcomes) which specify knowledge needed by learners in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
14.	Identify learning objectives (i.e., outcomes) which specify attitudes learners need to develop toward Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
15.	Identify learning objectives (i.e., outcomes) which specify skills learners need to develop in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
16.	Identify learning objectives (i.e., outcomes) which are appropriate for promoting multicultural ways of learning in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
17.	Develop lesson plans (i.e., learning activities) which incorporate the history of Mathematics / the physical sciences / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
18.	Develop lesson plans (i.e., learning activities) which integrate Mathematics / Physical Science / Biology with other subjects ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
19.	Design assessment items (e.g., questions or tasks) which assess achievement of learning objectives (i.e., outcomes) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
20.	Use various forms of assessment to identify learning difficulties in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

21.	Develop lesson plans (i.e., learning activities) for topics in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
22.	Select commercially prepared teaching materials (e.g., textbooks, charts, models, etc.) for Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
23.	Develop own teaching materials for Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
24.	Motivate learners to learn Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
25.	Use an inquiry/discovery teaching approach (i.e., method) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
26.	Use hands-on teaching methods in the Mathematics / Physical Science / Biology class ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
27.	Demonstrate process skills (e.g., generalising, defining, etc.) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
28.	Demonstrate manipulative skills (e.g., measuring) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
29.	Apply concepts taught in Mathematics / Physical Science / Biology to daily life of learners (i.e., to real-life situations) ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
30.	Conduct a field trip to help learners learn Mathematics / Physical Science / Biology better ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
31.	Employ teaching approaches (i.e., methods) where you are able to concentrate on teaching individuals rather than the whole class in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
32.	Employ teaching approaches (i.e., methods) for teaching large classes in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
33.	Employ teaching approaches that make learners teach each other (i.e., peer tutoring) in Mathematics / Physical Science / Biology lessons ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
34.	Use audio-visual equipment (e.g., overhead projector, cassette or video recorder, etc.) to facilitate teaching in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

35.	Use computers to <u>teach</u> Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
36.	Maintain learner discipline in your Mathematics / Physical Science / Biology classes ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
37.	Evaluate your own teaching effectiveness as a Mathematics / Physical Science / Biology teacher (i.e., become a reflective teacher) ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
38.	Use a computer to help <u>manage</u> teaching (e.g., keeping records of students) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
39.	Organise and manage physical space (e.g., position of learners' desks, etc.) in the Mathematics / Physical Science / Biology classroom to facilitate effective teaching ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
40.	Identify sources of free and locally available teaching materials for Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
41.	Select supportive materials (e.g. library and reference books, videos, etc.) for teaching in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
The following 7 items should be answered by <u>Physical Science / Biology</u> teachers only:	
42.	Demonstrate concepts in Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
43.	Organise (i.e., establish) a laboratory <u>room</u> for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
44.	Carry out a laboratory (i.e., practical) session in Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
45.	Provide for learners' safety during a laboratory (i.e., practical) session in Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
46.	Maintain laboratory (i.e., practical) equipment for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
47.	Construct laboratory (i.e., practical) equipment for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
48.	<u>Select</u> laboratory (i.e., practical) equipment for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

The following item should be answered by <u>Biology</u> teachers only:	
49.	Maintain live organisms for Biology teaching ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
SECTION B **Now please answer the following questions about <u>yourself</u> (*kindly mark your answers on the answer sheet provided*):**	
50.	The <u>greatest</u> barrier which currently prevents you from greater participation in Mathematics / Physical Science / Biology in-service training workshops in the Northern Province is (*please mark only <u>one</u> option!*) ***A** = lack of information; **B** = inconvenient time; **C** = inconvenient location; **D** = poor quality of workshops offered; **E** = workshops fail to deal with your needs; **F** = lack of personal energy or motivation; **G** = other (please <u>explain</u> briefly on the last page of the questionnaire)*
51.	Name of school <u>District</u> in which you teach *Region 1: **A** = Bakenberg; **B** = Mahwelereng; **C** = Palala; **D** = Warmbaths;* *Region 2: **E** = Bochum; **F** = Konekwena; **G** = Mankweng; **H** = Mogodumo; **I** = Polokwane; **J** = Zebediela;* *Region 3: **K** = Malamulele; **L** = Mutale; **M** = Sekgosese; **N** = Soutpansberg; **O** = Thohoyandou; **P** = Vuwani;* *Region 4: **Q** = Giyani; **R** = Phalaborwa;* *Region 5: **S** = Bolobedu; **T** = Hlanganani; **U** = Ritavi; **V** = Thabina;* *Region 6: **W** = Apel; **X** = Bohlabela; **Y** = Dennilton; **Z** = Magakala; **AA** = Nebo; **BB** = Sekhukhune;* *Region 7: **CC** = Acornhoek; **DD** = Bushbuckridge; **EE** = Mkhuhlu*
52.	You currently teach Mathematics / Physical Science / Biology in grades (*please mark <u>all</u> options that apply*) ***A** = 8; **B** = 9; **C** = 10; **D** = 11; **E** = 12*
53.	You have a <u>professional qualification</u> to teach (*please mark <u>all</u> options that apply*) ***A** = Biology; **B** = Physical Science; **C** = General Science ; **D** = Mathematics; **E** = Agricultural Science; **F** = Other*
54.	You are ***A** = male; **B** = female*
55.	Your age group is ***A** = 24 or younger; **B** = 25-30; **C** = 31-40; **D** = 41-50; **E** = over 50*
56.	Years of classroom teaching experience in Mathematics / Physical Science / Biology ***A** = 3 or less; **B** = 4-10; **C** = 11-20; **D** = 21-30; **E** = over 30*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

57.	Highest <u>academic level</u> achieved in Mathematics / Physical Science / Biology ***A** = less than Std 10; **B** = Std 10; **C** = 1st year university; **D** = 2nd year university; **E** = 3rd year university; **F** = Honours degree and higher*
58.	Highest <u>professional</u> (i.e., teaching) qualification you hold ***A** = PTC; **B** = SEC; **C** = JSTC; **D** = SED; **E** = PTD; **F** = SSTC; **G** = STD; **H** = UED; **I** = HED; **J** = BSc.Ed/BScPaed; **K** = BAEd/BAPaed; **L** = Other*
59.	Type of school in which you now teach ***A** = rural; **B** = location/township; **C** = urban; **D** = other*
60.	Number of learners in your <u>largest</u> Mathematics / Physical Science / Biology class this year ***A** = less than 20; **B** = 21-30; **C** = 31-50; **D** = 51-70; **E** = more than 70*
61.	Student enrolment in your school this year ***A** = less than 200; **B** = 201-500; **C** = 501-800; **D** = 801-1000; **E** = more than 1000*
62.	Number of in-service training workshops in Mathematics / Physical Science / Biology you attended between January and August this year ***A** = none; **B** = one; **C** = two; **D** = three; **E** = four or more*
63.	How much <u>confidence</u> do you have in teaching grades 10 to 12 in Mathematics / Physical Science / Biology ***A** = a lot of confidence; **B** = some confidence; **C** = little or no confidence*
64.	When would you <u>prefer</u> to attend in-service training workshops or activities in Mathematics / Physical Science / Biology (*please mark only <u>one</u> option!*) ***A** = in the afternoon on school days; **B** = on Saturday mornings; **C** = over weekends (i.e., Saturday and Sunday); **D** = during school holidays*
65.	What do you feel is your <u>greatest</u> professional need as a teacher of Mathematics / Physical Science / Biology (*please mark only <u>one</u> option!*) ***A** = improving classroom organisation/discipline; **B** = improving your teaching skills; **C** =improving your content knowledge; **D** = assessing learner's work; **E** = other (please <u>explain</u> briefly on the last page of the questionnaire)*
66.	What is the approximate number of resources for Mathematics / Physical Science / Biology available outside of school (e.g. construction sites, museums, science centres, etc.) within 100 km of your school ***A** = 0; **B** = 1-3; **C** = 4-6; **D** = 7-10; **E** = over 10*
67.	How would you describe the resources at your school (e.g., laboratories, libraries, etc.) you have available for teaching Mathematics / Physical Science / Biology ***A** = very inadequate; **B** = poor; **C** = adequate; **D** = very adequate; **E** = exceptional*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

The following 2 items should be answered by Physical Science / Biology teachers only:	
68.	How often do your learners carry out practical sessions in Physical Science / Biology ***A** = not at all; **B** = less than once a month; **C** = about once a month; **D** = once every 2 weeks; **E** = once every week;*
69.	How adequate are equipment and supplies for conducting practical sessions in Physical Science / Biology at your school? ***A** = none available; **B** = inadequate; **C** = adequate; **D** = more than adequate; **E** = not sure*
SECTION C **In your opinion, how much of a problem to Mathematics / Physical Science / Biology education in your school is caused by each of the following (*kindly mark your answers on the answer sheet provided*):**	
70.	Learners' belief that Mathematics / Physical Science / Biology is less important than other subjects ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
71.	Insufficient school funds for purchasing equipment and supplies needed in teaching Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
72.	Outdated teaching materials (e.g., textbooks) for Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
73.	Lack of learner interest in Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
74.	Lack of parental concern about their children learning Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
75.	Teachers inadequately prepared to teach Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
76.	Class size too large ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
77.	Too many lessons to prepare for each day ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

78.	No colleagues with whom to discuss teaching problems related to Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
79.	Insufficient problem-solving skills on the part of learners ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
80.	Lack of career role models in the community with respect to Mathematics / the physical sciences / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
81.	Learners' poor language competency in English ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
82.	Insufficient number of textbooks in Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
83.	Inadequate facilities to conduct practicals in Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*

SECTION D

How often do you use the following activities in teaching Mathematics / Physical Science / Biology (*please mark your answers on the answer sheet provided*):

84.	Practical activities in which almost all learners get to use apparatus/equipment ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
85.	Field trips outside school for objectives (i.e., outcomes) in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
86.	Peer teaching (i.e., learners teaching other learners) during your lessons in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
87.	Co-operative learning (i.e., small teams of learners working together on directed Mathematics / Physical Science / Biology tasks with each team having a role) ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
88.	Demonstrations by teacher in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

89.	Inquiry/discovery teaching approach in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
90.	Teaching approach where you are able to concentrate on teaching <u>individuals</u> rather than the whole class in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
91.	Problem-solving approach in Mathematics / Physical Science / Biology **A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly

You have reached the end of the questionnaire - please make sure you have responded to <u>all</u> items. When you are finished, please place the completed answer sheet in the envelope provided, and return it to your Curriculum Advisor <u>via</u> your Principal.

If you have made comments or have suggested additional professional needs that you feel are of great importance, please return the page(s) with your comments and/or suggestions <u>together</u> with the answer sheet.

Thank you for your assistance in this survey – it is <u>much</u> appreciated!

Northern Province
DEPARTMENT OF EDUCATION

92

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PIETERSBURG
0700
Tel.:015 297 0110, 015 29
0590, 297 0392, 297 038
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20/06/2000

Dr R.C Langksch
Department of Mathematics
Science and Technology Education
University of the North
Private Bag x1106
SOVENGA
0727

Dear Dr Langksch

Request for permission to conduct Research in the Department of Education Northern Province

1. The above matter refers.

2. This serves to inform you that your request for permission to conduct research on the perceived INSET needs of Secondary Mathematics and Natural Science (Physical Science and Biology) teachers in the Northern Province is hereby approved.

3. This approval covers also the three individual request to involve Mathematics, Physical Science and Biology teachers in the study by the three candidates under your supervision.

4. The approval is given subject to accepted ethical conduct being adhered to by all participations and researchers.

5. Your commitment to share the research findings with the Northern Province Education Department is highly appreciated.

6. This approval letter should be presented to Regional Directors, District Managers, Circuit Managers, school principals and participating teachers if necessary in order to obtain maximum cooperation and assistance with all aspects of the research.

7. Yours sincerely

21/6/2000

UNIVERSITY OF THE NORTH

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Tel: (+27 15) 268-3364
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E-mail: Laugkschr@unin.unorth.ac.za

Department of Mathematics, Science and Technology Education

The District Manager: Bakenberg
Department of Education
Private Bag X2692
0612 Suswe

19 July 2000

Dear Sir/Madam,

Research Project: ***Perceived INSET needs of secondary Mathematics, Physical Science and Biology teachers in the Northern Province***

I am currently conducting a research project - funded by the National Research Foundation - on the above topic. The project aims to address important factors related to the effectiveness, sustainability, and success of INSET programmes in mathematics and science, and will effectively facilitate and contribute to urgently-needed initiatives to improve mathematics and science education in the Northern Province. **This study is supported by the Northern Province Department of Education (see attached letter from the Superintendent General).**

The research project involves conducting a survey amongst relevant teachers by using a paper-and-pencil questionnaire. Thereafter, focus group interviews of teachers will be used to gather data on teachers' perceived needs in a more open-ended manner. I intend to distribute the questionnaires to all Mathematics, Physical Science, and Biology teachers via Curriculum Advisors in the Department's 31 Districts. The District Manager's monthly meeting with school principals would be a most convenient way of distributing the questionnaires to schools (and thus to teachers). **I would therefore be most grateful if you would be able to arrange holding the monthly meeting with secondary school principals in your District during the week of 21-25 August 2000.** I would appreciate it if you could kindly fax a brief note by the end of July, confirming that a meeting during this week will be possible, and what the date and time will be. Once I have received your confirmation, the questionnaires will be dropped off at your office either by myself or by my Masters students working on this project with me.

