DEMOGRAPHIC PROFILE AND PERCEIVED IN-SERVICE EDUCATION AND TRAINING NEEDS OF RURAL AND TOWNSHIP PHYSICAL SCIENCE 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.

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Signature Date

ABSTRACT

The Limpopo Province is characterised by poor Physical Science matric results and poorly qualified teachers. There are many reasons which contribute to the poor Physical Science matric results such as for example, lack of equipment and poverty in this largely rural area. Effective INSET programmes however, can be a possible solution to improving teachers' qualifications and competencies. The success of INSET programmes basically depends on obtaining and utilzing information on demographic profiles and perceived INSET needs of Physical Science teachers. Unfortunately, there is a lack of information on the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province.

This study aims at collecting and analysing data, which will provide information on the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province. It is anticipated that the availability and utilisation of this information will hopefully contribute to the improvement of Physical Science education in the Limpopo Province. The objectives of the study are reflected in the following research questions:

a) What is the demographic profile of Physical Science teachers in the Limpopo Province?
b) What are the perceived INSET needs of Physical Science teachers in the Limpopo Province?
c) What are the possible associations between the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province?

Two methods were used to elicit the demographic profile and perceived needs of Physical Science teachers, namely the survey method using a pencil-and-paper instrument—the *Science Teachers Inventory of Needs-Northern Province* (STIN-NP)—which was specially adapted and validated for this purpose, and focus group interviews with Physical Science teachers. The STIN-NP was developed from the *Science Teachers Inventory of Needs* (STIN-3) of Baird, Prather, Finson and Oliver (1994). The STIN-3 was adapted and validated for use in the Limpopo Province context by inviting 47 important stakeholders in Physical Science education at provincial and national level to suggest modifying, omitting or adding items to STIN-NP and to provide a rationale for their suggestions. Items in the instrument were thereafter modified for clarity and ambiguity by an English Second Language expert. STIN-NP was thereafter piloted on three samples of Physical Science teachers from urban, township and rural schools (n=29) in the Limpopo Province.

The final version of the STIN-NP consists of 98 items arranged in six sections. Information on the reliability of STIN-NP was determined by calculating the items' alpha coefficient and the instrument's Guttman split-half reliability coefficient after the instrument had been administered. The alpha coefficient reliability for use of with Physical Science teachers was 0.95, and the adjusted Guttman split-half reliability was 0.83. A total of 1629 questionnaires were distributed to Physical Science teachers in the Limpopo Province via District Office's Curriculum Advisers and school principals. Completed questionnaires were collected from teachers via the same way.

Focus group interview questions were structured to cross-validate the information obtained through the questionnaires and also to help acquire possible additional information on the teachers' INSET needs. The total number of Physical Science teachers who responded to the invitation for the interviews were 35 (18 male teachers and 17 female teaches) in six groups. The six groups were from urban, rural, and the township areas as it was assumed that INSET needs were largely influenced by school context. Interviews were recorded and later transcribed into a more formal and written style in order to facilitate analysis of what was said by the interviewees, as recommended by Kvale (1996: 170).

The quantitative results of this study are based on the responses of 352 Physical Science teachers (grades 10-12) in the Limpopo Province—a 22% response rate. Only eight responses were received from teachers at urban schools, but these responses were ignored as this sample is too small to enable the researcher to draw conclusions about urban teachers with confidence. The effective sample used in the analysis is thus 344, comprising 300 rural and 44 township teaches.

Professionally, teachers need help with improving their teaching skills, followed by improving content knowledge, classroom organisation and assessing learners' work. The above ranking is the same for both rural and township teachers. The above ranking also suggests that INSET providers should focus on improving teaching skills and content knowledge of teachers first, and only later on for example, assessment.

Physical Science teachers further indicated that they need help with carrying out laboratory practicals. These teachers' limited academic knowledge and the lack of textbooks suggest that INSET providers should aim at empowering these teachers to improvise equipment and learning and teaching materials. The fact that most teachers have limited academic knowledge suggests that a suitable INSET model for them, will be Dunn's traditional model which will assist them to gain additional qualification (Nduna, 1999).

Most of the Physical Science teachers failed to attend the workshops due to lack of information (Table 4. 5 page 36). INSET providers should issue a year programme in time to reach all Physical Science teachers. Physical Science, Mathematics and Biology workshops should not take place simultaneously, so that learners are not left unattended, and some teachers also teach all three subjects.

The Department of Education in the Limpopo Province is urged to provide workshops based on practical sessions in Physical Science and how to improvise equipment. This will help to restore learners' interest and understanding of science. Establishing and staffing resource-centres in various districts will help many schools without equipment. INSET programmes for Physical Science should be guided by teachers' professional needs in order to be more appropriate, sustainable and effective. Workshops should be conducted at a convenient time and venue for teachers.

It is anticipated that the established perceived needs of Physical Science teachers in the Limpopo Province as described and stated above will provide an important, valid and reliable basis for designing effective, and sustainable programmes for Physical Science in the Limpopo Province. It is also hoped that such programmes will significantly facilitate attempts to improve Physical Science education in the Limpopo Province.

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

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Chapter One

GENERAL INTRODUCTION

BACKGROUND AND RATIONALE

The South African government's White Paper on Science and Technology (Department of Arts, Culture, Science and Technology, 1996) pointed out clearly that adequate skills and knowledge of Mathematics, Science and Technology are vital components of successful contemporary life. Ngoepe (1995) maintains that skills and knowledge of mathematics and the natural sciences are a prerequisite for the nation's long-term economic prosperity, and many countries in the world such as, for example, Jordan and Malaysia realised the importance of science in improving societal conditions (Zurub & Rubba, 1983). These countries have undertaken a giant step of establishing science as a major teaching subject to be studied by all students throughout three levels of their schooling (Zurub & Rubba, 1983). The importance of Physical Science in education was also highlighted by the National Department of Education in South Africa, when it put in place a National Strategy for Mathematics, Science and Technology Education in General and Further Education and Training (Department of Education, 2001a). Table 1.1 below shows the pass rates in the Senior Certificate exams for Physical Science between 1999 and 2003. Data have been derived from Department of Education (2000, 2001b, 2003).

Table 1.1: Provincial and national pass rates (%) in Physical Science for the years 1999-2003.

Province	1999	2000	2001	2002	2003
EC	58	66	62	72	80
FS	69	84	66	79	87
GT	73	79	81	84	87
KN	68	70	70	78	80
LP	47	50	54	65	65
MP	55	60	58	65	73
NC	79	85	94	95	95
NW	56	62	68	74	79
WC	89	89	90	92	95
National	64	69	69	76	80

Note: The acronyms in the first columns are representing the following names in brackets: EC (Eastern Cape), FS (Free State), GT (Gauteng), KN (Kwa-Zulu Natal), LP

(Limpopo Province), MP (Mpumalanga), NC (Northern Cape), NW (North West), WC (Western Cape).

Examination of all data shows that the Limpopo Province, one of the nine provinces in the Republic of South Africa, is experiencing a problem of poor Physical Science results for fulltime candidates taking six subjects in grade 12.

Though there is an increase in the Limpopo Province pass rate over the last five years, it is nevertheless consistently the lowest in the country and therefore below the national average (Table 1.1). The total number of candidates in the Limpopo Province writing the Physical Science examination has decreased from 26082 in 1999 (Department of Education, 2000) to 19017 in 2003 (Department of Education, 2003). If it is assumed that all students who take Physical Science in grade 12 at school also write the exam, then this change represents a 27% decrease in Physical Science enrolment in the Limpopo Province in the last five years, compared to a 6% decrease over the same period nationally (Department of Education, 2000; Department of Education, 2003).

The racially dis-aggregated data have only been available since 2002 (Kahn, 2001, 2004), but in that year a total of 7708 African students achieved a pass in Higher Grade (HG) Physical Science country-wide, and the pass rate of these students was 26% (Kahn, 2004). In a crucial subject like HG Physical Science – acting as a 'gateway' to higher education- comparatively few African students succeed. Although comparative data are not available for the Limpopo, the vast majority of Limpopo Province inhibitants are African (Statistics South Africa, 2004), so that it is unlikely that the situation will be different for the Limpopo. All the above evidence points to the fact that all is not well in the Physical Science education provided in the Limpopo Province.