When the questionnaires are dropped off, we will then also use this opportunity to brief you and the Curriculum Advisor(s) about the research project. Curriculum Advisors will then be in a position to answer any possible questions principals may have about this study. We would then also like to request the Curriculum Advisor(s) to identify a total of about 10 secondary teachers <u>each</u> for Mathematics, Physical Science, and Biology at schools in close proximity of the District Office whom we could interview when collecting the completed questionnaires again during the third week in September.

Should you have any queries regarding this research project or my request, kindly contact me telephonically on (015) 268-3364, or via fax on (015) 268-3364 or 268-2965, or via E-mail at "Laugkschr@unin.unorth.ac.za" (no quotes).

I do hope that you will be able to accede to my request.

Thank you.

Yours sincerely,

<u>Dr R C Laugksch</u>

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**Department of Mathematics,
Science and Technology
Education**

The District Manager: Bakenberg District
Department of Education
Private Bag X2692
Suswe
0612

18 August 2000

Dear Sir/Madam,

Research Project: ***Perceived INSET needs of secondary Mathematics, Physical Science and Biology teachers in the Northern Province***

1. My letter of 18 July 2000 in the above regard refers.
2. Please receive the questionnaires of the above survey to be **distributed** to **secondary** school principals for **Mathematics/ Physical Science/ Biology** teachers **via** the relevant Curriculum Advisors.
3. A letter for the Curriculum Advisor(s) in Mathematics/ Physical Science/ Biology is enclosed.
4. Principals should return the completed questionnaires to the District Manager via Curriculum Advisors not later than **14 September 2000.**
5. The questionnaires will be collected from the District Manager on **21 September 2000** by Capricorn Distributors.
6. Enclosed please find the completed waybill, which needs to be given to the courier company (Capricorn Distributors) at collection of the questionnaires!
7. Should you have any queries regarding this survey or my request, kindly contact me telephonically on (015) 268-3364, or via fax on (015) 268-3364 or 268-2965.

Thank you very much for your assistance and cooperation!

Yours sincerely,

Dr R C Laugksch

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Department of Mathematics, Science and Technology Education

The Mathematics/ Physical Science/ Biology Subject Advisor(s)
Department of Education: Bakenberg District
Private Bag X2692
Suswe
0612

29 August, 2003

Dear Mathematics/ Physical Science/ Biology Subject Advisor(s)

Research Project: ***Perceived INSET needs of secondary Mathematics, Physical Science and Biology teachers in the Northern Province***

1. Please receive questionnaires regarding **a survey of perceived INSET needs of Mathematics/ Physical Science/ Biology teachers.** (This research project has the approval of the Department of Education — see attached letter from Superintendent General.)
2. You are kindly requested to distribute the questionnaires to **secondary Mathematics/ Physical Science/ Biology teachers** via principals.
3. Principals should return the completed questionnaires to you not later than **14 September 2000.**
4. The questionnaires will be collected from the District Manager on **21 September 2000.**
5. Should you have any queries regarding this survey or this request, please feel free to contact me telephonically on (015) 268-3364, or via fax on (015) 268-3364 or 268-2965, or via E-mail at "Laugkschr@unin.unorth.ac.za" (no quotes).

Thank you for your assistance and cooperation – it is greatly appreciated!

Yours sincerely,

Dr R C Laugksch

Encl.

SCIENCE TEACHER INVENTORY OF NEEDS (STIN-NP)

SECTION C

Now please answer the following questions about yourself (*kindly shade in your answers on the answer sheet provided*):

50.	The greatest barrier which currently prevents you from greater participation in Mathematics / Physical Science / Biology in-service training workshops in the Northern Province is (*please shade in only one option!*) ***A** = lack of information; **B** = inconvenient time; **C** = inconvenient location; **D** = poor quality of workshops offered; **E** = workshops fail to deal with your needs; **F** = lack of personal energy or motivation; **G** = other (please explain briefly on pages 14-15 of the questionnaire)*
51.	Name of education District in which you teach *Region 1: **A** = Bakenberg; **B** = Mahwelereng; **C** = Palala; **D** = Warmbaths;* *Region 2: **E** = Bochum; **F** = Konekwena; **G** = Mankweng; **H** = Mogodumo; **I** = Polokwane; **J** = Zebediela;* *Region 3: **K** = Malamulele; **L** = Mutale; **M** = Sekgosese; **N** = Soutpansberg; **O** = Thohoyandou; **P** = Vuwani;* *Region 4: **Q** = Giyani; **R** = Phalaborwa;* *Region 5: **S** = Bolobedu; **T** = Hlanganani; **U** = Ritavi; **V** = Thabina;* *Region 6: **W** = Apel; **X** = Bohlabela; **Y** = Dennilton; **Z** = Magakala; **AA** = Nebo; **BB** = Sekhukhune;* *Region 7: **CC** = Acornhoek; **DD** = Bushbuckridge; **EE** = Mkhuhlu*
52.	Total number of Mathematics AND Physical Science AND Biology teachers at your school (including yourself) ***A** = 1; **B** = 2; **C** = 3; **D** = 4; **E** = 5; **F** = 6; **G** = 7; **H** = 8; **I** = 9; **J** = more than 9*
53.	What proportion of your *total* teaching time (i.e., number of lessons) per week do you currently spend teaching Mathematics? (*Please calculate this proportion!*) ***A** = I don't teach this subject; **B** = less than 21%; **C** = 21-40%; **D** = 41-60%; **E** = 61-80%; **F** = more than 80%*
54.	What proportion of your *total* teaching time (i.e., number of lessons) per week do you currently spend teaching Physical Science? (*Please calculate this proportion!*) ***A** = I don't teach this subject; **B** = less than 21%; **C** = 21-40%; **D** = 41-60%; **E** = 61-80%; **F** = more than 80%*
55.	What proportion of your *total* teaching time (i.e., number of lessons) per week do you currently spend teaching Biology? (*Please calculate this proportion!*) ***A** = I don't teach this subject; **B** = less than 21%; **C** = 21-40%; **D** = 41-60%; **E** = 61-80%; **F** = more than 80%*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

56.	You currently teach Mathematics / Physical Science / Biology in grades (*please shade in all options that apply*) ***A** = 8; **B** = 9; **C** = 10; **D** = 11; **E** = 12*
57.	You have a professional qualification to teach (*please shade in all options that apply*) ***A** = Biology; **B** = Physical Science; **C** = General Science ; **D** = Mathematics; **E** = Agricultural Science; **F** = Other*
58.	You are ***A** = male; **B** = female*
59.	Your age group is ***A** = 24 or younger; **B** = 25-30; **C** = 31-40; **D** = 41-50; **E** = over 50*
60.	Years of total classroom teaching experience (i.e., in any subject) ***A** = 3 or less; **B** = 4-10; **C** = 11-20; **D** = 21-30; **E** = over 30*
61.	Years of classroom teaching experience specifically in Mathematics / Physical Science / Biology ***A** = 3 or less; **B** = 4-10; **C** = 11-20; **D** = 21-30; **E** = over 30*
62.	Highest academic level achieved in Mathematics / Physical Science / Biology ***A** = less than Std 10; **B** = Std 10; **C** = 1st year university; **D** = 2nd year university; **E** = 3rd year university; **F** = Honours degree and higher*
63.	Highest professional (i.e., teaching) qualification you hold ***A** = PTC; **B** = SEC; **C** = JSTC; **D** = SED; **E** = PTD; **F** = SSTC; **G** = STD; **H** = UED; **I** = HED; **J** = BScEd/BScPaed; **K** = BAEd/BAPaed; **L** = Other*
64.	Type of school in which you now teach ***A** = rural; **B** = location/township; **C** = urban*
65.	Number of learners in your largest Mathematics / Physical Science / Biology class this year ***A** = less than 20; **B** = 21-30; **C** = 31-50; **D** = 51-70; **E** = more than 70*
66.	Student enrolment in your school this year ***A** = less than 200; **B** = 201-500; **C** = 501-800; **D** = 801-1000; **E** = more than 1000*
67.	Number of in-service training workshops in Mathematics / Physical Science / Biology you attended between January and August this year ***A** = none; **B** = one; **C** = two; **D** = three; **E** = four or more*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

68.	How much confidence do you have in teaching grades 10 to 12 in Mathematics / Physical Science / Biology ***A** = a lot of confidence; **B** = some confidence; **C** = little or no confidence*
69.	When would you prefer to attend in-service training workshops or activities in Mathematics / Physical Science / Biology (*please shade in only one option!*) ***A** = in the afternoon on school days; **B** = on Saturday mornings; **C** = over weekends (i.e., Saturday and Sunday); **D** = during school holidays*
70.	What do you feel is your greatest professional need as a teacher of Mathematics / Physical Science / Biology (*please shade in only one option!*) ***A** = improving classroom organisation/discipline; **B** = improving your teaching skills; **C** =improving your content knowledge; **D** = assessing learner's work; **E** = other (please explain briefly on pages 14-15 of the questionnaire)*
71.	Type of appointment you hold ***A** = permanent post; **B** = temporary post*
72.	What is the approximate number of resources for Mathematics / Physical Science / Biology available outside of school (e.g. construction sites, museums, science centres, etc.) within 100 km of your school ***A** = 0; **B** = 1-3; **C** = 4-6; **D** = 7-10; **E** = over 10*
73.	How would you describe the resources at your school (e.g., laboratories, libraries, etc.) you have available for teaching Mathematics / Physical Science / Biology ***A** = very inadequate; **B** = poor; **C** = adequate; **D** = very adequate; **E** = exceptional*
The following 2 items should be answered by Physical Science / Biology teachers only:	
74.	How often do your learners carry out practical sessions in Physical Science / Biology ***A** = not at all; **B** = less than once a month; **C** = about once a month; **D** = once every 2 weeks; **E** = once every week;*
75.	How adequate are equipment and supplies for conducting practical sessions in Physical Science / Biology at your school? ***A** = none available; **B** = inadequate; **C** = adequate; **D** = more than adequate; **E** = not sure*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

40.	Identify sources of free and locally available teaching materials for Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
41.	Select supportive materials (e.g. library and reference books, videos, etc.) for teaching in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
The following 7 items should be answered by Physical Science / Biology teachers only:	
42.	Demonstrate concepts in Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
43.	Organise (i.e., establish) a laboratory room for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
44.	Carry out a laboratory (i.e., practical) session in Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
45.	Provide for learners' safety during a laboratory (i.e., practical) session in Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
46.	Maintain laboratory (i.e., practical) equipment for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
47.	Construct laboratory (i.e., practical) equipment for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
48.	Select laboratory (i.e., practical) equipment for Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
The following item should be answered by Biology teachers only:	
49.	Maintain live organisms for Biology teaching ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

The questionnaire continues with SECTION C on the next page...

29.	Apply concepts taught in Mathematics / Physical Science / Biology to daily life of learners (i.e., to real-life situations) ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
30.	Conduct a field trip to help learners learn Mathematics / Physical Science / Biology better ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
31.	Employ teaching approaches (i.e., methods) where you are able to concentrate on teaching individuals rather than the whole class in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
32.	Employ teaching approaches (i.e., methods) for teaching large classes in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
33.	Employ teaching approaches that make learners teach each other (i.e., peer tutoring) in Mathematics / Physical Science / Biology lessons ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
34.	Use audio-visual equipment (e.g., overhead projector, cassette or video recorder, etc.) to facilitate teaching in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
35.	Use computers to teach Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
36.	Maintain learner discipline in your Mathematics / Physical Science / Biology classes ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
37.	Evaluate your own teaching effectiveness as a Mathematics / Physical Science / Biology teacher (i.e., become a reflective teacher) ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
38.	Use a computer to help manage teaching (e.g., keeping records of students) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
39.	Organise and manage physical space (e.g., position of learners' desks, etc.) in the Mathematics / Physical Science / Biology classroom to facilitate effective teaching ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

SECTION D

In your opinion, how much of a problem to Mathematics / Physical Science / Biology education in your school is caused by each of the following (*kindly shade in your answers on the answer sheet provided*):

76.	Learners' belief that Mathematics / Physical Science / Biology is less important than other subjects ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
77.	Insufficient school funds for purchasing equipment and supplies needed in teaching Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
78.	Outdated teaching materials (e.g., textbooks) for Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
79.	Lack of learner interest in Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
80.	Lack of parental concern about their children learning Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
81.	Teachers inadequately prepared to teach Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
82.	Class size too large ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
83.	Too many lessons to prepare for each day ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
84.	No colleagues with whom to discuss teaching problems related to Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*

85.	Insufficient problem-solving skills on the part of learners ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
86.	Lack of career role models in the community with respect to mathematics / the physical sciences / biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
87.	Learners' poor language competency in English ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
88.	Insufficient number of textbooks in Mathematics / Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
The following item should be answered by Physical Science / Biology teachers only:	
89.	Inadequate facilities to conduct practicals in Physical Science / Biology ***A** = Not really a problem; **B** = Hardly ever a problem; **C** = Sometimes a problem; **D** = Often a problem; **E** = A serious problem*
SECTION E **How often do you use the following activities in teaching Mathematics / Physical Science / Biology (*please shade in your answers on the answer sheet provided*):**	
90.	Practical activities in which almost all learners get to use apparatus/equipment ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
91.	Field trips outside school for objectives (i.e., outcomes) in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
92.	Peer teaching (i.e., learners teaching other learners) during your lessons in Mathematics / Physical Science / Biology **A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly
93.	Co-operative learning (i.e., small teams of learners working together on directed Mathematics / Physical Science / Biology tasks with each team having a role) ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

17.	Develop lesson plans (i.e., learning activities) which incorporate the history of mathematics / the physical sciences / biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
18.	Develop lesson plans (i.e., learning activities) which integrate Mathematics / Physical Science / Biology with other subjects ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
19.	Design assessment items (e.g., questions or tasks) which assess achievement of learning objectives (i.e., outcomes) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
20.	Use various forms of assessment to identify learning difficulties in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
21.	Develop lesson plans (i.e., learning activities) for topics in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
22.	Select commercially prepared teaching materials (e.g., textbooks, charts, models, etc.) for Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
23.	Develop own teaching materials for Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
24.	Motivate learners to learn Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
25.	Use an inquiry/discovery teaching approach (i.e., method) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
26.	Use hands-on teaching methods in the Mathematics / Physical Science / Biology class ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
27.	Demonstrate process skills (e.g., generalising, defining, etc.) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
28.	Demonstrate manipulative skills (e.g., measuring) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

6.	Update your knowledge of <u>issues</u> in society related to Mathematics / Physical Science / Biology (e.g., economics, electrification, HIV/AIDS, etc.) ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
7.	Update your knowledge of the way in which learners learn Mathematics / Physical Science / Biology in a <u>multicultural</u> society ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
8.	Update your knowledge of learning to include a <u>constructivist</u> approach to learning Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
9.	Improve your <u>content knowledge</u> of Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
10.	Update your knowledge of how mathematics / the physical sciences / biology is <u>used</u> in society ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
11.	Update your knowledge and skills in ***A** = Geometry; **B** = Algebra; **C** = Calculus; **D** = Trigonometry; **E** = not applicable (Physical Science / Biology teacher)*
12.	Update your knowledge of the <u>history</u> of mathematics / the physical sciences / biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
13.	Identify learning objectives (i.e., outcomes) which specify <u>knowledge</u> needed by learners in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
14.	Identify learning objectives (i.e., outcomes) which specify <u>attitudes</u> learners need to develop toward Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
15.	Identify learning objectives (i.e., outcomes) which specify <u>skills</u> learners need to develop in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
16.	Identify learning objectives (i.e., outcomes) which are appropriate for promoting <u>multicultural</u> ways of learning in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

REMEMBER – please complete this questionnaire with respect to the professional needs of **EITHER** a **Mathematics** teacher, **OR** a **Physical Science** teacher, **OR** a **Biology** teacher, depending on your answer to question 2!

94.	Demonstrations by teacher in Mathematics / Physical Science / Biology **A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly
95.	Inquiry/discovery teaching approach in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
96.	Teaching approach where you are able to concentrate on teaching <u>individuals</u> rather than the whole class in Mathematics / Physical Science / Biology ***A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly*
97.	Problem-solving approach in Mathematics / Physical Science / Biology **A** = never; **B** = less than monthly; **C** = once a month; **D** = every 2 weeks; **E** = weekly
SECTION F	
98.	Please fill in your school's 9-digit EMIS number (i.e., reference number) on the answer sheet provided. (*If you do not know your school's EMIS number, please ask your <u>Principal</u>, who will be able to supply it.*) <u>Note</u>: The only reason for asking you to provide this information is for us to be able to calculate the proportion of schools we have covered in our survey.

You have reached the end of the questionnaire - please make sure you have responded to <u>all</u> items.

When you have completed the answer sheet, kindly return the <u>entire</u> booklet to your *Curriculum Advisor* <u>via</u> your Principal.

Please return the booklet *as soon as possible*, *<u>but not later than 14 September 2000</u>*!

Thank you for your assistance in this survey – it is <u>greatly</u> appreciated!

PAGE FOR YOUR EXPLANATIONS, COMMENTS, AND/OR SUGGESTIONS

Please use this page to write your explanations (e.g., to questions 50 and 70), as well as comments and/or suggestions with respect to additional professional needs that you feel are of great importance.

Please start here (and kindly respond to all questions):

SECTION A	
1.	Which of the following subjects do you teach this term? (*If all options apply, please shade in all three options on the answer sheet provided!*) ***A** = Mathematics; **B** = Physical Science; **C** = Biology*
2.	In which of the following subjects do you teach the most lessons per week this term? (*Please shade in only **one** option on the answer sheet provided!*) ***A** = Mathematics; **B** = Physical Science; **C** = Biology;* **IMPORTANT** **Please note that you should complete this questionnaire with respect to the professional needs of EITHER a Mathematics teacher, OR a Physical Science teacher, OR a Biology teacher, *depending on the subject in which you teach the most lessons per week this year* (i.e., depending on your answer to question 2)!** Hence, • if you have shaded in option **A** in Question 2 above, please regard yourself as a **Mathematics** teacher for purposes of filling in this questionnaire; • if you have shaded in option **B** in Question 2 above, please regard yourself as a **Physical Science** teacher for purposes of filling in this questionnaire; and • if you have shaded in option **C** in Question 2 above, please regard yourself as a **Biology** teacher for purposes of filling in this questionnaire.
SECTION B **The following items relate to your professional needs as a teacher of Mathematics OR Physical Science OR Biology. Please respond to each item. (*Shade in your answers on the answer sheet provided at the back of the booklet.*)** **Is there a need for you to:**	
3.	Develop skills in recognising and correcting common misconceptions in Mathematics / Physical Science / Biology among your learners ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
4.	Update your knowledge of career opportunities for learners related to Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*
5.	Update your knowledge of effective teaching approaches (i.e., methods) in Mathematics / Physical Science / Biology ***A** = not familiar; **B** = no need; **C** = little need; **D** = moderate need; **E** = great need*

SCIENCE TEACHER INVENTORY OF NEEDS – NORTHERN PROVINCE (STIN-NP)

INSTRUCTIONS AND GUIDELINES

This questionnaire has been designed to help you to express your needs as a classroom teacher of Mathematics / Physical Science / Biology. Each item is composed of statements and a scale on which to shade your reaction to the statement. The statements describe tasks which a teacher of Mathematics / Physical Science / Biology may be called upon to perform. Following each item number on the answer sheet (on page 16 at the back of the booklet) is a scale marked **A**, **B**, **C**, **D**, and **E**. Use this scale for items in **Section B** of the questionnaire:

A = not familiar
B = no need
C = little need
D = moderate need
E = great need

Here is an example of an item (i.e., professional need):

Employ a learner-centred approach to teaching

In responding to this item, you are asked to shade in on the answer sheet the **one** letter that best describes the degree to which you feel a need for help with that task. (Please use only a **black/ blue** pen or a **pencil!**) *If you are not familiar with the learner-centred approach, you shade in response **A** for this item. **B** represents the absence of need, while **C**, **D**, and **E** represent increasing levels of need for assistance in improving your skill on the task.*

Please note that this survey is anonymous and that in the results no individual or school will be identified!

If you would like to suggest additional item/s that you feel are of great need, please write them on pages 14 and 15 of the questionnaire. **Please return the entire booklet (i.e., questionnaire) to us!**

Let's begin then...

Answer sheet continued . . . (Start on previous page)

SECTION D:

76	A B C D E	81	A B C D E	86	A B C D E
77	A B C D E	82	A B C D E	87	A B C D E
78	A B C D E	83	A B C D E	88	A B C D E
79	A B C D E	84	A B C D E		
80	A B C D E	85	A B C D E		

For teachers of Physical Science / Biology only

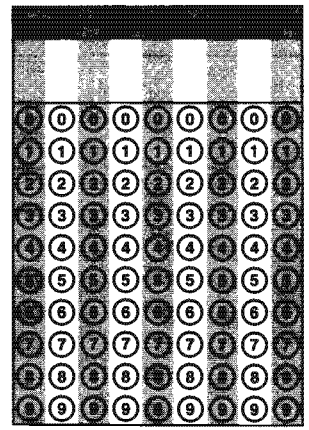
89 A B C D E

SECTION E:

90	A B C D E	95	A B C D E
91	A B C D E	96	A B C D E
92	A B C D E	97	A B C D E
93	A B C D E		
94	A B C D E		

SECTION F:

98



If you do not know your school's EMIS number, please ask your principal who will be able to supply it to you.

Thank you for your assistance - it is greatly appreciated. Please return the entire booklet to your Curriculum Advisor via your Principal.

Kindly return the booklet as soon as possible but not later than 14 September 2000!

UNIQUE NUMBER

6736

DESIGNED BY MGX (011) 458-6560 JULY 2000 MGX341

DMSTE

NEW DEPARTMENT OF MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION

University of the North

The University of the North has long seen the need to develop a department in the area of Mathematics, Science and Technology Education. The university has been successful in obtaining funding from Billiton and ISCOR to help set up such a department. The vision of our fast growing department is to enhance the teaching and learning of Mathematics, Science and Technology in the Northern Province through:

- The design of an educator career path consisting of quality programmes;
- Educational research of local and global relevance;
- Community involvement through NGO linkages, donor projects etc.

Programmes on offer	Contact details
Bachelor of Education, first degree B.Ed. Mathematics and B.Ed. Science ***Advanced Certificate in Education*** ACE Mathematics and ACE Science ***Bachelor of Education (Honours)*** ***Post Graduate Diploma in Education*** PGDE Mathematics and PGDE Science ***Master's Degree in Education*** M.Ed. Mathematics Education M.Ed. Science Education ***Doctoral Degrees in Education***	**Postal address** Department of Mathematics, Science and Technology Education, University of the North, Private Bag X 1106, 0727 Sovenga. **Visiting address:** Old R-block, University of the North, Turfloop, Northern Province Tel: (015) 268 2875/3006/2415 Fax: (015) 268 2965

UNIVERSITY OF THE NORTH

Department of Mathematics, Science and Technology Education

IN-SERVICE TRAINING NEEDS OF SECONDARY *MATHEMATICS, PHYSICAL SCIENCE,* AND *BIOLOGY* TEACHERS IN THE NORTHERN PROVINCE – A SURVEY OF TEACHERS' VIEWS

14 August 2000

Dear Teacher,

You have been selected to participate in a province-wide survey of professional needs felt by secondary **Mathematics / Physical Science / Biology** teachers in the Northern Province. Perhaps you felt that no one cared about your problems or wished to help you improve or acquire skills to develop your teaching effectiveness further. The attached questionnaire can be the first step in assisting you!

Please take a few minutes from your busy schedule to help us find out what Northern Province secondary Mathematics / Physical Science / Biology teachers need most to improve the quality of their teaching. (Please note that the survey is anonymous: you do not need to give your name!) The results of this survey are expected to have a positive impact on the planning and provision of suitable, effective and continued in-service education and training (INSET) activities in Mathematics / Physical Science / Biology in the Northern Province. In order to be effective, INSET activities must recognise your professional needs as **you** see them – your participation in this survey is therefore very important!

Please return the completed answer sheet together with this booklet to your Curriculum Adviser via your Principal *as soon as possible*, but not later than *14 September 2000*.

Thank you for helping us to help you!