Among many factors that influence achievement in Physical Science, the role of teachers' pedagogical knowledge and skills in their subject is acknowledged to be key (Department of Arts, Culture, Science and Technology, 1996). Teachers' craft knowledge, that is, knowledge and beliefs regarding pedagogy, 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 & Thereson, 2001; Goldhabber & Brewer,

2000). Historically teachers' training in the former Lebowa, Gazankulu and Venda (now currently known as Limpopo Province) is of variable and largely inadequate nature (Ngoepe, 1995). The disparity in teacher training was caused by the apartheid policy of separate and unequally funded education systems for different racial groups before the democratic government was instituted in 1994 (Hartshorne, 1987). Physical Science teachers in Limpopo Province lack a sound academic background (Ashley & Mehl, 1987), yet it is believed that teachers' effectiveness will grow concurrently with academic achievement (Mailula, 1995). An important initial response to the poor state of science education in the Limpopo should therefore include the establishment of efficient, effective, and sustainable programmes of in-service teacher education and training (INSET).

In order for INSET programmes to be effective and sustainable, planners need accurate demographic information on the teacher corps, and INSET programmes should expressly address the perceived needs of teachers (Baird, Easterday, Rowsey, & Smith, 1993). Teachers' perceived needs are likely to enhance programme effectiveness if attended to (Thembela, 1985). When teachers are not consulted about their work environments, and planners assume that they know what is best for teachers, teachers morale suffers, INSET programmes are poorly attended, and achievement is scarcely influenced (Mecca & Klindiest, in Baird & Rowsey, 1989). Secondly, INSET- programmes should develop teachers' level of paedagogical knowledge and skills in their subject area.

Factors such as lack of resources in schools for teaching Physical Science contribute to possible reasons for poor performances in matric results. In my day to day experience as a Physical Science Curriculum Advisor in one of the six districts in Limpopo Province, teachers expressed their frustrations in regard to carrying out practical sessions due to lack of apparatus. Moreover teachers are unable to improvise due to their limited level of paedagogical knowledge and skills in their subject knowledge.

For INSET programmes to be efficient and effective, planners must have at their disposal accurate demographic information and perceived teachers' INSET needs (Tembela, 1985; Lungu, 1996). Demographic information on teachers with respect to, for example, their age, teaching experience and qualifications will help in the following ways: a) contribute in making planners know what background teachers have in order to make the workshops

relevant to them and; b) enable programme organisers to focus more attention on young and inexperienced teachers rather than teachers who are about to retire from teaching.

Unfortunately demographic data are not available for the Limpopo Province due to the following historic reasons. The history of in-service training in the Limpopo Province (before 1994) is linked to the previous apartheid regime (i.e., separate education system for separate racial and ethnic groups). Money and facilities were gravely under utilised by the previous apartheid government, and programmes were duplicated (Hartshorne, 1985). Before the democratic government in South Africa was instituted in 1994, there existed seven different education departments in the geographical area of the current Limpopo Province. Each department had racially-based in-service education and training of teachers (Hartshorne, 1987). The various initially racially based education departments in the Limpopo Province were unified in 1994. The Limpopo Province Department of Education now consists of those departments of the former homelands, namely Lebowa Department of Education, Gazankulu Department of Education, Venda Department of Education, the former Transvaal Education Department, Department of Education and Training House of Representatives for Coloureds, House of Delegates for Indians and House of Assembly for Whites.

This history calls for an integrated approach to in-service education and training. The Education Department in the Limpopo Province had instituted a directorate for curriculum support services in 1994. The task of the curriculum directorate was, firstly, to coordinate continuing professional development and in-service training for all teachers particularly for Mathematics, Physical Science and Biology; and, secondly, to develop INSET relevant to the Limpopo Provinc teachers of Mathematics and Science (Northern Province Department of Education, 2000).

There is thus a draft policy for INSET, but the Limpopo Province Department of Education has no reliable demographic profile of Physical Science teachers. Demographic data (before 1994) of the previous homelands currently constituting the Limpopo Province are too old to be useful. Although so-called 'snap surveys' are now conducted annually by the Limpopo Department of Education, these surveys do not ask for comprehensive information on teachers' demographic details (MA Seopa, personal comminication, 23 August 2004). Also data of the first survey that did ask for such detail

information as part of the Annual School Survey in 2003 are unlikely to be available soon (MA Seopa, personal communication, 23 August 2004). Therefore, accurate and reliable detailed demographic information on Mathematics and science teachers for the whole province is, for all intents and purposes, still not available.

STATEMENT OF THE PROBLEM

The Limpopo Province is characterised by consistently poor matric results and decreasing enrolments in Physical Science. There are many reasons which contribute to this deplorable state of Physical Science education such as, for example, lack of equipment, inadequately qualified teachers, and poverty in this largely rural area. As teachers' competencies influence student achievement, effective INSET programmes can be a possible solution to improving Physical Science education. The success of INSET programmes basically depends on obtaining and utilsing information on demographic profiles and perceived INSET needs of Physical Science teachers. Unfortunately, there is a lack of information on the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province. This study therefore aims at filling this gap.

AIMS AND OBJECTIVES OF THE STUDY

This study aims at collecting and analysing data, which will provide information on the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province. It is anticipated that the availability and utilisation of this information will hopefully contribute to the improvement of Physical Science education in the Limpopo Province. The objectives of the study are reflected in the following questions:

a) What is the demographic profile of Physical Science teachers in the Limpopo Province?
b) What are the perceived INSET needs of Physical Science teachers in the Limpopo Province?
c) What are the possible associations between the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province?

SIGNIFICANCE OF THE STUDY

The survey results will provide potential INSET providers such as, for example, universities, non-governmental organisations and the Limpopo Province Department of Education (which is likely to be the largest INSET provider) with appropriate, up-to-date and valid information. The INSET programme-planners will hopefully utilise the survey results to develop programmes which meet INSET needs of Physical Science teachers, and therefore are effective and sustainable. The study is thus facilitating and contributing to urgently needed initiative to improve science education in the Limpopo Province.

ASSUMPTIONS OF THE STUDY

It is assumed that Physical Science teachers in the Limpopo Province have INSET needs which INSET providers should address in their workshops. It is also assumed that Physical Science teachers' INSET needs are essentially related to academic and professional qualifications, school context (i.e. rural, township, urban), class size, and grades taught.

DEFINITION OF CONCEPTS

In-service education and training (INSET)

This concept refers to programmes that assist teachers to improve their academic, professional and practical knowledge (i.e., craft knowledge) in order to improve their effectiveness in the classroom and their professional service in general (Ngcongo, 1994). The above definition refers to upgrading of skills and knowledge of Physical Science teachers who already serve the Limpopo Province Department of Education.

Perceived INSET needs

According to the Oxford dictionary of current English (Hornby, 1989) "perceive" means when one becomes aware of something. According to Lubben (1994), INSET needs refer to professional concerns and classroom problems experienced by Physical Science teachers, with which they require assistance in order to improve their classroom practice.

Physical Science teachers

All teachers employed by the Limpopo Province Department of Education during the third term in 2000, who teach Physical Science in government secondary schools in grades 10 to 12. Physical Science teachers are defined as those who spend most of their teaching periods teaching Physical Science in proportion to all lessons taught per week.

Demographic profile

This term is used here to refer to information related to teachers' characteristics such as, for example, sex, age, academic and professional qualification, grades taught, years of teaching experience, type of school they teach at (e.g., urban, township, rural), and so forth.

LIMITATION OF THE STUDY

The National Education Policy Act of 1996 (Department of Education, 1998) enabled the implementation of the rationalisation and redeployment of teachers in accordance with stipulated norms. The Limpopo Province Department of Education consequently redeployed teachers who were considered to be in excess at their schools, to schools which had shortages. This process was guided by the curriculum needs of the school and aimed at achieving equity in education staff provisioning (National Department of Education, 1998). The rationalisation and redeployment process has not yet been completed in the Limpopo Province (MA Seopa, personal communication, 23 August 2004). Although this delay is beyond my control, it has led to uncertainty on the part of teachers. As a result teachers may not have been at ease in participating in this survey, as they might feel they could be disadvantaged if their qualifications are not appropriate for teaching Physical Science.