Dr RC Laugksch
(Research Project Co-ordinator)

APPENDIX D

STIN-NP COMMENTS AND SUGGESTIONS FROM THE FREE RESPONSE SECTION

Question naire no.	District	Item no.	Comments
3823	Hlangan ani	76	Importance of maths compromised by subject streams (76)
		24	Motivating repeaters. (24)
3824	"	50	No workshops (50)
3843	"	9	No incentives to study further (9, 11)
		50	Lack of INSET workshops (50)
		32	Overcrowded classes hamper individual attention. (32)
		80	Parents should help their children with maths (80)
1204	Bochum	50	No workshops (50)
		83 & 84	No colleagues to help one another as one educator teaches maths from grade 8-12. (83 & 84)
		34	Lack of resources, e.g. audio-visual equipment (34)
		35	Lack of computers (35)
1370	"	50	Lack of information (50)
1440	"	40	Lack of equipments
4125	Ritavi	73	No laboratory and library (73)
		34 & 35	Lack of audio-visual equipments & computers (34 & 35)
1155	Warmba ths	50	Lack of information (50)
4687	"	5	Need information on OBE
4730	"	9	Educators should upgrade their qualifications
		11	Science & Maths committees to be established from district to provincial level, to help educators with the necessary knowledge and skills
4734	"	50	No workshops
		70	Information received late
4481	Bohlabe la	85	Learners lack basic knowledge and skills (85)
		72	All learners should have access to institutions with resources (72)
		80	Parents should be able to help their children (80)
4567	"	50	Workshops only for grade 12
4620	"	50	Workshops to be conducted monthly and their quality needs to be improved
		24	Learners need to be encouraged to practice maths
2616	Malamu lele	24	To instill a positive attitude in learners towards maths. (24)
		85	Learners lack problem solving skills (85)
2606	"	80	Lack of parental concern (80)
		73	Lack of resources (73)
		24	Lack of motivation (24)
		86	Lack of role models (86)
		36	Lack of learner discipline (36)
2777	"	70	Motivating learners to do homeworks and assignments (24)
2847	Mutale	32	Overcrowded classes
		50	Improve the quality of workshops
4415	Apel	70	Lack of funds to join AMESA

5523	Sekhukhune	50	No workshops
5470	"	50	Workshops fail to meet needs
		5	Lack of teaching skills, appropriate methodologies and
		24	strategies
		72	Nurture learner interest
			Lack of resources
5098	Nebo	50	Poor quality of workshops and information should come well in advance.
4764	Dennilton	24	Students' attitude and interest
		36	Lack of discipline
6805	Bushbuckridge	24	Motivating learners with regard to the importance of maths
		69	Workshops should be held thrice a month during weekends or school holidays
5764	"	79	Learners lack interest as they are forced to learn mathematics
6808	"	5	Improving skills and methods of approaching topics in maths
		29	Applying concepts taught in mathematics to daily life of
		50	learners
			Lack of information and workshops fail to deal educators' needs
3234	Vuwani	50	Information comes late
			Lack of information on what the workshop is about
0684	Bakenberg	70	Improving content knowledge and teaching skills are inseparable
0644	"	50	No in-service training workshops were held
0692	"	50	No in-service training workshops were conducted
4143	Thabina	5	Learn new skills/methods of teaching maths
4150	"	5	Improve methods of teaching maths
4157	"	50	Workshops should be sustained to be taken seriously
		70	Problem solving skills
4161	"	36	Learner discipline should be highly considered
4188	"	50	No in-service workshops were conducted
		70	Motivating learners to like and appreciate maths
			Peer teaching
0069	Mkhuhlu	50	No in-service training workshops held
1040	Phalala	50	No in-service workshops held
3573	Bolobedu	88	Shortage of textbooks
		82	Overcrowded classes
3302	Giyani	50	No workshops by the department of education
3303	"	70	Integration of improving content knowledge and teaching skills
3403	"	87	Language problem on the part of learners
		79	Lack of learner interest
6960	Polokwane	50	Poor quality of workshops
		70	Improving teaching skills with regard to the learner-centred approach
2240	"	36	Maintain learner discipline in class
		82	Large number of learners in a class
2239	"	50	No mathematics workshops held

2541	Zebediela	50	No workshops organized
		79	Encourage learners to have a positive attitude towards maths
		88	Learners do not have textbooks or study guides
2577	"	50	No workshops organized
6416	Kone-Kwena	50	No workshops for maths teaching, only grade 12 CASS workshops.
		70	Workshops should be organized for lower grades, to lay proper foundation for higher grades.
			Teaching skills that accommodate all groups of learners
6459	"	50	Workshops are held in urban areas, which is far from where one stays
6339	"	11	Update knowledge and skills in all sections of maths
6362	"	73	Lack of resources and facilities
6581	"	88	Resources should be in greater numbers.
		80	Parents should be interested and try to motivate their kids
2061	Mogodumo	5	Revisit teaching methods and be retrained to be learner-centred
		79	Lack of interest
2108	"	50	No in-service training workshops
6870	"	50	No in-service training workshops
		9	Improving content knowledge
		79	Improving learner attitude
		29	Using mathematical skills in everyday life
		4	Prepare learners for relevant careers with mathematics
2139	"	50	Workshops are held at 14h00 and far from one's school
0242	Soutpansberg	50	Workshops not meant for the grades one teaches. Sometimes only one teacher attends if it is during working hours, so that teaching cannot lag behind. In some cases, there are no workshops, or they are not sufficient for that year.
		24	Always faced with learners with poor motivation, need to improve in motivating learners
5941	"	50	INSET offered inadequate.
		5	Emphasis on content, instead of how an educator can successfully teach learners in different conditions experienced
		24	in the classroom.
		29	How to instill interest in mathematics to learners.
			INSET should also focus on how the educator should teach learners the application of mathematics in daily life situation.
			Theory and practice should supplement each other in every lesson.

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**Department of Mathematics,
Science and Technology
Education**

The District Manager: Hlanganani District
Department of Education
Private Bag X5006
Vongani
0853

31 August 2000

Dear Mr. Khoza,

Research Project: ***Perceived INSET needs of secondary Mathematics, Physical Science and Biology teachers in the Northern Province***

1. Our telephone conversation of this morning, and my letter of 18 July 2000 in the above regard, refers.
2. I would be grateful if you would be able to identify a total of about 8-10 secondary teachers each for Mathematics (grade 10-12), Physical Science (grade 10-12), and Biology (grade 10-12) at schools in close proximity of the District Office whom we - the research team - could interview with respect to their perceived INSET needs.
3. We would like to interview the three groups of teachers on 19 September 2000 at your District Office at a convenient time, say at 12h00 or 13h00.
4. Teachers of Mathematics, Physical Science, and Biology will be interviewed separately but simultaneously, i.e. three venues would be required.
5. Kindly confirm the arrangements with me telephonically on (015) 268-3364.

Thank you very much for your assistance and cooperation!

Yours sincerely,

Dr R C Laugksch

APPENDIX E

INTERVIEWS

BOCHUM INTERVIEWS

Introduction

There were ten interviewees: five male and five female teachers, all from rural schools (one an ELSEN school). Seven of them taught grade 8-12; one grade 10-12; one grade 9-12 and one grade 8 & 9. The interviewer briefly explained the purpose of the interview (to establish INSET needs of teachers) and also asked the teachers' permission to record the interview. Teachers were also made aware that the interview would be anonymous. Teachers were allocated numbers T1 to T10 to identify them.

I: **If you want to improve your teaching skills to address problems you encounter in your classroom situation, what kind of skills would you like to acquire to help you to become a better Mathematics teacher?**

T4: I would like to be helped with *skills of teaching larger classes (n32),* overpopulated classes, because I have a problem with that.

I: **How large is your average class?**

T4: 60-90 learners per class.

I: **You generally have a problem in teaching large classes, i.e. you would like to be helped in how to manage teaching large classes. Any concerns? What kind of skills would you like you acquire?**

T3: The skill of *being able to explain concepts and relate those concepts to conditions or materials around the environment in which students live (n29).*

I: **Being able to relate Mathematics to real life situations, i.e. how Mathematics is used in our society. Many learners find Mathematics difficult and abstract, so it is a**

challenge to teachers to help learners see the value of Mathematics outside the classroom situation.

In which area do you need help the most?

a) improving organisation of learners in a class, b) improving skills to teach Mathematics, c) improving content knowledge of Mathematics and d) how to assess learners.

T1: In my case it is *improving skills of teaching Maths (n5/11).*

T2: *Assessing learners (n19/20).*

I: What about others? What is the most important issue you would like to be helped with?

T5: *Improving skills to be able to teach Maths (n5/11).*

I: I would like to find out from all of you so that I can say these are the pressing issues here.

T6: *Improving skills (n5/11).*

T7: *Improving skills (n5/11),* if this is addressed all others will follow.

T8: *Skills (n5/11).*

T9: *Skills (n5/11).*

T10: *Skills (n5/11).*

I: Skills. You have content, you need the how part.
What about developing a lesson, identifying objectives?

T1: Not in all sections, *mostly in Trigonometry (n11).* Learners would like to know *how Trigonometry is going to help them (n10/29),* where are they going to use it. So you are dealing with why are you teaching them Trigonometry.

I: It goes back to the question of how does one relate Maths to real life situations.

T4: Developing a lesson plan is a problem. You can go to class with a prepared lesson but fail to finish it in time, because you have not clearly identified objectives. This means

you are bringing in some other things in to the lesson, which are not necessarily the objectives. So there is a *problem of developing a clear lesson plan (n21).*

I: **Is there anybody who would like to be helped with individualised teaching? So you are all comfortable with this. Then, what about using different teaching aids? As a teacher you must be able to develop your own teaching aids or improvise, since there are very few aids in most schools. Do you think that can be a need? That is, to be able to develop your own teaching aids.**

T3: *It goes back to skills (n5/11).* Being able to *relate Maths content to situations in which students live (n29)* will help the teacher to come up with his or her own teaching materials without relying heavily on textbooks or on what the school has to offer. For example, one can draw a soccer field when teaching trigonometry, with circles and everything.

I: **So you need to be helped with teaching skills, how to develop a lesson, identifying objectives and developing own teaching aids that will help you and your learners to achieve objectives.**
What about other sections, do you want to improve your skills in Trigonometry only, or in all sections?

T4: *In all sections (n11),* one might have a problem with Trigonometry, another with Algebra, Geometry or Calculus.

I: **Madam identified Trigonometry as her problem area, what about others, I would like each one of you to indicate the section in which you really need help.**

T2: *Calculus (n11)*
T3: *Calculus (n11)*
T4: *Calculus (n11)*
T5: *Calculus (n11)*

T6: *Trigonometry (n11)*

T7: *Trigonometry (n11)*

T8: *All sections (n11)*

T9: *All sections (n11)*

T10: *Linear programming (n11)*

I: Basically you need skills in all sections of Maths; how to manage large classes, preparing lessons; developing own teaching aids; and identifying objectives. What else are we leaving out? I need to hear more from you. What other important needs do you want to be addressed?

T2: To be a successful teacher, *learners should also be motivated (n24).*

T3: *Encourage learners to love the subject (n24).* In most cases Maths is compulsory, but *learners do not like Maths (n14),* it is like forcing them to do something they do not like. Some teachers also say Maths is difficult, that must stop. We must *encourage pupils to love all subjects that they do (n24),* even *parents (80).*

I: I think he has said a mouthful, is there anybody who would like to add on what he has said?

T4: I think the other thing that we will be comfortable with is the level of assistance. If everything that we give to learners during the course of the year is at the level of the examinations that will be better. As of now, we give learners what we think can be the memorandum, but at the end of the year they find that the standard is too high and they cannot cope. I do not know how we can *improve the level of assessment (n19/20).*

I: Assessment is the issue here, if you can be able to assess learners appropriately, that will improve learners' achievement.
Assessing learners; skills of preparing own teaching materials and lesson plans according to identified objectives; managing to teach large classes and relating Maths to real life situations in order to be able to motivate learners to love Maths. I am trying to wrap up, are these your most important needs?

T3: In most cases, what makes us not to master our subject is that *teachers teach every subject in a grade, because of teacher pupil ratio (n83).* I am teaching Maths, Science and Agriculture of which some I am not even trained to teach, because of lack of teachers. We are obliged to teach these though I may be killing the next teacher up. That is why most learners go to the next grade knowing only half of what they are supposed to know.

I: Another problem is that of work overload, due to understaffing. Is it experienced by all of you?

T1: *I am a Science teacher, but I also teach languages, so it is strenuous (n83).*

T2: I am the only *Maths teacher from grade 8-12, I also teach Afrikaans grade 11 & 12 (n83).*

T4: I am the *only Maths teacher from grade 8-12 (n83).*

T5: I am the *only Maths teacher from grade 8-12 (n83).*

T6: I am the *only Maths teacher from grade 8-12, I also teach Northern Sotho grade 11 & 12 (n83).*

T7: I teach *Maths grade 8-12, General Science grade 9 & Northern Sotho grade 8 (n83).*

T8: I teach *Maths grade 9-12 & Physical Science grade 10-12 (n83).* I am the only Maths and Physical Science teacher.

T9: We are two, I am *teaching grade 8-12 (n83)*, in grade 11&12 we share papers. I teach Maths only.

T10: I am *teaching grade 8-12 (n83)*, but we are sharing grade 11 & 12. I teach second paper, the other one first paper. The problem is just that the *classes are overcrowded (n32/82).* We are unable to do individualised teaching.

I: There is a general problem of having too many preparations for different grades, so it kills your enthusiasm and morale.

T1: I want to add to the question of mastery. Looking at my situation, I am *teaching Maths grade10-12, General Science grade 8 & 9, Afrikaans grade 8 and Agriculture 10 (n83).* I have less than five free periods per week, and it is too much for one person.

I: **everything Can we say we have discussed that we want to be addressed in future workshops?**

T2: The biggest problem is *discipline in our schools (n36).* Pupils do what they want, it is their right. *They do not do homeworks and classworks (n36),* e.g. they say they don't have a pen or they say they have forgotten to do their homework.

T1: Class discipline or discipline in general cannot be addressed in workshops, it is an administrative and management matter, it should be taken up with the principal and the SGB. I would like to raise a question of recognition. If people can be given a certificate after attending a workshop, that will *motivate teachers (new).* If for example, a particular section has been treated in a workshop and teachers are accredited for that, that will be better.

I: Recognition is important to motivate teachers.

T2: We must *have programmes in advance (n50)* of what is going to be treated in the workshop. Sometimes we go to workshops without knowing what is going to be discussed. I want to prepare myself beforehand, questions, problem areas, etc.

T4: Another important factor is calling *workshops for two subjects on the same day (n83).* Since we are teaching more than one subject, it will be appreciated if one subject is called per day.

I: **Which time is convenient for you to attend workshops? After school, Saturdays, school holidays?**

T2: *Weekdays in the morning (n69),* i.e. during school hours as in the afternoon we will have transport problems. Maybe even *during school holidays (n69).*

I: **Policy states that no teacher should be taken out of the classroom.**

T3: We attend workshops for the benefit of learners, so *during school hours is better (n69).* If it is after school, or holidays no principal can blame me that I have not attended but during school hours I must give a report.

I: Can we close? Did you air all your concerns and problems?

T3: One other thing I am worried about is *textbook supplies (n22/23/78).* They are not productive, I have ordered some study guides from Cape Town and their standard is not equivalent to that of textbooks. Learners cannot benefit from them.

I: Are you saying they are outdated or are of low standard?

T1: *They are outdated (n78),* hence they cannot match the standard of how exams are set.

I: Any other input?

T2: *Textbooks have less information (n19),* it is not meeting the requirements of how exams are set. *There are few exercises (n19),* for instance in Geometry after a theorem there are 2 or 3 exercises, and that is not enough for learners to master or apply the theorem.

Tc: *We need to work as a group (n84)* so that such problems can be addressed. Since we are not using the same textbooks, I can be able to lend other teachers mine, i.e. exchange textbooks and information for the benefit of the area. We will try to raise the level of Mathematics performance in the area.

I: Can we round up?

T4: I would like to encourage my colleagues and other teachers to make our classrooms more attractive. How about if a teacher and learners can take charts and draw various theorems, and paste them on the wall so that when the learners come to the maths class they must feel that they are in a maths classroom. You find that maths classrooms cannot be differentiated from other classrooms, where you find that there is no chart or anything that shows that this is a maths classroom. So how about if we *involve our learners so that*

they must work (n24), they must know how to construct theorems, they must see them daily.

T5: I agree with her but it can only be possible if learners can move from class to class. If the teachers go to classrooms, it will be a bit difficult and time consuming.

T6: Learners can still be involved by drawing the theorems in their workbooks or notebooks or on small charts which learners can keep. *Learner involvement is primary (n24).*

Conclusion

The interviewer thanked the interviewees for participating in the interview. She also indicated that their contributions were highly valuable, and that their opinions would help in addressing their professional needs

POLOKWANE INTERVIEWS

PART 1: BOKAMOSO HIGH SCHOOL

Introduction

There were seven teachers: one female and six male, all teaching at township schools. Each one taught different grades: grade 8; grade 10; grade 9 & 11; grade 9 &12; grade 8, 10-12; grade 10-12; grade 11 &12. The interviewer briefly explained the purpose of the interview (to establish INSET needs of teachers) and also asked the teachers' permission to record the interview. Teachers were also made aware that the interview would be anonymous. Teachers were allocated numbers one to eight (i.e., T1 to T8) in order to identify them.

I: **If you want to improve your classroom situation regarding teaching and learning maths, what skills would you like to acquire in addition to what you already have?**

T1: *Learner-centred skills (n5), demonstration approaches (n94), project works, discussions (n5).*

I: **Learner-centred approach, what about others?**

T2: *Group work discussions (n5).*

T3: *Group work discussions (n5).*

T4: Teachers also need a lot of training from NGO's and Department of Education. Because usually what we are doing, *we are still using the system we inherited from our old teachers (n5)*, so there is no improvement in our teaching fields and at the end of the day, we end up being frustrated because we are not coping with this new system which is now in place.

I: The new system what exactly do you mean?

T1: I mean *in teaching and learning there are a lot of changes (n5)*, and of which we teachers still approach everything with the system we were taught long ago, so there are a lot of changes which are in place. So I think it will be good for us if we get a lot of training and support from the Department.

I: Regarding what? New methods or ways of teaching?

T1: *New methods of teaching (n5)*, how we can implement new strategies and all those kind of things.

I: So you would like to be helped with new methods like hands on methods, group work, so mostly the ones he mentioned, learners-centred approach, teamwork.

T4: How can we change the whole system in order to cope with what we are going through now?

T1: Or maybe inculcate as a form of OBE approach, *a method of CASS, it comes to teaching method which maybe implemented in that regard (n5); use audio-visual aids (n34),* all these supplementary teaching material, i.e. the support material that is sophisticated more than the primitive style of teaching. For instance we may *use overhead projectors, TV's (n34), computers (n35)* as it is necessary to the type of education we need for today's learners.

I: So, you need help in using various teaching learning materials, new technologies.

T2: I just want to add on what they have already said. Our learners these days are not like the old ones, because these ones need more activities than just sitting down and learning. So *we need to have a good approach towards their kind of learning (n5)*, they need learning where there is some exercise and some activity so that they can learn more.

I: Basically you are concerned with improving teaching skills based on the new methods which are learner-centred, where learners will be actively involved in the classroom rather than being passive. Anything to add to that?

Regarding classroom organisation, teaching skills, which you've really emphasised, content knowledge and assessing learners; which one of the four is your greatest professional need?

T4: I think is *teaching skills (n5).*

T1: *Classroom organisation (n36/39).*

T2: *Classroom organisation (n36/39).*

T3: *Content knowledge (n9).*

T5: *Classroom organisation (n36/39).*

T6: *Classroom organisation (n36/39).*

I: In terms of classroom organisation, what kind of help do you need?

T2: *Teacher-pupil ratio must be limited (n32/82).* The teacher must be able to reach every child.

I: You mean help in teaching overcrowded classes.

T1: That is quite basic to say, addition to that will come to discipline type of atmosphere, which is *disciplined for the necessary flow of knowledge to take place (n36).*

T3: Which *includes time management, personal management (n36).* In fact it is a broader concept because it *incorporates in itself CASS and teaching skills (n5).*

T5: I think in most cases, we find it difficult to teach learners because they are *overcrowded in a class (n32/82),* it is *difficult for a teacher to teach discipline (n36)* and the mathematical charts that must be displayed in the Maths class so that learners can see Maths wherever they are.

I: Okay, so basically you are having a problem with teaching overcrowded classes. Another one talked about content knowledge, we've got different sections in Maths, which one would you like to be helped with: algebra, geometry?

T3: *Geometry, theorems (n11).*

I: So, he is the only one who has a need for content knowledge. So is it safe to say you have content knowledge, you only need skills?

T2: We must know *how to integrate Maths with the society (n10/29).* Can I just add geometry, *we don't know how it is applied in the society (n10).*

I: So the concern is to be helped in trying to relate Maths to real life situations so that learners know how to use maths outside the classroom situation.

T4: Okay, I talked about *teaching skills (n5)*, like what I have indicated in the beginning, we need a lot of support and training. I think the knowledge is there which we have inherited long ago, but how do we implement, *how do we teach that particular content (n5),* how do we manage to *integrate the content to the life in general (nn29)?*

I: How large are your classes?

T2: Between 60-70.

T1: About 23, I have a learner content of 23. So, this is an exceptional case, because mine is still a developing school.

T3: About 80.

T4: More or less 60.

T5: My largest one is 69.

T6: 68.

T7: Between 60 and 68.

I: How large is your roll?

T1: The roll is between 150 & 200

T2: 750

T3: 750

T4: 960

T5: 600

T6: 500

T7: 750

I: What other issues do you feel are still outstanding, we haven't touched in the questionnaire, and you feel that you need those to be addressed in future workshops, be it NGO's, the department or any other service provider.

T1: Issues which are centred around practicality. We are so devastated by the government that actually theorises the whole system of maths and other science subjects. In terms of sending people here, who would guide us through the subjects but, theory-based. We need to see the *practical implementation (n34/41)* in display. When those people come, they should actually demonstrate by using what we are expected to also use in the classroom. That will mean *provision of these necessary tools (n41/73)* by the government. Therefore we start from the point of budgeting and all that, but then provision must be done, we needn't enter into the real politics of the budget for education and all that, but then we don't have proper tools.

I: By the way, remember that the government stresses improvisation, they say they don't have money. So, I think maybe your point can be that whoever is coming to help you, should demonstrate. Demonstration of whatever, say maybe if you are having a problem with learner-centred approach, then whoever is going to help you should come and demonstrate how that should be done practically with your learners in class, is that what you are saying?

T1: On the question of improvisation, madam, based on the suggested system of OBE, how do I improvise technology? I may improvise some basic tools like the squares and angles for arithmetic. Now these were done in the past. Now I need to point to the learner how a programme is fitted into the computer, *how to go through finding answers from the computer of complex mathematical problems (n35*) and that and demonstration in itself, for instance our learners are not acquinted with the *uses of a simple overhead projector (n34)*. These people when they come for these workshops, they don't bring with them the

material, such that the practical scene would ensue in a classroom situation. They may come here, and group us like learners and perhaps, start to actually emphasise what we already have in our normal classes. Now they teach us what we know.

I: **Okay I get your point, so you want that which you are not familiar with. Bring overhead projectors, use them, so that you also see how they operate.**

T1: Believe me, some of these teachers around here, I'm not painting them black, they *don't know how to operate an overhead projector (n34).*

I: **No, I agree with you there, I mean if it's not there, how can you know how to operate that. So, we have his concern: practicality, demonstration of the skills you need. And sir, you caught us in the middle of the discussion. What is your pressing need as a maths teacher, which you would like to be helped with, so that you can be a better maths** teacher?

T7: Even my concern is just the materials, *we are running short of materials, these new textbooks and so on (n23/40/88).* So my main concern is that one of *overcrowded classes (n32/82).* I don't know how to, we don't have that effective teaching in classes, *no discipline in classes (n36).*

I: Textbooks are outdated, you don't have the new ones; overcrowded classes and lack of class discipline. So these are your main concerns.

T7: Even in this one of the prescribed Classroom Maths. So, *it doesn't have a lot of information, especially maybe on grade 12 (n19/22/78).* We are doing exercises in that very textbook, but *questions in the exam, they differ from what learners were doing (n19/22/23).* So, I think it's not adequate.

I: **So, some of the textbooks which have been prescribed for you do not have enough information which can help your learners. And, you have something to say?**

T5: The problem of textbooks is what we are having here at our school. *We don't have even one textbook for grade 11 (n23/88)*, so we just teach them, they rely on our notes. So, it's the problem we are facing.

I: So, no supply of textbooks?

T5: *We don't have textbooks (n23/88).*

T4: And *we keep on making a lot of requisitions to the department, but there is no answer (n23/88).* We wait and wait until we wait no more. It also frustrates us.

I: Okay, no, that one I don't know of, requisitions which end up somewhere, but not where they are supposed to be. So, I would like to round up what we were saying. Unless somebody is having something more, I just want to check as to whether I have all your concerns: You are practically worried about teaching skills, you want help regarding how to teach maths using the new approaches. Somebody even mentioned OBE, I think basically the new approach which is learner-centred, group discussions, using hands-on and so on. Those are the things you would like to be helped with. How to manage overcrowded classes, assessing learners and demonstration of concepts practically and even how to use teaching aids like audio-video materials, overhead projectors, and the like, and what else?

T1: *Integration of the taught content in the classroom with the outside world. Being able to relate that to real life situations (n29).*

I: By the way we are all reflecting, what else didn't I mention that you feel is your main concern?

T2: *Outdated textbooks (n22/23/78).* There should be supply of new textbooks.

I: By new textbooks, are you referring to OBE textbooks or textbooks used in the interim core syllabus?

T2: Textbooks that will be suitable for teaching skills that will be used.

T1: Shall we perhaps put it under an umbrella here, by saying the *learning support materials which will not basically point to the textbooks (n22/23/40),* as OBE stretches its horizons further than that. We also need correlating materials that will sort of *marry maths with other fields of studies (n18)*, say EMS and other others which are also part of the field that falls under MLMMS.

I: MLMMS, that's your learning area.

T1: So, we need to *move away from the textbook as a core source of information (n22/23/41)*, and *visit other fields of studies and incorporate them into the field of maths (n18).*

I: I am happy it seems you have already attended the OBE workshops; meaning that in being helped, you also want some ideas of how to use other resources, and how even maybe to construct your own teaching materials, not just rely on textbooks. I mean, given how broad what you are going to do is, then, you must be able to be resourceful on your own, know where to get materials, how to get it and also integration of your learning area as it is now known, with other learning areas. So, what is your main concern, this new methodology. Don't just want textbooks, but everything that goes with the new methodology. So, can I say these are all the concerns you are having? If you are called upon in any INSET activity or workshop, these are things which you want to be addressed by the workshops, not something you already know, the content you already know. You want skills.

T2: So far, yes.

T3: And if ever we are going to have such workshops, can we say we request the service providers to *organise their workshops in time, to let us know in time (n50)*, so that we prepare ourselves, and those workshops don't temper with our programmes. Because what happens sometimes people just pop in at the eleventh hour and we did not know all along about their coming, so it also inconveniences us. So, if ever there are going to be workshops, let it be brought forward to us in time, so that we prepare ourselves, and not

late in the year. If you are going to implement whatever thing, let it be as early as in the beginning of the year, so that we are able to go and implement, and not to say we only get these workshops maybe for the next year.