OVERVIEW OF CHAPTERS

Chapter 2 focuses on international and national developments in designing effective and efficient INSET programmes. Different INSET models are discussed and the strength as well as weaknesses of each model is indicated. This chapter thus highlights the theoretical framework of this study.

In Chapter 3, the choice, adaptation, modification, and pilot testing of the instrument used in this study is discussed. In particular the chapter outlines the adaptation of the *Science Teacher Inventory of Needs-3* (STIN-3), leading to the development of the *Science Teacher Inventory of Needs-Northern Province (STIN-NP).* The chapter also explains how the instrument was validated and finally administered. The use of focus group interviews in conjunction with the questionnaire is explained. Finally, the chapter outlines the capture and analysis of the quantitative and qualitative data collected.

Chapter 4 describes important findings from the survey and focus group interviews. Tables are provided in order to present the demographic profile (e.g., age, qualifications, class size, type of schools, Physical Science teaching experience, etc.) and Physical Science teachers' perceived INSET needs.

Chapter 5 discusses and interprets the results of the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province. An attempt is made to compare the above-mentioned results to those of other, similar, studies conducted internationally and nationally. The chapter also provides conclusions and recommendations based on the findings, and highlights possible avenues of further research.

Chapter Two

LITERATURE REVIEW

INTRODUCTION

The previous chapter highlighted the poor matric results and low enrolment of learners in Physical Science in the Limpopo Province. This chapter takes stock of developments at international and national level with respect to designing effective and efficient INSET programmes. Teachers, particularly of Physical Science, are faced with the ever expanding scientific knowledge. Physical Science teachers thus have a need to improve their professional knowledge, skills, and attitudes in order that they can educate learners more effectively (Bolam; in Dunkin, 1987).

INSET IN GENERAL

There is general consensus that professional development for teachers can best be realised through In-Service Education and Training (INSET). Initially, the development of INSET from the 1950s to early 1970s did not recognise that a fundamental analysis of the teachers' needs was required (Ashton et al., in Lungu, 1996). INSET Programe organisers considered themselves to be in the best position to decide what is good for their teachers and what they need (Hartshorne, in Ashley & Mehl, 1987). The lack of consultation resulted in INSET programmes not being effective. Easterday and Smith (1992) described a situation in the United States where many teachers in states such as, for example, Minisota and Maryland, expressed dissatisfaction that staff development programmes were not useful.

It was later realised that programmes which involve cooperative efforts among secondary teachers and university representatives have resulted in more favourable responses than those programmes which did not include teachers' input (Smith and Haley, in Easterday & Smith, 1992). Howe and Stubb (in Wallace, Nasbit & Miller, 1999) suggested a different approach to the one without teacher consultation, advanced the argument that "if we continue to do things we have always done, we will continue to get the results we

have always gotten, and those results are not serving us well." The contemporary approach to INSET provisioning stresses the importance of the participants' perspective. It was realised that the understanding of the individuals involved, their organisation, and the change process is key to improved professional development practice (Fullen and Guskey, in Wallace et al., 1999). In designing INSET for provincial development programmes, the school context which includes both school culture and classroom climate thus needs to be considered (Guskey, 1994). Different models are being used in the provisioning of INSET programmes.

INSET models

There exist several approaches to the provisioning of INSET in the world, for example Dunn's five models (Nduna, 1999), namely a) the traditional model, where the participants enroll at universities to complete particular course work in order to gain an additional qualification; b) the institute model encompassing workshops and seminars of a short duration (this model is focussed on defined topics and does not cater for on-going in-service training); c) the academic model which is similar to the traditional model, with the exception that professional qualification for completion of a particular course takes place; d) the networking model mainly used outside school by teachers associations and unions as a forum by teachers to discuss school-related issues of concern; and e) the competency-based model focusing on the needs of the participants. Competency-based in-service programme is teacher centred, because their input in the development of the programme is critical.

INSET IN SOUTH AFRICA

INSET provisioning in South Africa prior to 1994 can be understood within the context of apartheid, which polarised the population mainly into Blacks and Whites (Hartshorne, in Ashley & Mehl , 1987). Schools were segregated and unequally funded. As a result of the apartheid approach to education, Black teachers were poorly trained and lacked relevant resources at their schools. The INSET programmes thus operated on the premises that Physical Science teachers lacked a sound academic background (Ashley & Mehl, 1987). According to Ashley and Mehl (1987), most Black teachers had low qualifications in terms of the government's ruling of 1983 (i.e., in 1983, one was

regarded qualified if one had matric plus a minimum of three years training). Physical Science teachers were regarded qualified if they obtained a Senior Certificate and three years of professional qualification. Eighty percent of Black teachers were underqualified (Ashley & Mehl, 1987) in terms of the above stated criteria. Ashley and Mehl (1987) adds that 82% of Black teachers, and 62% of the so-called 'coloured' teachers, had a highest academic qualification of standard 8 (grade 10) or lower, which implied that teachers needed content knowledge in order to satisfy the minimum requirements. Black schools were also overcrowded, yet staffed with under-qualified teachers with poor facilities (Christie, 1985:93, 243). Kahn (2004) argues that the consequences of the apartheid years will persist into the future without specific redress measures. INSET is likely to offer an effective solution to teachers' professional development if teachers' needs are properly addressed.

The general perception held by some INSET developers was that teachers' effectiveness is influenced by factors such as qualifications and motivation (Gorton, 1976; Nqcongo, in Ashley & Mehl, 1987). INSET workshops in South Africa before 1994 were geared towards improving teachers' qualifications, manipulative skills, and teaching strategies in order to improve their teaching effectiveness (Nqcongo, 1987). INSET workshops in South Africa were also dominated by the desire to update teachers' knowledge. There were workshops organised by NGOs which all aimed at stimulating commitment and competence among all Physical Science teachers in South Africa as a whole (Ashley & Mehl, 1987; Bot, 1986) in addition to the provincial INSET programmes offered. Teachers, who successfully completed TOPS programmes, were awarded various diploma such as, for example, Senior Education Diploma (SED). Since TOPS participants gained additional qualification, the model they used; relates to Dunn's traditional model. SEP, SCITIP and MATIP did not award additional qualifications. Teachers mostly attended workshops and seminars of short duration, focussed on defined topics. The latter programmes thus relate to Dunn's institute model (Nduna, 1999).

According to Mailula (1995), other INSET programmes offered in South Africa for Black science teachers were a) the Science and Mathematics Subject Support Programmes (SMSSP) offered by the Funda Centre (in Soweto) for all Black primary science teachers in South Africa; b) the Urban Foundation Project which operated in 1986 and 1987 for primary schools which were SEP feeder schools; and c) Mathematics and Science In-

service Training Projects (MATIP and SCITIP) which was a joint effort of Lebowa and Gazankulu together with the Research Institute for Education Planning (RIEP) of the University of Orange Free State.

INSET IN THE LIMPOPO PROVINCE

INSET activities in the Limpopo Province prior to 1994

Bagwandeen and Louw (1993) maintain that INSET is mainly used as a tool to mould better teachers by improving their knowledge, providing ways to help them improve their effectiveness in the classroom and by instilling in them a desire to do better job of teaching. According to Feiter, Vonk and van der Akker (1995), most workshops conducted before 1994 in the Limpopo Province were aimed at improving job-related knowledge, insights, repertoire, and attitudes. In-service workshops were thus directly or indirectly related to the improvement or change of teachers' own practice, that is, addressing issues related to difficulties experienced in the classroom by teachers (Feiter, Vonk & van der Akker, 1995).

According to Mailula (1995), departmental in-service courses were aimed at the enhancement of qualification of the teacher based on premise that the academic growth of the teacher will improve both his / her professional performance and that of the school (i.e., matric results). This view of enhancing teachers' qualification in the Limpopo Province was manifested in the programmes offered at various centres within the Limpopo Province as illustrated below.