T1: And the question of frequency as well, as to the periods, the intervals through which hese are conducted. *We do not need to wait for a long time to get an update, that is recent in maths (new).* You find that we are behind time always, we are rushing behind time, and hence finding ourselves pressurised to achieve much in a little space of time. If we are *informed of the proper dates of attendance, as well as to sort of having a programme (n50),* perhaps for the year that there will be a course in March, there will be a course in June. You sort of also schedule your life programme to suit what is needed from the department.

I: So, actually, you are trying to tell me barriers which might prevent you from attending workshops. If you don't know in advance, you might find that you are having some other plans.

T1: Because if you tell me now that I have a course to attend on Wednesday, and already on Wednesday I have a commitment of some sort, then it's inconveniencing. But if I *know well in advance, that there will be a course in Maths on this date (n50,)* I then can look back into what I intended to plan for that date, and perhaps sort of shift commitments to suit what is prioritised first.

I: Planning in advance is important, so that those who are involved should also be given an opportunity to plan ahead.

Conclusion

The interviewer thanked the interviewees for participating in the interview. She also indicated that their contributions were highly valuable, and that their opinions would help in addressing their professional needs.

PART 2: HOERSKOOL PIETERSBURG

Introduction

There were three teachers: all female, teaching grade 10-12 at urban schools. One taught Mathematics, another one Biology and the third one Physical Science. The interviewer briefly explained the purpose of the interview (to establish INSET needs of teachers) and also asked the teachers' permission to record the interview. Teachers were also made aware that the interview would be anonymous. The teachers were allocated numbers in order to identify them, that is, T1, T2, and T3.

I: What do you need information on?

T1: On syllabus. If we are writing an exam in 3 months' time, we need to know what we are writing about. Where are we going to get the papers, how are we going to get the papers. I mean Science is a subject where you are left-brain dominated. I mean Science, Maths, Biology, we are all left-brain dominated. We would like to be organised. Nobody knows what is going on. If I don't know, working in a radius of about 1km from the department, what about those teachers living in a radius of 30km from the department? They don't have phones, how will they know? They are also writing the same exams, they are Science, Maths and Biology teachers. I know that there are other Science teachers who have to go to telephone booths. I know where they come from. How will they know? Are they getting all the stuff? Do they know what the students are going to write about? Will they get the matric memoranda? Are they going to get the papers? I never received any official Chemistry memo. After a week and a half we sat down and wrote our own memorandum, because we are in a priviledged position, because I went to university. What about my colleagues out there, who only have matric or grade 11? Will they be able to do that?

T2: Schools in the rural areas, they don't have electricity, photocopying or fax machines, or anything. They are faced with 90 children in a class. Black schools in the rural areas are the ones which desperately need help. The department should really look into that. They do not even have textbooks.

I: **We are having a dichotomy of teachers here, poor versus advantaged background.**

T2: We draw children from poor backgrounds, we even go to an extent of feeding these children at school.

I: **What are your needs as against those of people in rural areas?**

T2: We need modern technology, we have books. I am looking for a cyber future for my children. But Mr Molepo from Sekhukhune is just going to want pencils and textbooks, something to write on.

I: **What if we organise workshops? You are well-educated, well-trained teachers, what ssues would you like to be addressed in workshops?**

I: **How do you relate to your learners from multicultural backgrounds? You may find that examples are not relevant to their background.**

T2: No, I accept them from where they come. We have done a little bit of background.

I: **Do you teach only Maths, Science, Biology?**

All: Yes.

I: **As teachers in urban priviledged schools, your only need is computers.**

T2: Yes, not just computers, any modern technology, we are looking for new skills. We have OHP's and all that.

Conclusion

The interviewer thanked the interviewees for participating in the interview. She also indicated that their contributions were highly valuable, and that their opinions would help in addressing their professional needs.

MOGODUMO INTERVIEWS

Introduction

There were six teachers: four female and two male, three teaching at township and three at rural schools. Two teachers taught grade 11& 12, one grade 9 & 10, one grade 9, one grade 8 & 9 and the sixth one grade 8. The interviewer briefly explained the purpose of the interview (to establish INSET needs of teachers) and also asked the teachers' permission to record the interview. Teachers were also made aware that the interview would be anonymous. They were allocated numbers, that is, T1 to T6 in order to identify them.

I: **And what is more less the number of learners in your classes?**

T3: Plus or minus 55.

T4: Grade is 64, and grade 9 is two classes, 34 and the other class is 45

T5: About 45.

T2: And that is two classes, that is, 84 in number.

I: **One per class, how many?**

T2: The number is 84 all of them, the two classes.

I: **I want the number per class.**

T2: Number per class, how many can they be? 27 and 46.

T6: So, in grade 11 they are 11, they are exactly 11, and then in grade 12 they are 17.

I: **70?**

T6: 17.

T3: Grade 9, I am teaching two classes. Then all of them, they are hundred and something in grade 9. Grade 10, they are 60.

I: **Okay, you said you are teaching Maths only, no other subjects.**

T4: No, we are not teaching Maths only.

I: **You teach Maths and what other subjects?**

T2: Science.

I: **Physical or General Science?**

T2: General Science.

T6: So, I am also teaching Physical Science, not only Maths in both grades.

T1: Okay, I am teaching English in grade 12, Maths grade 9, and Sepedi in grade 8.

T5 : I am teaching Maths only.

I: **Oh, fortunately.**

T3: I am teaching Maths grade 9 & 8, and then General Science from grade 8 & 9, Physical Science from grade 10-12.

T4: I am teaching Maths grade 8, Physical Science grade 8-10, and Biology grade 12.

I: **So, you are the only fortunate one. So, plus minus the roll of the school, what do you think it can be?**

T1: The roll of the school, maybe they are 482 in my school.

T6: I think they the roll is about two hundred and ninety-something.

T2: About 462.

T5: Yes, it's about 560.

T3: Plus minus 400.

T4: Plus minus 600.

I: **So, it's more or less the same. As Maths teachers, what skills do you like to acquire, which will make you better Maths teachers, in addition to what you already know or have?**

T1: In fact, madam, we are facing problems, when we come to classes. I don't know where to start, but our learners are still having problems, I don't know. Sometimes

maybe we deal with numbers, you find that learners don't even know where we can start, to let them do this thing practically, so that they must *use it in daily life (29).*

I: So, are you are you saying the problem is to relate Maths to the real life situation?

T1: With the real life situation, that is right.

I: So, you would like to be helped to teach Maths in such a way that you can relate it to the real life situation?

T1: Probably, yes.

I: And what are your greatest needs?

T5: Can I, come up? There are parts that I don't enjoy teaching, so I want help. Grade 11 I would like to get help in the part of *linear programming, and in grade 12, the application of differential calculus (n11).*

T3: My problem is *overcrowding of classes (n32).* For example, grade 9 I am teaching 64 learners, so, I am not able to know those kids, exactly their performances. In grade 8, I am teaching grade 8 General Science, Maths and English. You can see that assessing those kids is very much difficult.

I: So, can I say you need help in teaching overcrowded classes?

T4: And another thing I am aware that these learners, there is a problem of not taking it as if, if I am doing triangles, and then in grade 8, then that's grade only. And then, if I am going to do triangles in grade 10 maybe, then that's a new thing, then, those are for grade 10. Then, if they come to grade 11 & 12, they think that that's only for grade 11 & 12, they don't know that these are a continuation of knowledge. So, I think maybe if these classes can, let's say if you treat a chapter that is related to the other classes, maybe if these classes can just be combined; the lower classes with the higher classes, I think that will help them to know that these things are related.

I: **Integration.**

T3: Integration.

T4: I think maybe if they can *come up with a method (n5)*, I think the method that they used to train us, was not okay. Because you find that, if say, you take for example, learners who are attending the model C schools, and compare them with ours, you find that, maybe we don't have the skills of imparting knowledge, the skills, the how, how to teach learners. I am worried about the way we were trained, and again we need enrichment. We want *enrichment courses (n11)*.

I: **So, you want to be helped with skills of how to teach Maths. Particularly what kind of skills?**

T4: I can say, maybe say, I want to teach learners fractions, how to go about maybe the introduction part of it, how to let them learn. Because you find that you try your level best, trying to explain, but they don't understand. So, I think maybe the *problem is the method we use (n5)*.

I: **So, you would like help with skills.**

T4: Yes, and we need enrichment.

I: **Your greatest needs? Sir, I didn't hear you talk.**

T2: My problem is that my *learners are not disciplined (n36)*. If you *give them homework, they don't do it. Most of them don't do it, maybe 80% (n24)*.

I: **Class discipline, that is your greatest need.**

T2: Yes, they are not disciplined, then they are lazy and they take time to grasp the subject matter.

T6: So, in my case, the problem that I have, especially in grade 11 and 12 is that, remember that in Maths we just give examples. Say, you give examples and you find

that another time you give them some classwork, and only you find that the steps that you were doing, *they do not follow (n5).* And you have to start afresh, meaning that you can teach one example it can, that example that you taught, when you ask individuals, you only find that they will tell you that, or maybe you were checking steps, you say why did you do this here, and whatsoever. They actually tell you that they forget, it's so easy for them to forget.

I: So, what kind of help do you need in order to address that?

T6: So, that is why I am having a problem. I don't know how to help them, because in my case, what I think of, is just to give them examples, and after that, check them, or assess them whether they did understand the steps I have given them. So, there I need help from you, how can I help those pupils?

I: Using another approach.

T4: Yes, basically, I think the approach we are using, maybe is not right. If we can be helped with that, *basically the approach (n5).*

T6: Yeah, the approach, because you will teach a certain aspect, and you find that those students, if you say, did you follow what I was trying, they say yes. Theirs is just to say yes right through, and this is what worries us, because we don't know how to help them. Because the method that really we acquired at the college, *we don't have another method to help them (n5).*

I: So, do you want to add?

T5: Yeah, what I would like to get at is a question of materials. One of them is, for the past ten years we have been applying to get textbooks. It is only this year that we have textbooks for std. 10, *we don't have textbooks for std. 9 (n23).* We do not know what to do, so we end up teaching Maths like we are giving notes. They have to practise from textbooks, but they don't want to buy the textbooks.

I: **The problem is learning support material (LSM), supply of that.**

T3: Because parents don't want to buy books as the government has promised to buy books for them. So, even if you can ask the learners to buy the books, parents won't respond.

I: **Okay, so what I read here is that the burning issue here, is that one of skills, new approaches to teaching; and then classroom organisation, teaching overcrowded classes, class discipline; and,**

T4: *And enrichment (n11).*

I: **Oh, let me not forget about that one. Personally, you would like to be enriched, and support from parents. So, basically, those are the three things, nobody is having any problem in connection with assessment. How to assess learners is no problem to you, and developing learning activities.**

T3: The problem of assessment, it will still go back to that one of enrichment. Because we are used to *assessing these learners in the means of classworks, tests, and that is all, unless you give them assignments (19/20).*

T4: And it will still be there, as long as the approach we use is not correct, *the problem of assessment (n19/20)* will still remain.

T3: So, we do have a problem with assessment.

I: **And,**

T5: Yes, another problem that I have, especially, can I say with the department, is that courses are organised just before the exams. I think it will be better to organise courses in the first quarter of the year, so that everybody must have direction. Now you find that after 9 months, what we have taught is 30% right, you still have 70% to round up after courses before the final exams.

I: **So, information, or planning of things that you have to do during the year, that information should reach you as soon as possible. Either end of the year for next year, or beginning of the year. So, the main problem is communication breakdown between the department and yourselves. So, are we saying what you have mentioned are your greatest needs? So, if anybody whether in the form of the government, NGO's, whoever comes, he must know that he must help you with new strategies, new approaches; how to assess learners; how to teach overcrowded classes; class discipline, and address aspects like Calculus and in Algebra, linear programming, and what else? That which you really need, and that which those of you who have filled in the questionnaire, didn't see really coming up, and you feel this is what you want to be helped with. Whoever comes with a workshop should address these things. Not even if you don't look at that, what do you as a person, feel that is what I really want. If I can just get this kind of help, then I am sure I can do my job better than I am doing now.**

T2: But, I think if maybe the government can take us to a workshop for a week, or three weeks, full three weeks, maybe we can do it. Unlike right now, we come to a workshop one day and go back to school, and we are not sure whether we are using the new methodology, or the old one. I am suggesting that if the government can maybe take three months workshopping us, maybe we will see the progress.

I: **when would you like to be workshopped? That is, where you can be workshopped for a week or two, or so.**

T2: Maybe during the holidays.

T4: Yeah.

I: **Are we saying holidays are better because you have a longer time?**

T5: Yeah, on this question of workshops. Basically what happens is that the state of education is just basic. The criteria used are to benefit the matric results. And, what is happening is that pupils, when they come to matric, you find that some of them

are empty. Now, maybe if start from primary, so that pupils, when they come to secondary, they know all the concepts. You will find that when you are to give instructions, come to std. 9, you say half + half, it becomes a problem, until you come with a practical example. So, somewhere, somehow in the primary, in the junior phase, something is not done.

I: **So, this kind of workshops, in changing whatever, should start right from primary.**

T4: Yes, primary level, they must have a base.

I: **So, is that all? Can we say you are okay, that is all what you think you need?**

T5, T6, T2: Yes, I think so.

Conclusion

The interviewer thanked the interviewees for participating in the interview. She also indicated that their contributions were highly valuable, and that their opinions would help in addressing their professional needs.

HLANGANANI INTERVIEWS

Introduction

The interviewers welcomed teachers who attended the interview. The interviewers introduced themselves and gave the teachers a brief summary of the aims and objectives of the study and the interview discussion. Teachers were asked to remain anonymous in the discussion so as to allow free and active participation in the discussion. There were nine teachers involved in the interview and out of these teachers; three were Physical Science, four Biology and two Mathematics teachers. Two Physical Science teachers were teaching also Mathematics and all Mathematics teachers were teaching either Physical Science or General Science. Only one Biology teacher was teaching other subjects like General Science. They were all from rural schools having the enrolments of between 300 and 800 learners. These teachers were identified by T1 representing Teacher no 1, T2 for Teacher no 2, up to Teacher no 9 for the sake of the discussion and the transcription thereafter. After clarifying all their misconceptions, misunderstandings and answering their questions, we then started with the interview questions stated below:

I: **Ok, I heard some of you talking of the number of subjects you are teaching...(not audible), which might impact on the in-service training. May be if you may need this to be included...(not audible). Now in short as I have said if you were to design the INSET workshops, the number of subjects will be considered...(not audible). What could affect the number of teachers from attending? You could or may explain as much details as possible. You are all welcomed, anything that you would like to see being offered in the workshops. In other words meaning that as Mathematics or Physical Science or Biology teachers as you are, what do you need in order to be the best teachers in this area?**

T3: I know that Physical Science learners need *individual attention (n31)* and we are *teaching over-crowded classes (n32).* It does have a great impact when it comes to the *overall control or monitoring of the work* of the children *(n20/19),* and also to help those that are below average because we do have learners who are above average, of average and below average. All those need to be included in the workshops.

I: **Yes, to address the question of over-crowded classrooms? Teacher no. 4, feel free to say what ever you want to.**

T4: Taking into consideration the area that we are being rural and also not equipped with equipments. Textbooks usually come very late and we find ourselves sometimes *unable to improvise (n23).* I think in workshop *methods of improvising (n23)* when coming to certain sections especially in Physical Science should come as a very good help.

I: **Which sections do you find being very difficult?**

T4: I do not have any section which is difficult but there are sections that you find that when you were to demonstrate their concepts, you are unable to do so. May be because of lack of proper equipments. Thus, if there was an *alternative of improvising*, things may be fine *(n23).*

I: **Do you want to learn more about improvising?**

All: Yes.

I: **Speaking of lack of equipments in your schools, suppose you were to be supplied with equipments in due course, will you be comfortable in managing and utilising them?**

T4: I think most of Science teachers were trained on how to use the equipments and how to utilise them, how to incorporate them in their lessons.

I: **I mean if the government gives you those equipments, so do you have the skills to use them?**

T4: No, we do not have adequate *skills to use the equipments (n34)* and I was thinking of *improvising (n23),* where you find that the school does not have money and the equipments are not available, like for example (not audible).

I: **Ok, my question is that will you be able to use them? Can you improvise to be able to do all those experiments in your textbooks? Do you have the skills to demonstrate those experiments?**

T5: Yes, in Biology. I can do that.

T3: Yes, generally we do have skills, but what we are running short of are the equipments. One other thing that I would like to be included in the workshops is the *relationship between Science subjects and the society (n29).* The kids that we are teaching are not that exposed to the outside world, and as a result that also affect their performance because *they do not see really the seriousness of education (n24).* And now that we are switching slowly to this curriculum OBE, then it would be very difficult for teachers more especially in rural areas where there are kids without visions. Most of them are without vision because we do not have many going on without us. It would be very difficult for us to *handle group discussions (n36)* because once you can organise kids into groups, if both of them are discussing the context you have given them to discuss, then they will *start to discuss some other things (n36).*

I: **Do you mean things that are not contained in the syllabus?**

T5: Yes, they will *discuss their own indabas (n36)* and not the things that are in the syllabus.

T2: Not in that...(not audible). May be as teachers, something that...(not audible). Another thing is that the *classes are over-crowded and grouping is very difficult (n32).* In some of the schools there is *not even a space to move between the tables (n39).* You can hardly move among learners...(not audible).

T4: The most difficult thing for me as I teach Physical Science is in Chemistry when I relate content to pupils. For instance, to relate the mole content to the pupils is difficult. They cannot even imagine what is happening there.

I: **Could we please find out what is the most difficult aspects of teaching Mathematics if you are a Mathematics teacher or teaching Biology if you are a Biology teacher or Physical Science if you are a Physical Science teacher? We found one suggestion**

that trying to relate the mole context to pupils is difficult, so what about Biology and Mathematics? You have mentioned earlier on that pupils do not see the relevancy of mathematics to their environment, is there any particular aspect that you find it difficult to do?

T4: I do not find it difficult to do, but when they think of x in Mathematics, they do not think of x as any number. They think of x as a tool of getting Mathematics right and they *do not relate it to the society (n10/n29).* They are unable to see what we are teaching them more especially at the lower grades that they could use that in life. Most children fail grade 9 and they cannot proceed to the other standards and are *unable to apply their knowledge of Mathematics to real life (n29).* May be the curriculum needs to be changed.

T3: ...(not audible) but when I was teaching things like Statistics and Interest rates, kids are interested in those things because they are more practical. But when we talk of *quadratic equation and linear equation,* which cannot be seen, *they do not need that (n10).*

T9: ...(not audible) but if may be parent involvement ...(not audible), because if this kids go home early they say nothing ...(not audible).

T5: I think as I see the problem is *learners not involved actively in their learning (n24)*...(not audible). They *do not even know why they must come to school and why they are learning and they are still lacking the skills of learning (n24)*...(not audible).

T3: (not audible). Now if you look around in our school we do not have enough resources. Even if you try to *motivate our learners (n24)* it should be done at early stages because it would be very much easy for us at higher grades. We would be very much happy if the parents can be involved and be taught skills to *motivate their learners (n24)* because at school is very much difficult for us as they were not motivated at their homes. The learners must first be motivated at their homes so that at school they are *self-motivated (n24)* because learners who are demotivated cannot get good results. Naturally *they are inactive and they do not participate actively in class (n24).* Teachers who get good results get motivated learners and they are just there to teach and learners know where they are from and where they are going and doing. So without those *motivational skills (n24)* they

would not know what to do with their learners. Number 1, I think after they have completed matric they want to get money, so if money is not there I do not know. When it comes to motivation there are many things that may *motivate the learners (n24),* because I got something from those who are teaching in urban areas and in township. You will find that most parents there, have went to schools up to a certain level, but here most of the parents do not even know how to write their names and there is no motivation from their homes. I do not know actually how to involve parents who do not even know what to do. Parents are finding it very difficult to motivate their kids more especially those parents who have not fully gone to school. Maybe when we opt for field trips that may have the *other form of motivation (n24).* When pupils go to trips where they can see their subjects being applied the *application of what they are learning at school (n24).* Parents do not pay and say they do not have money and even for the school fees especially in grade 12.

I: **Ok, is that not a question of priority? Because you may find parents having money for other things rather than paying school funds.**

T3: Yes, what I have realised is that most kids that are coming to school are sent by parents who are rich enough. Now more parents have been redeployed, then is not a matter of priority or a matter of poverty.

I: **If you call them to do service at school like to offer physical work? Would they like to come?**

T2: Parental involvement, yes, I am seconding this because parents are not working, most of them depend on (not audible).

I: **Suppose you want something to be done. Could they come and make the garden so that they may sell the products?**

T2: If you make them to do the work, it means you are going to pay them. Yes, these means they will be paying by labour they cannot, because they are after money. I think we need

to call them and tell them the importance of the work at school. We need to educate them about the work at school.

T3: There are those people who are average than the middle class at these places. Most of them are sending their children to powerful education because we belief that those people are fine.

I: Before you close the discussion Dan, I would like to know from all of us, what other issues would you like to be addressed in INSET workshops?

T2: I think the other thing is that Mathematics need *individual attention to learners (n31)* and I need the workshop to address the *approach of teaching it in class (n5)* (not audible). May be in the past there were better things given to good performing learners but now nothing.

T3: What I was thinking about is teacher *information empowerment (n22).* The more information you have as a teacher matters not, but gathering that information is difficult if you *do not have resource centres and other things (n22).* I think these should be addressed that *one centre for a group of schools next to one another be done (n22)* for schools to get information and materials around them.

I: How effective will be the resource center if done around here?

T3: This area is not effective. I think if it is *established in all schools not one school it will be effective (n22).* I think learning is all about facilitators, if we can get facilitators to facilitate our learning and teaching, and the little that we have got will help a lot to improve our schools' performance.

Other teachers' responses were not audible from the tape during discussion as they were not talking very loudly.

Conclusion

The researcher concluded the discussion by thanking the teachers for their contributions. She indicated that she learned a lot from them and their contributions will not be ignored by the department and INSET planners for better and sustainable planning of INSET programs for the Northern Province teachers of Mathematics and Science and Biology.

VUWANI INTERVIEWS

Introduction

The teachers who attended the interview were welcomed and interviewers introduced themselves. Teachers were given a brief summary of the whole study aims and objectives as well as the whole interview. They were asked to remain anonymous in the discussion in order to ensure that they participate freely and actively in the interview. There were five teachers, one for Biology, two for Physical Science and two for Mathematics. A Biology teacher was also teaching Economics and General Science, One Mathematics teacher was teaching Venda and other subjects not for examination, Physical Science teacher was also teaching Mathematics in grade 12 and another one was teaching also Biology in grade 12. All teachers were from rural schools. After they had no further questions and clarifications, we then started asking them the interview questions as stated below.

I: **I would like to know the type of school in which you are teaching, the subject that you are teaching, as well as the overall school environment. How many learners are there in your school?**

T5: It is a rural school, our school is not so much developed, *we do not have major resources (n22),* and I was given… (not audible), because they are from rural school. They are *not so much motivated (n24)* because I am teaching Biology, and they are taking it as very difficult for them. As far as motivation, the whole subject is interesting but they are *feeling demotivated (n24)* mainly because of the environment they are from. The number of learners is about 780 and I am teaching Biology from grade 8 to 12 and the other class is for economics.

I: **Are you teaching also economics?**

T5: No, one class is for economics and one classroom is for general science. I am teaching 3 classes of Biology.

T4: I am from a rural school. I am teaching Mathematics grade 9 to 12. I teach Venda grade 9,11 and 12. I also teach Guidance from grade 8 to 12 and music grade 9. There are 290 learners.

T3: I am coming from a rural school, and the environment we are working in, is not conducive because the classes have holes. Apart from that we have children *without textbooks (n22).* We have got 350 learners. I am teaching only Mathematics from grade 8 to grade 12.

T2: I am also coming from a rural school, which has got +-400 students. The school is not so much developed, is still under developed. I am saying I am offering Physical Science from grade 9 up to 12, as well as Mathematics grade 12. We have got serious problem concerning the laboratory, therefore it is very difficult for us to perform some experiments.

T1: I too from a rural school which has got 720 learners. I teach Physical Science from grade 10 to 12 and Biology grade 12. The environment is such that is not conducive to learning. Our school is situated in the bushes and sometimes we are interrupted by animals.

I: Are you all coming from the same school?

T1: No, I come from the same school as teacher number 5, and I have said we are often interrupted by cows and goats, and many problems are already said by the other teacher (new). We have a *shortage of classrooms (n39)* and such that when we come to a laboratory (n47), I think that is the first thing that we want, and that students do not even know what some chemicals and apparatus look like. (Not audible). But taking the apparatus out to do some experiments would not work. Our schools are still making use of what we call...(not audible), and as such we also have problems as regard to children who are doing Science. The problems are, number 1: Some of the children do not have good attitudes for Science. Number 2: When it comes to equating subjects, you find for argument sake, a student will be able to *change the subject of the formula in Mathematics (n18),* but when you give the child a problem, say for argument sake he must make the subject of the formula, and if it is in other subjects then it becomes a problem. Thus why I

say some learners have a problem of changing the subject of a formula. And one other thing is that some children are very bad, you *give them work they do not do, you give them tests they do not write (n14/24)*. (not audible). For just to cite an example in grade 12 some learners only wrote the trial examination, for the whole tests they were absent, and the whole marks for CASS they got nothing … (not audible).

I: **Ok, I think as Teacher no. 1 has stated some of the problems, I think even Teacher no. 2 has some problems in his classroom teaching environment. So, could we please listen to what Teacher no. 2 needs to be helped with?**

T2: Right, our problems are more or less the same because what I am going to say is more or less the same as Teacher no. 1. I am also a teacher who offers Science and I also experience the same problem of *students not doing their work (n14/24)*, and only to find that out of 13 only 2 or 3 have done the assignments correctly. But if you try to find out what are their problems they keep quiet.