The Lebowa Department of Education (which existed before the unification of the Limpopo Department of Education) offered centre-based workshops at the Lebowa In-service Training Centre located at Limburg (Mailula, 1995). The workshops lasted for a week, and were residentially based (i.e., provided teachers with sleeping accommodation). According to Mailula (1995), problems relating to classroom practice were addressed. Topics to be addressed in the workshops were selected by programme organisers and not by the teachers, and participation in the workshops was not voluntarily. The workshop programme was issued six months in advance. No teacher was expected to refuse to abide by the departments' instruction to attend in-service

programmes (Nqcongo; in Mehl, 1987). Yet teachers who attended because they were instructed were not sufficiently committed to the programme (Mailula, 1995). The model followed by the Lebowa in-service training for science teachers did not award an additional qualification to the participants. Teachers were mostly attending workshops of a short duration and thus the model followed by the Lebowa In-service, matches with the institute model of Dunn (Nduna, 1999),

Other teacher centre which existed in Limpopo before 1994 was the Ramano Mbulaheni Training Centre established in the former Venda (Mutshekwane, 1995) which is now incorporated in to the Limpopo Province. This centre had the objective inter alia, to upgrade teachers in Physical Science and Mathematics in order to develop their professional competence, confidence and relevant subject knowledge and skills (Mutshekwane, 1995). The centre lacked educational facilities such as teaching materials, properly equipped lecture-rooms and laboratories. The staff of Ramano Mbulaheni Training Centre, though academically qualified, lacked the practical skills of handling teachers (Mutshekwane, 1995). Teachers' INSET needs were not considered when planning programmes. Mutshekwane adds that teachers complained of travelling long distances to the centre and leaving their classes unattended. The INSET model followed at Ramano Mbulaheni Training Centre comprised workshops and seminars of a short duration focussed on defined topics and therefore suits the institute model of Dunn (Nduna, 1999).

The Giyani Science Centre was established in the former Gazankulu, and is currently also part of the Limpopo Province. The Giyani centre was associated with improvement of the practice of serving Physical Science teachers (Bandi, 1999). According to Bandi (1999), the centre offered ad hoc, short, often provincially- or NGO-sponsored, courses. Teachers received attendance certificates for the workshop offered. The model used by the Giyani Science Centre, in my opinion, was the competency-based model of Dunn because teachers inputs and INSET needs in the development of the programme were critical (Nduna, 1999).

INSET activities in the Limpopo Province after 1994

After 1994 the previous home-lands' in-serve training centres mentioned above (i.e., Lebowa In-service Training Centre, Ramano Mbulaheni Trasining Centre, and Giyani Science Centre), ceased their funtions as in-service centres. Physical Science teachers received their INSET training at the University of the North (Mailula, 1995) in order to upgrade their academic qualification. The University of the North (UNIN) was basically preferred by the Limpopo Department of Education to upgrade Physical Science and Mathematics teachers because it had better facilities and well-qualified staff in contrast to the Department itself. One of the programmes offered by UNIN between 1994 and 1996 was the University In-service Training (UNIST) one. Here the training was focussed on skills in Mathematics and Physical Science, and UNIST aimed at improving the academic qualifications of science teachers (Mailula, 1995). The INSET model used by UNIN was the traditional model of Dunn since the participants enrolled at the university to complete particular course work in order to gain additional qualification (Nduna, 1999).

The success of INSET workshops also depends on a joint venture by various stakeholders, as illustrated by Mutshekwane (1992) in his work on INSET in Venda. Mutshekwane stated that a key theme in effective in-service training is a partnership between all those involved (i.e., teachers, principals, curriculum advisers, area managers, teachers) in order to create a continuous, open process of consultation aimed at identifying needs of teachers as the basis for planning of relevant workshops.

THE IMPORTANCE OF TEACHER NEEDS

Teacher should first be consulted and be part of the decision-making regarding the INSET programme they would like to have. According to Eraut (in Anderson, 1995), school and teachers will be more committed to changes they have initiated and planned themselves. Assessment of strengths and weakness of school science should be made by teachers in collaboration with university staff before choosing an INSET model (Wallace, Nasbit & Miller, 1999). Van den Berg (in Ashley & Mehl, 1987) argues in favour of teacher consultation in regard to their INSET needs. The ownership resides in the users, who identify and diagnose the need, outsiders (i.e., programme providers) become involved on the basis of terms laid by the users themselves (Van den Berg, in Ashley &

Mehl, 1987). In-service education programmes should be grounded in the needs and interests of the persons to be served (Bandi, 1999; Eraut, 1995; Hofmeyer and Pavlick, 1987; Lungu, 1996; Mutshekwane, 1995; and Nduna, 1999).

The following are some of the scholars who eliciting perceived INSET needs of science teachers: Smith (2000) conducted a national survey in order to find out professional development of Chemistry teachers' needs across the United States of America. In the United States of America and district of Colombia, (Banilower, 2002) conducted a survey in 50 states of America on Physical Science INSET needs for professional development. Rubba (1982) conducted a research on ' Do Physical Science teachers Have a special in-service Needs?', in Kansas (Ramsey, 1993) conducted a research to establish perceived needs of Houston-area middle school science teachers' in-service related content. Ramsey (1993) also conducted a survey of the perceived needs of Houston-area middle school science teachers concerning curricula, in-serve and related content. Wallace (1999) made an assessment of strength and weaknesses of the school science programme in North Carolina. Zurub (1982) assessed the needs of active science teachers of the 11 in-service regions in Jordan. Jbeily and Barufaldi (1985) assessed the needs of active science teachers for the state as a whole in the Republic of Lebanon. Abu Bakar (1986) assessed needs of science teachers in order to set the national policy in Malaysia.

SUMMARY

This chapter highlighted the importance of professional development through INSET programmes which accommodate teachers' perceived INSET needs. It was strongly stated that teachers who attend INSET workshops mainly because they are instructed are not sufficiently committed to the programme.

Various INSET models by Dunn were discussed and an attempt was made to identify models used in South Africa and Limpopo Province. The poor qualification of teachers in the Limpopo Province necessitate INSET programmes to be geared towards improving teachers' qualifications and manipulative skills. The INSET programmes offered in South Africa and Limpopo were a joint effort of various stakeholders such as, for example, the Department of Education, NGOs (e.g. SEP, TOPS, SCITIP), and the University of the North. The University of the North used the traditional method in UNIST to award

teachers' additional qualifications. The NGO component of Giyani Science Centre partly used the competency-based model.

Almost all INSET programmes offered by the Limpopo Province Department of Education paid little attention to teachers' views or needs and were basically institute models. This lack of consultation lead to INSET programmes to be unpopular with teachers who ended up despising and viewed INSET programmes as "top–down" activities (Mutshekwane, 1995). The contemporary trend in INSET provisioning is to address needs identified and defined by teachers.

The research methods followed in the present study of perceived INSET needs and the demographic profile of Physical Science teachers in the Limpopo Province are described in the next chapter.

Chapter Three

METHODOLOGY

The theoretical perspective of this study was elaborated in the previous chapter. In this chapter a rationale is provided for the quantitative (i.e., using questionnaires) and qualitative (i.e., using interviews) data collection approaches used in this study. This chapter also addresses the questionnaire design, and includes an outline of the choice of the instrument, its adaptation, modification, pilot testing; and its administration to science teachers in the Limpopo Province. Details of the capture and analyses of both quantitative and qualitative data are also provided.

RESEARCH DESIGN

Two methods were used in the study, namely a survey using questionnaires and focus group interviews with Physical Science teachers. The study was designed to gather data on the demographic profile, and to elicit perceived INSET needs, of Physical Science teachers in the Limpopo Province. The survey using a questionnaire was used because it is an efficient and an effective way of obtaining information from a large number of individuals (Steiner, 1998; Macmillan & Schumacher, 1993). It was necessary to use a census approach (i.e., involve the whole population) as the researcher aimed at gathering demographic data of all Physical Science teachers in the Limpopo Province. The focus group interviews method was used because it helped the researcher to capture qualitative information, which was otherwise not possible to be obtained using the survey method (Kvale, 1996:94). The qualitative method was used to double-check the findings from the questionnaire.