I: **Have you ever punished them?**

T2: No, I have always tried to speak to them and tried to show them the importance of doing things on their own, to have that confidence in finding things on their own. Instead of me giving them information, and giving them notes. You are going to find that *they are not motivated at all (n24).*

I: **I think Teacher no. 3 has some additional needs that are not yet mentioned through the whole discussion? So feel free to add.**

T3: One of the things is that parents are not involved in the learning of their children. That is why you find them having *lack of discipline (n36)* and this issue of discipline goes hand in hand with corporal punishment. And right now the Education act is not allowing it, but not that I am against that, but the government should find other ways of trying to solve this problem. *Students are not writing homeworks, and sometimes they come with dangerous weapons around the school premises (n36)*, so if that problem is left unsolved I think students are still going to fail.

T2: I think *discipline is the major factor (n36).* We find that because of poor discipline, even the *results are poor because of discipline (n36).* If a learner knows that there is nothing that is going to be done to him, *that learner will not take the work serious (n36).* The issue of *lack of motivation on the part of the learners (n24),* as teachers, we are trying to guide them, to show them the right way but *we are demotivated (n24)* because we are given the reason that even if I pass this Mathematics there is no way in which I can find a job. And there are other reasons that they gave us and I think if we motivate them.... (not audible).

I: What I pick up in your point, is that students do not write tests, but they write mock exam and final exam? Can you say with confidence that those who have passed the exam?...(not audible).

T2: Some of them write the exam that is set by teachers, but some of them *do not come to school (n36)* although they know that the exam is set by teachers. And I think those who refuse to write tests and examination throughout the year do not pass at end of the year.

I: What is your contribution Teacher no. 5? I think you want to be a better teacher and produce 100% pass. So what are your problems? What are those things that prevents you to be a better teacher to produce better results?

T5: May be the problem we are experiencing at our schools is the *overcrowded classes (n32).* You find that you are teaching more than 100 children in one class, and they do not have ideas, tables and chairs. So you find it *difficult to pay attention to all of them (n32).* And again that problem of parents involvement really in our school they are not involved even though you call them to hold a meeting. They will never attend. May be the government may come with other ways of *disciplining this learners (n36)* and *motivating them to do the work (n24)* because if we just speak to them they are doing nothing. They need something like a catalyst to work on them.

I: So if you were to have a workshop to be conducted here in Venda, is there something you wish these workshops to do for you?

T5: Yes, the workshops are important, unfortunately this year especially in Biology, there were no workshops, unless the one that is conducted now because you are doing a research. Otherwise from January till now we never had any course for Biology, and again *the government did not supply us with textbooks this year (n23).* You find that the only textbook we are using is only for the teacher for the new syllabus. The children do not have and we have to make the notes for them every day and they do not read.

I: May I just ask, you have mentioned a new syllabus, what do you mean by new syllabus?

T5: The first book was used for grade 8 and grade 9 and they are using the *new books and our schools were not supplied (n23).* I have to go to the bookshop to look for it, but they will just not provide you with the syllabus, and they say the syllabus is like this and this. *The old textbook we are using do not have some topics (n22).* There is one new textbook which has all those topics

I: Mr Mabye talked of workshops, each one listed the number of problems that you have, if you think of in-service training workshops, what kind of topics would you like those workshops to address? And you are free to say what ever you like.

T3: I will talk mostly on the side of Mathematics. I suggest that the arrangement must be of *problem solving that students should understand the questions (n85).* After solving those questions, they must be able to do that kind of work because right now teachers are doing 90% and children are doing only 10%, and that issue of spoonfeeding is very bad to our learners.

I: Do you have any other topic that you suggest or are you covered?

T1: I should think one of the things that we learned at high schools were the worksheetsof the learners. We rather look at the issue of ways or means of the kind of children, hence on activities. I think, I for one have realised that children are doing very bad. One of the things is that the worksheets make too much of the work for the teachers, but this is

because even if we are still not using the board and chalk method, the *other methods are still not working (n5).* So *we can have ways and means of encouraging them to go and work on their own for examinations (n24)*... (not audible). I am not ashamed to tell you that at the beginning of this year I do not remember any child asking me a question or a question of some sort. The period will end and they will write tests and I explained the problematic areas but no comment. So there is *no link to show us that we communicate (n5)* because there is only the teacher who is talking.

I: **Do you have any suggestion of encouraging the learners that you have got?**

T1: I hope we have to encourage the parents now to correct their children at home. The parents should also tell their learners to ask questions. (not audible). Most parents have not gone to school to such an extent, may be...(not audible). If the parents do not push their children and leave them to the teacher, that is not good. Some of the parents should be called upon to see their children's performance, and they should even see the proper job that teachers are doing. They should also encourage their children to do proper job. It must be a fifty-fifty hour job for the teachers and the parents.

I: **So, I heard you talking of lack of equipment, let say the government provides you with those equipments that you need, so do you have some skills of using those equipments? In other words can you demonstrate all those experiments that you are saying you are unable to demonstrate?**

T1: To me I do not have any problem of performing experiments because I have done them while I was still at training. The only problem is that we do not have enough apparatus and laboratories to do them. The sizes of our classes are too small that you cannot do any experiment in it. But concerning the know how of the experiments we do not have any problem. Both schools need to be electrified because some experiments need electricity.

I: **Given that new equipments of course, cause a lot of money and as you know the majority of the budget for the Northern Province goes to teachers' salary. It is very unlikely for the government to give you a lot of equipments, so what do you think you should do to overcome shortage of equipments?**

T1: There are a lot of ways to overcome that problem. I mean while we were still at training we were also taught of improvisation. I can also improvise some of the equipments to use the available material to make some of the experiments. If to give an example, I still remember teaching grade 10 Physical Science in the section of light, for example, reflection, refraction and total internal reflection and doing experiment of the application of total internal reflection. We try to make ourselves a telescope that was made of cardboard boxes and some few mirrors and only to find that is working and was very much useful.

I: Is a follow up to that, are you saying that if a workshop was to offer skills on improvisation for practical equipment, that is not something that you require?

T2: I think *that is something (improvisation) that should be taken into consideration (n40/23).* It will help us a lot because most of us we are from schools where we do not have equipments to perform practicals.

I: Is that something that you agree with or something that you do not agree with, Biology teachers, Maths teachers, improvisation of apparatus is that something that you like to know about? Or not really?

T3: Yes, as a Biology teacher you may find that you do not want to use one chemical and you prefer the other chemical as it produce better results and safety and *we need this particular kind of experience (n40/23).*

T4: In addition to that, money is a problem. I should think the department should rather try to have a centre of laboratories. Say now in particular you have one laboratory where pupils gather together with teachers to help them in experiments. Say a well-centred laboratory with all apparatus accessible to whatever number of schools are around. That will minimise money for having expensive well-established laboratories in a school where most teachers will not be able to go.

I: **So do you have anything that you think is necessary that the workshop should address that we never discussed? Anything that gives you the problem that you feel that I really need it to be addressed in our workshops? Let say we are going to have a Mathematics workshop, or Physical Science workshop, or a Biology workshop. Some of the things that you really need workshops to address referring to those ones never mentioned in the discussion. So you are free to can say that.**

T1: There is this problem where you find *teachers teaching grade 12 are the only people you call for workshops (n5).* Now for example in Mathematics, Mathematics is a continuous subject. If you talk about negative signs you find that a grade 10 student do not know the result after multiplying some of the numbers. Which means even those *teachers at lower grades need to be workshopped (n5) in order to teach the students all the topics in Mathematics.* They also need to be supervised by the head of the department because if a learner is not well in grade 8 he cannot make it in grade 9. This is the other problem that people are not taking it into consideration.

T3: I think we are going to run the workshop in such a way that we integrate the teachers in order to equip them with skills being together. From there we can even invite people from the province to help us with the approach of teaching the subjects because *people have been trained differently (n5)* and some are trained in those traditional methods. Like for instance right now they are taught the *methods of OBE and thus were we are going to be acquainted with various methods of teaching (n5).* I am interested in language literacy because if a child does not understand the language he is not going to solve anything because language literacy goes hand in hand with culture, and some other areas and topics.

I: **Do you feel happy about the way in which you assess your students at school? Are you happy about the skills you are using every day to assess your students?**

T1: No unfortunately this year they have introduced continuous assessment. I think it is a good process as we will be assessing our students at our schools continuously. I think the learners will take things very serious and it is also going to involve parents because parents are going to see what is happening in their learners' learning.

T4: *Some topics are not covered in the lower classes (n11)* and I realised the problem of classification. When we do classification at the begin of the year, you will find that *some teachers are given subjects that they were not trained for (n11).* Say for example, a person who has majored in Mathematics being given Maths and Venda. It is difficult to teach x times x, and thereafter teach Venda. You find that the results at the end are poor, and *some teachers are given subjects that they are not trained for (n9).* They are *teaching only those topics they understand and leave those that they do not understand (n11).* And in the next grade the teacher who is going to offer the same subject is going to have many problems because some of the work is not covered due to the *lack of the knowledge from the teacher (n9/11).*

I: What would those aspects be? And I am happy if we can go around for Maths, Physical Science and Biology. What content area would you like help with? If any and if you feel the content area or knowledge is not a problem feel free to say that?

T4: Generally, you would find that in Mathematics most teachers are interested in the Algebra part. But other parts like *Geometry and Trigonometry, most of them have problems (n11).* There are two papers at the end of the year and you will find that even if a child may score a certain percentage in Algebra, when it comes to Geometry and Trigonometry there is nothing that he gets. I think that will be addressed.

T5: I say Biology is a practical subject and it needs practicals. And from my experience I have realised a serious problem in our schools and I do not know in white schools. Most of us are teaching theory instead of practical. So I do not know how can we do that.

I: Is there any topic or chapter that is giving you difficulties?

T2: In any way the subject is easy and simple straightforward. Only to find that you are teaching theory and the pupils do not know the practical part. May be if they can be taken to the real situation to know exactly what we are talking about. For example, if we talk of inner parts and take these pupils to the hospital to see how people there operate the inner parts. May be they will be stimulated.

T3: Yes, some of them and plants I can. I have realised that pupils are interested in things, which they can do practicals but not theory.

T5: Actually, there are no difficult topics. That is only a matter of understanding of *how we relate that topic to day to day life (n29).* For instance, if you are *teaching Geometry. We must try to show the children how this is related to real life (n29).* If you are talking about a rectangle, you must also talk about a kitchen table so that students must not memorise, but should realise the characteristics of the table. The student will have the shape of that rectangle.

I: So are you able to do that?

T3: Yes, like for instance if you are trying to teach different kinds of theorems. Lets say theorems of grade 8 to 12, you can just draw a circle making use of wood, a diameter, take some pins and a plastic wherein you can teach them that this is the diameter, this is the angle between the tangent and the chord, this are opposite angles of a cyclic quad. In three minutes time you are going to cover all those theorems.

T2: What I can say is that I do not have topics that are difficult for me. But the only problem is that we experience a problem when we try to make students understand certain topics in Physical Science. For example, let me say I am teaching about the reactions between acids. Students are having a problem of not knowing the chemicals we are talking about. Some of them think that I am talking of a certain object that they never come across. So it is difficult to teach using theory and we need to do practicals to make students understand.

T1: Yes, the topics are not difficult. *The problem is to impart that knowledge to the children (n5).* For argument sake, if you look at some of our curricula, our curricula need a child to link a side of wild science subject and it also goes to the general stream subjects with one science subject of which is Biology. I take it from Std. 6, the child who has done General Science but when it comes to Std 7 he now have to take a special role. It quite so happen that when that child comes to grade 9, it is a must that that child must have one

Science subject. Now most of our children that do general subjects have a negative feeling that Science is difficult. You are going to deal with that kind of a child, and take a lemon and tell him that when is poured in tea it changes colour, and he will understand. But when it comes to Sodium Hydroxide, thus where some of the students will be saying there goes our teacher now, he is starting his stupid stories. And to deal with that kind of a child is very much difficult, thus now the problem we teachers are facing every day.

I: How can we turn that situation around? What can a teacher do to change the negative attitudes?

T1: It is somehow ridiculous, you have *to relate what you teach to the learners' understanding (n29).* And for argument sake, knowing that you are going to talk of silly terms and what have you, tell them of only things they make use everyday, and at the end of the day in a lesson tell them of a soap, then they will cope with the subject. That is still a problem. Who can tell me tricks and means of finishing this large syllabus? It might be our children who are uncooperative, who have got *adverse feelings against the subjects (n14)*, who are *not doing their work (n36)* so that you must think the way that you are not doing your work. So I do not know because you are requested to finish the syllabus. The funny thing, which is always there, is that we even receive the scopes after some of the trial examination (new) has been written. And the students did not cover the subject that was covered by the scope. So if your workshops could also provide ways and means of completing 20 to 25 chapters in a year which is full of wonders, full of children striking over their school funds, full of teachers been called upon for meetings, I will be very grateful and cheer respect on that.

Conclusion

The interviewers thanked all teachers for their contribution. It was indicated that it was a great pleasure to learn some challenges from them and those challenges will be taken into consideration for the INSET program planners to plan effective and sustainable INSET programs for Biology, Physical Science and Mathematics teachers in the Northern Province.

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