SURVEY INSTRUMENT

The instrument used in this study is called the *Science Teachers Inventory of Needs in the Northern Province* (STIN-NP).[1] This questionnaire was developed from STIN-3 of Baird,

[1] The name of the province was changed after the development of the instrument, and hence the new name is not reflected in the instruments' name

Prather, Finson, and Oliver (1994), which evolved from the first form of STIN developed by Zurub and Rubba (1983). The purpose of designing STIN was to develop and validate an inventory which could be used in developing nations to identify the needs of science teachers in order to provide a base of information for planning science teachers INSET activities (Zurub & Rubba, 1983). STIN was successfully used in many countries like the United States (Baird & Rowsey, 1989), Jordan (Zurub & Rubba, 1984), Malaysia (Bakar, 1984), and Lebanon (Jbeily & Barufaldi, 1985). The instrument was selected for its established reliability, validity and structure, which could be easily interpreted within specific categories of need.

The original STIN

The 76 items contained in the original STIN are organised into seven categories of teachers' needs. The categories are namely (1) specifying objectives for Science education, (2) diagnosing and evaluating learning, (3) planning Science instruction, (4) developing Science instruction, (5) managing Science instruction, (6) administering instructional facilities and equipment, and (7) further professional development of Science teachers. Each item describes a task that a teacher may be called upon to perform, followed by a five-point scale (i.e., A = not familiar, B = no need, C = little need, D = moderate need, and E = great need) (Baird, Prather, Finson, & Oliver, 1994). The STIN questionnaire had additional spaces to allow open-ended responses to each item (Baird et al., 1994).

Baird and Rowsey (1989) revised STIN for the survey of Alabama secondary science teachers' needs in the USA. Easterday and Smith (1992) also revised STIN but for a survey of Mathematics teacher needs in the same state. The last (i.e. third) revision of STIN was 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, and was named STIN-3. STIN-3 contained a total of 100 items, divided into four sections. The first 52 items assess needs in the seven need categories mentioned above 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." The last 13 items described problems that confront teachers in their class, and used a five-point response option from "not a significant problem" to "a serious problem" (Baird, Prather, Finson, Oliver, 1994). Open-ended response options were eliminated in order to allow for machine scoring through optical mark reading.

Modification of STIN-3

The researcher accepted STIN-3 as a reliable and valid instrument used in other countries but its use in the Limpopo Province with a different educational context to that of earlier uses of STIN demanded that the STIN-3 be modified and its validity be determined. The procedure followed in the modification of STIN-3 is as follows: a) initial modification was completed by the researcher, b) validation of INSET needs was undertaken by stakeholders, c) a pilot-test was carried out on a sample of teachers, and d) the final modification of the instrument was carried out by the researcher.

Initial modification of STIN-3 by the researcher

The researcher adapted the STIN-3 questionnaire by firstly correcting or changing some American terms, phrases and sentences to South African terms. For example "kilometers" were used instead of "miles", and "primary area of certification" was replaced with a more familiar term of "professional qualification".

Specific terms were replaced to make the language consistent with OBE terminology, as Outcomes- Based Education was recently introduced in South Africa. Examples of such terms "students" being replaced with "learners", "objectives" replaced with "outcomes", and "test data" replaced with "various forms of assessment".
Some instructions were rephrased to simplify language for Physical Science teachers in the Limpopo Province, as the majority are English second language speakers. For example, the instruction in "in responding to this item you are asked to use a #2 pencil to bubble in the 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". "Employ peer tutoring in science teaching" was rephrased to

"Employ teaching approaches that make learners teach other (i.e. peer tutoring)", and so forth. In addition to the first two items in the questionnaire used to identify if a teacher was responsible for teaching Mathematics, Physical Science, or Biology; new items were also added (i.e., 53, 54, and 55) in order to cross check if the teacher was correctly classified as a Physical Science teacher.

In STIN-3 the option of "not familiar or no tools" was used, whereas in STIN-NP the "no tools" option was removed due to the fact that a teacher may have tools but only to find that s/he is not familiar with them. The 5-point response option ranging from "not familiar" to "great need" was printed in italics for teachers to take care of it in STIN-NP. In order for teachers to take note of vital ideas, key and important instructions were a) formatted in bold face (e.g. **"Please use a black/blue pen or a pencil to answer the questionnaire"**), b) printed in red ("Please note that this survey is anonymous and that in the results no individual or school will be identified"), c) written in italics ("If you would like to suggest additional item/s that you feel are of great need, please write them, on page 14 -15 of the questionnaire"), and, all action verbs were underlined on each item in the whole questionnaire (e.g., update your knowledge of effective teaching approaches/methods). At the top of every page in the questionnaire teachers were always reminded to answer the questionnaire from the perspective of either a Mathematics or a Physical Science or a Biology teacher, depending on the answer they provided to question 2.

Validation by stakeholders

It is important to find out if a questionnaire really measures what it was intended to measure (Aray, Jacob & Razavich, 1990), and this can be achieved by establishing the validity of an instrument before administering it. According to Kvale (1996: 236), "validation refers to the truth and correctness of a statement, which is well grounded, justifiable, strong and convincing". To find out whether the questionnaire measured what it was supposed to measure, the researcher sought content-related evidence in regard to the appropriateness of the items included (Ary et al., 1990). Relevant stakeholders in Physical Science were therefore invited to modify the questionnaire and give a rationale for their suggestions. Stakeholders were selected because of their expertise in Physical

Science, and 47 individuals from different organisations with sound knowledge and interest in science were consulted. The stakeholders categories consisted of Curriculum Advisors, various university academics in science education, Physical Science examiners in grade 12, members of teacher unions (i.e., Professional Educators' Union [PEU], South African Democratic Teachers' Union [SADTU], Suid Afrikaanse Onderwysers Unie [SAOU]), members of professional associations (i.e., South African Association for Research in Mathematics, Science and Technology Education [SAARMSTE]), and Non-Governmental Organisations (NGOs) involved in Physical Science (e.g., Phalaborwa Foundation, Centre for the Advancement of Science and Mathematics Education [CASME]).

Each of the above seven stakeholder categories used were selected because of their insights unique and important role into Physical Science, as indicated below. Officials from the Department of Education engaged with curriculum support are influential and experienced INSET providers. Curriculum Advisors are directly involved with teachers and they are INSET providers and organisers because they have better knowledge of the subject than teachers do. They know possible problems teachers might need help with, and that INSET activities could address. Academics as masters of the subjects need to ensure that items are relevant and appropriate to Physical Science teachers. Grade 12 examiners have the primary role of setting and marking Physical Science Senior Certificate exam papers. From marking learners' scripts and controlling their sub-examiners' work, examiners are fully acquainted with areas where teachers need help. Teacher unions take a keen interest in their members' welfare and occasionally even run workshops for them. The union members at the education-desk are subject specialists who know their teachers' INSET needs, and they will thus have relevant insight into the usefulness of the instrument. Professional Associations consist of members who are active researchers. Members of the professional association share opinions during conferences with their international colleagues. Contributions from individual members of such associations can thus help in developing a suitable instrument, which will identify valid INSET needs of Physical Science teachers. NGOs as INSET providers are directly involved with teachers and Curriculum Advisors, and their members therefore know what needs to be offered in INSET workshops.

Instruction to stakeholders

The aim of the questionnaire was explained to stakeholders as follows: a) to provide the Limpopo Province Education planners with an accurate, reliable and valid list of perceived INSET needs of Physical Science teacher; b) to establish an accurate database for Physical Science teachers; and c) to enable INSET programme planners in Physical Science to plan effective and sustainable programs in the Limpopo Province.

The purpose of the validation activity was to check whether INSET needs described were appropriate and relevant to Physical Science teachers in the Limpopo Province, to suggest changes in wording if the instructions were not clear and unambiguous, as well as deciding whether the language used was clear and appropriate for second language users (Appendix A, page 62). In the event where instructions and / or needs did not meet the above criteria, the stakeholders were requested to justify their decision with a brief explanation, and to suggest new items or changes in wording. Stakeholders were requested to write all their comments, explanations and suggestions on a separate sheet and to label the number of the item(s) concerned. Stakeholders were requested to return the separate sheets with their comments and suggestions in the self-addressed and stamped envelopes provided by a given date.

Table 3.1: Return rate of stakeholders' responses in the validation of STIN-NP

Validation category	No. sent out	No. returned	Return rate %
Department of Education	3	3	100
Physical Science examiners	3	3	100
Teacher unions	3	2	66
Professional associations	2	2	100
University academics	8	5	62
Physical Science curriculum advisors	37	30	81
NGO staff	5	2	40
Total	61	47	77

The questionnaires were posted to 61 stakeholders, and the researcher had phoned stakeholders before sending the questionnaires off in order to encourage their participation. Follow-ups were also done several times by phoning some of the stakeholders after the deadline had passed in order to obtain their responses. It was found

that some stakeholders had either lost or misplaced the questionnaire. In these cases, new questionnaires were sent to replace lost ones. The overall return rate was 77% and Table 3.1 shows the return rate of different stakeholders' responses.

Analysis of stakeholders' responses and modification of items

The contributions of all the stakeholders were recorded in a table and the frequency of occurrence of each given item was determined. The frequency with which changes were suggested and the reason(s) given for the change were used as a basis for accepting or rejecting recommendations. The final modification of the questionnaire, however, remained the responsibility of the researcher.

The researcher analysed stakeholders' responses by identifying patterns of suggested changes, considering reasons given by stakeholders for suggested changes, and comparing items in STIN-3 with proposed new items for STIN-NP. Changes were placed into the categories "rephrase", "replace", "delete", "new items", and "accept as it is". The researcher then modified the items in the light of stakeholders' responses.

Rephrasing

Items were rephrased and their meaning enhanced by providing examples in brackets to ensure that language was not a problem for understanding the items. For example, the STIN-3 item "Update your knowledge of science related societal issues" was rephrased to read "Update your knowledge of issues in the society related to Physical Science (e.g., economics, electrification, HIV/AIDS)". This was done in order to provide additional clarification of the items.

Replacing items

Some terms were replaced as for example "Write" was substituted with "identify", as in "Identify learning objectives (outcomes) which specify knowledge needed by learners in Physical Science and "Deliver" was replaced with "teach" as in "Use computers to teach Physical Science". Terms like the above ones were replaced to clarify concepts.

Eleven items related to teachers' demographics (e.g., "what is the approximate average annual income of families sending students to your school") were replaced by eleven items more relevant to the South African context and the study such as, for example, "Number of learners in your largest Physical Science class this year", "What is the highest professional (i.e., teaching) qualification you hold" and so forth.

Deleted items

Items such as "Construct and use a data bank item test " were deleted from STIN-NP because data test items are not used in South Africa. The item "Set up a laboratory supply order with a storage and a retrieval system" was also deleted from STIN-NP because most schools in South Africa are without electricity and therefore do not have computers. As a result, the item "Select and order science software for microcomputers in your school" was deleted from STIN-NP.

New items

Twenty new items were added to STIN-NP such as for example, "Apply concepts taught in Physical Science to daily life of learners (i.e., to real life situation)." This was done in order to ascertain if the teacher has a problem of relating the subject matter to the application of concepts in every day life situation. Another added item was "Employ teaching approaches (i.e., methods) for teaching large classes in Physical Science". This item was designed to help the researcher to know if the teacher has a problem with teaching large classes as this is often a problem in the Limpopo Province. In my experience as a Physical Science Curriculum Advisor in Limpopo, many teachers are responsible for teaching about three science subjects in a school, and therefore the item "In which of the following subjects do you teach the most lessons per week this term?" was also included. Items were added also to clarify the demographic profile of responding teachers such as, for example, "Years of classroom teaching experience specifically in Physical Science", which was aimed at ascertaining teachers' experience in teaching of Physical Science.

General changes

The original sequence of the need items was changed in order to position relatively easy and interesting questions at the beginning of the questionnaire. This was done in order to

motivate teachers to complete the questionnaire. Thus the need category of improving personal competence (which was the last in STIN-3) was made the first in STIN-NP because of its inherent interest to teachers. The section on items which teachers perceive as problems were placed after the demographic items, and items on the frequency of teaching strategies were last.

Language modification

Finally, an English Second Language expert was requested to modify the language to be suitable for English Second Language speakers in the Limpopo Province. The expert was requested to read through the instructions and items of the STIN-NP questionnaire and to underline any sentence(s), phrase(s) or word(s) which appeared inappropriately, and to then suggest changes in wording.

Thus out of 100 STIN-3 items, 22 were deleted as they were not relevant to South African context, 14 were left unchanged, 68 were changed or modified, and 20 new items were added to make the instrument relevant to the South African context.

Pilot study

To determine whether the STIN-NP would function in the intended manner the questionnaire was exposed to a small group of Physical Science teachers (n=60) as recommended by, for example, Ary et al. (1990). The pilot-test was also undertaken in order to identify misunderstandings, ambiguities and useless or inadequate items (Wiersma, 1991) before it was finally administered to all the Physical Science teachers in the Limpopo Province. Groups of 20 teachers, each from rural, urban, or township schools were selected to comment on the questionnaire. The selected teachers were from three administrative of the Limpopo Department of Education districts. Their selection was based on the type of schools they were teaching at (i.e., rural, township and urban), because school context was assumed to be one of the major variables influencing INSET needs (Chapter 1, page 6).

Teachers who participated in the pilot test received the questionnaire with a covering letter which explained the purpose and value of the study as well as the importance of

teachers' participation (see Appendix B, page 64). Teachers were asked to indicate problems in regard to their understanding of the instructions, statements (i.e., items), and answer options by underlining any word(s) or phrase(s) or sentence(s) they did not understand. If they believed any item to be ambiguous, they were asked to circle the item number and suggest changes in wording, or suggest different or additional answer options.

The questionnaires were distributed to teachers via the District Offices and their principals, and were returned the same way. Questionnaires were returned within two weeks. Out of 60 questionnaire sent to teachers, 29 were returned. The pilot-test responses gave an indication of how teachers would generally understand the questionnaire. It was clear to the researcher from the responses that the questionnaire would be understood as teachers did not underline any words phrases, or sentence.

The final version of the STIN-NP

The final version of the *Science Teacher Inventory of Needs-Northern Province* (STIN-NP) consists of 98 items arranged in six sections (Appendix C, page 69). Section A contains two items designed to identify the subject the teacher offered (i.e., whether Mathematics, Physical Science or Biology) and the subject they teach the most lesson per week. Section B contains 47 items that assess teachers' INSET needs, offering responses from not "familiar" to "great need". The seven categories of needs are as contained in the original STIN-3: a) improving one's competence as a science teacher (10 items); b) specifying objectives for science instruction (6 items); c) diagnosing and evaluating learning (2 items); d) planning science instruction (3 items); e) delivering science instruction (14 items); f) managing science instruction (5 items); and g) administering science instructional facilities and equipment (7 items). Section C contains 26 items which determine demographic information about teachers and their schools (e.g., sex, age, academic qualification, highest professional qualification, Physical Science teaching experience, etc.), offering variety of responses. Section D contains 14 items which describe problems that confront Physical Science teachers in their classes, offering responses from "not really a problem" to "a serious problem". Section E contains eight items that assess the frequency of use of particular teaching strategies, offering responses

from "never use" to "weekly use". Section F contains one item which asks for the EMIS number (Educational Management Information System) of the teacher's school. This number is designed to assist the researcher calculate the proportion of schools covered in the survey.

Information on the reliability of STIN-NP was determined 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 use of with Physical Science teachers was 0.95, and the adjusted Guttman split-half reliability was 0.83.

Administering of STIN-NP questionnaire

As the success of the study depended on the involvement and participation of teachers and by implication and also that of educational officials- written approval for this study was obtained from the Superintendent-General of the Limpopo Department of Education. The STIN-NP questionnaire was administered by delivering copies to all 31 District Offices of education in the Limpopo Province, accompanied by a covering letter from the researcher as well as a copy of the Superintendent-General's approval letter for this study (Appendix C, page 66). District Managers were requested to distribute the questionnaires via the Curriculum Advisers and school principals to Physical Science teachers. In addition to the above arrangements, the researcher personally requested Curriculum Advisors during their official interactions (e.g., during Physical Science workshops), to help with the administration of the questionnaires.

The total number of secondary schools in the Limpopo Province (i.e., 1629) was established with the assistance of the provincial education department. It was estimated in collaboration with education department officials that each school would have one Physical Science teacher. A total of 1629 questionnaires were thus distributed to Physical Science teachers in the Limpopo Province in July and August 2000.

The researcher tried to maximise the response rate by, firstly compiling an attractive questionnaire with a logical structure (Appendix C, page 69). Secondly, the questionnaire

contained a covering letter that explained the purpose of the study and its anticipated significance in contributing to the improvement of science education in the Limpopo Province. Thirdly, the covering letter was also printed on official stationery of the university to indicate the study's status. Fourthly, District Managers and Curriculum Advisors were informed of the study in advance of the distribution of the questionnaires to facilitate plans to get them to principals and teachers (Appendix C, pages 67 & 68), and were also contacted after the distribution to ensure that they have received them. Fifthly, Districts that had not received them, or had misplaced them, received a new batch of questionnaires. Finally, follow-up phone calls were made to District Offices and officials responsible for the distribution and collection of the questionnaires. These calls were made at weekly intervals for two months after the submission deadline, until it became obvious that no further completed questionnaires would be received.

FOCUS GROUP INTERVIEWS

Interview questions were structured to cross-validate the information obtained through the questionnaires and also to help acquire possible additional information on the teachers' INSET needs. Six groups of Physical Science teachers were invited for the interviews, which took place in September 2000. Each group comprised about 10 teachers. The total number of teachers who responded to the invitation for the interviews were 35 (18 male teachers and 17 female teaches). The six groups were from urban, rural, and the township areas as it was assumed that INSET needs were largely influenced by school context (Chapter 1, page 6), the district managers and the curriculum advisors concerned were thus requested to invite the purposefully selected teachers (Appendix C, page 68).

As is indicated in Table 3.2, six interview sessions were held with three groups of pure Physical Science teachers (i.e., only teaching Physical Science) and three mixed groups (i.e., teachers who taught a combination of Mathematics, Physical Science and Biology). Out of a total of 35 teachers who were interviewed, 21 were Physical Science teachers as per the definition in Chapter One (page 7).

It was essential for the researcher to establish a free and cordial relationship with teachers, in the interviews as recommended by Wiersma (1991). The researcher started the interviews by introducing himself, welcoming all present to the interview, and stating the objective of the interview (i.e., asking teachers the issues they would like to be addressed in future INSET workshops). The fact that it would be difficult to analyse any information unless captured by a tape recorder, meant that teachers' permission was sought to use a tape recorder. This was in accordance with ethical demands (Kvale, 1996:113), and all teachers consented. Teachers were assured of anonymity in order to alleviate any fear of victimisation, and were thus requested not to use their names but assigned letters like T1, T2, and so forth.

Table 3.2: Number of teachers interviewed, subject they taught, and type of school they taught at

Session	Type of school	Subject group	NO. and sex
1	Rural	Pure	10 (3M, 7F)
2	Township	Pure	6 (4M, 2F)
3	Urban	Mixed	4 (F)
4	Rural	Mixed	5 (4M, 1F)
5	Township	Pure	5 (4M, 1F)
6	Rural	Mixed	5 (3M, 2F)
Total			35 (18M, 17F)

Semi-structured interview questions were intended to elicit perceived INSET needs of Physical Science teachers, and included questions such as for example. "What are your greatest professional needs as a Physical Science teacher? ", "What needs would you like to have addressed in INSET workshops as a teacher of Physical Science? ", "What further skills would you like to acquire in order to be an effective Physical Science teacher? ", and "Which topic(s) would you like to see included in Physical Science INSET workshops?" Questions were also asked with respect to the teachers' demographic profile (e.g., years of classroom teaching experience, type of school in which you teach, etc. The duration of the interviews was about 45 minutes. Teachers' active participation was gratifying and some rural teachers even asked the question why such interviews were not conducted in the past. The researcher concluded each interview session by thanking the teachers for their time and effort, as some teachers in rural areas came on foot and even in rainy weather sometimes.

DATA CAPTURE

STIN-NP (Questionnaire)

The answer sheets were detached from the questionnaire booklets as they contained teachers' answers to the questionnaires. As answer sheets collected were from Mathematics, Physical Science and Biology teachers, answer sheets were firstly sorted according to teachers' responses to items 1 and 2 (i.e., "Which of the following subjects do you teach this term?" And "In which of the following subjects do you teach the most lesson per week this term?"). This was the main criterion used to identify whether the teacher was a Mathematics, Physical Science or Biology teacher. The researcher further used the teachers' responses to items 42-48 and item 49 as they were to be answered only by Physical Science and Biology teachers respectively. Only few response cards did not satisfy the above demands, and were considered spoiled.

Data from STIN-NP was machine read with an optical mark-reading scanner, and subsequently captured in a SSPS file on a personal computer. When the answer-sheets were machine read (i.e., scanned) any item with two responses gave an error message. In such cases, the researcher manually checked individual items in the questionnaires to ascertain whether one response was perhaps cancelled out and another substituted. The intended response was then manually entered into the SPSS file. Questionnaires with comments on the page provided for this were set aside, and original wording of the comments was recorded in a table according to the questionnaire number (see Appendix D, page 68).

Focus group interviews

A tape-recorder was used during the teachers' interviews. The recorded interviews were first transcribed verbatim into written texts by the researcher in order to ensure that all data were captured, as recommended by Kvale (1996: 163, 169). Thereafter superfluous materials e.g. "uh'' and ''umm'' or "you know" digressions and repetitions were eliminated, as suggested by Krueger (1998: 81). Transcription was then transformed into more formal and written style in order to facilitate analysis of what was said by the

interviewees, as recommended by Kvale (1996: 170). Interview transcripts are presented in Appendix E: (page 86).

SUMMARY

In this chapter, the rationale for the research design was outlined, and methods used to collect data were described. A methodology using both quantitative and qualitative methods was used to maximise the trustworthiness of the findings of this study and to acquire possible additional information on teachers' INSET needs. The instrument used to collect quantitative data on the demographic profile and perceived INSET needs of Physical Science teachers was developed from the *Science Teacher Inventory of Needs* of Baird et al. (1994) by adapting and modifying it for use in the Limpopo Province context.

The survey instrument was validated by 61 stakeholders in science education (having insight in Physical Science). Modifications were then made in the light of stakeholders' comments and suggestions. The validated instrument was then pilot-tested on a sample of 29 Physical Science teachers in the Limpopo Province. Final modifications were then made by the researcher; resulting in the *Science Teacher Inventory of Needs- Northern Province (STIN-NP).*

Questionnaires were distributed to Physical Science teachers by the Curriculum Advisers and school principals via the District Managers. Completed questionnaires were collected from teacher via the same way. Focus group interviews were used to collect qualitative data on Physical Science teachers' INSET needs. Six interview sessions were held with a total of 21 Physical Science teachers. Focus group interviews helped the researcher to cross-validate responses from questionnaires.

In the next chapter, the results of the survey are described with respect to the demographic profiles and perceived INSET needs of Physical Science teachers. The views of teachers expressed during the focus group interviews are also presented and analysed.

Chapter Four

RESULTS

INTRODUCTION

The research design and methodologies used to gather demographic data and to elicit perceived INSET needs of Physical Science teachers in the Limpopo Province, as well as how the instrument in this study was designed and administered, were addressed in Chapter Three (page 16). The current chapter provides results based on the survey of and focus group interviews with Physical Science teachers in the Limpopo Province. Demographic profile relates to information concerning Physical Science teachers' characteristics such as for example, sex, age, qualification, experience, and grades taught. Issues relating to demographic data are presented before perceived INSET needs of Physical Science teachers because particular INSET needs might be associated with demographic variables. Frequency tables of demographic data were determined using descriptive statistics. Possible relationships between certain variables such as, for example, type of school, the teachers' sex, age, professional qualification, and so forth, were established by making use of non-parametric analyses using contingency tables. For INSET need items, chi-square analyses were performed in order to measure the degree of interest in each need item. INSET items were thereafter rank-ordered by mean score, and results are presented in tables. Qualitative data from interviews were analysed by identifying quotations describing INSET needs, and then presented in a table according to the needs frequency of occurrence.

QUANTITATIVE DATA (STIN-NP)

The sample consists of 352 Physical Science teachers (grades 10-12) in the Limpopo Province who responded to the STIN-NP questionnaire, yielding a 22% response rate. Only eight responses were received from teachers at urban schools, but these responses were ignored as this sample is too small to enable the researcher to draw conclusions about urban teachers with confidence. The effective sample used in the analysis is thus 344, comprising 300 rural and 44 township teaches. 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 varies between 319 and 344. The total number of schools covered is more than 232, as some respondents either did not fill in the unique school EMIS number used to identify schools, or the number was incomplete (i.e., not all digits were written).

The proportion of responding teachers who were officially qualified to teach Physical Science was 85%. From my experience as a Curriculum Advisor in the Limpopo Province, such a high percentage of qualified teachers in the Limpopo Province is highly unlikely. It is therefore concluded that not all teachers felt free to complete STIN-NP. It is assumed that the main reason for teachers' failure to respond was fear of redeployment as some of the teachers may have confused the questionnaire with a redeployment strategy. It is thus concluded that teachers who responded were mostly those who were sure that they would not be re-deployed.

Demographic profile

As the number of rural teachers in the sample is much more (i.e., 300) than the number of township teachers (i.e., 44), the trend among rural teachers largely determines what the overall (i.e., combined) trend in this sample will be like. I will therefore focus largely on the responses by teachers at rural and township schools.

Eighty-five percent of Physical Science teachers who responded to the survey held permanent appointments. There is how ever a higher proportion of temporary teachers in the township schools (23%) than in rural schools (13%). The proportion of female teachers amongst those who responded was 14% in township and 22% in rural schools (Table 4.1). (The STIN-NP question number from which the data for each variable were derived, is given in brackets in every table). While the general proportion of teachers 40 years or younger is comparatively similar for township and rural teachers (i.e., 84% and 86%, respectively), township schools have a higher proportion of teachers in the 25-30 years age bracket (Table 4.1). Very few teachers are older than 50 years (Table 4.1).

Most teachers (63%) who responded had been teaching Physical Science for 10 years or less, but about a third of responding teachers had 11 to 20 years teaching experience in this subject (Table 4.1). The proportion of teachers from both township and rural schools in the different experience categories is almost identical.

Table 4.1: Physical Science teachers' sex, age, and teaching experience by type of school

Variable	Category	Percent of rural	Percent of Township	Percentage of Total
Sex (58)		(n=296)	(n=44)	(n=340)
	Male	78	86	79
	Female	22	14	21
Age (59)		(n=295)	(n=44)	(n=339)
	24 years and younger	2	0	2
	25-30 years	24	41	26
	31-40 years	60	43	58
	41-50 years	12	11	12
	Over 50 years	2	5	2
Physical Science teaching experience (61)		(n=295)	(n=43)	(n=338)
	3 years or less	10	7	9
	4-10 years	53	56	54
	11-20 years	34	33	34
	21-30 years	2	2	2
	Over 30 years	1	2	1

Note: The STIN-NP questionnaire number from which the data for every variable were derived, is given in brackets.

Qualifications of Physical Science teachers in the Limpopo Province

A higher percentage of responding teachers with academic qualification equal or less than standard 10 came from rural than from township schools (i.e., 59% and 51%, respectively). Twenty-two percent of rural teachers and 19% of township teachers have completed either a first- or second-year university course in Physical Science. There is however a lower percentage (19%) of Physical Science teachers in the rural schools having an undergraduate degree or degree in Physical Science compared to teachers in the townships (30%). There is a higher percentage of post-graduate teachers in township schools than in rural schools (Table 4.2).

Sixty-three percent of responding rural teachers held a matric plus 3 year qualification (M+3) and three quarters of township teachers held the same professional qualification. Similar proportions of rural and township teachers reported having a matric plus 4 year qualification.

Table 4.2: Physical Science teachers' academic and professional qualifications by type of school.

Variable	Category	Percentage of Rural	Percentage of Township	Percentage of Total
Academic		(n=278)	(n=41)	(N=319)
qualification	Less than Standard 10	1	5	2
(Physical	Standard 10	58	46	56
Science)	1st year university	14	12	14
(62)	2nd year university	8	7	7
	3rd year university	15	20	16
	Honours degree & higher	4	10	5
Highest		(n=285)	(n=40)	(n=325)
professional	Matric + 2 years of training	4	0	3
qualification to	Matric + 3 years of training	63	75	64
teach Physical	Matric + 4 years of training	25	22	25
Science (63)	Other	8	3	7

Note: The STIN-NP question number from which the data were derived is given in brackets.

Matric plus 3 years of training comprises different qualifications as shown in Table 4.3. The overwhelming majority of teachers (79% of rural and 77% of township teachers) with matric plus 3 years have Secondary Teachers' Diploma (STD), followed by Primary Teachers' Diploma (PTD) and a higher proportion of them (19%) being in township schools. Few teachers (7% rural & 3% township) reported having Secondary Education Diploma (SED).

Table 4.3: The different qualifications obtained by Physical Science teachers with Matric plus three years.

Variable	Category	Percentage of Rural	Percentage of township	Percentage of total
Highest	SEC	(n=2	-	(n=2)
professional		1	-	1
qualification	SED	(n=13)	(n=1)	(n=14)
you hold		7	3	6
(63)	PTD	(n=26)	(n=6)	(n=32)
		14	19	14
	STD	(n=150)	(n=24)	(n=174)
		79	77	78

Note: Matric plus three years (i.e., Secondary Education Certificate [SEC], Secondary Education Diploma [SED], Primary Teachers' Diploma [PTD], and Secondary Teachers' Diploma [STD]). The STIN-NP question number from which the data were derived is given in brackets.

School demographics

Details of school statistics such as largest class size, grades taught, student enrolment at school, approximate number of resources for Physical Science available outside the school, state of resources, and how adequate the equipment and supplies are for conducting practical sessions in Physical Science are in the opinion of responding teachers are given in Table 4.4.

Table 4.4: Largest class size in Physical Science, grades taught, student enrolment, self-reported state of resources, and perceived equipment supply.

Variable	Category	Percentage of rural	Percentage of township	Percentage of total
Grades taught		(n=291)	(n=41)	(n=332)
(56)	Junior grades only	10	5	9
	Senior grades only	36	51	38
	Mixed grades	54	44	53
Largest class size		(n=293)	(n=43)	(n=336)
in Physical Science	Less than 20	16	2	14
(65)	21-30	14	16	14
	31-50	30	28	29
	51-70	21	40	24
	More than 70	19	14	19
Student enrolment		(n=298)	(n=44)	(n=342)
(66)	Less than 200	7	2	6
	201-500	40	16	37
	501-800	32	32	32
	801- 1000	14	18	15
	More than 1000	7	32	10
Self-reported		(n=288)	(n=42)	(n=330)
state of resources	Very poor	47	29	44
(73)	Poor	44	26	42
	Adequate	7	43	12
	Very adequate	1	0	1
	Exceptional	1	2	1
Perceived		(n=281)	(n=38)	(n=319)
equipment supply	None available	15	5	14
(75)	Inadequate	73	63	71
	Adequate	10	29	13
	More than adequate	0	0	0
	Not sure	2	3	2

Note: The STIN-NP question number from which the data were derived is given in brackets.

Ten percent of rural and 5% of township teachers who responded to the questionnaire teach in junior grades only. A higher percent of rural teachers compared to township teachers is responsible to teach in both junior and senior grades (54% and 44%, respectively). A smaller proportion of rural teachers (36%) is teaching only senior classes whereas just above half of township teachers reported teaching such classes.

Although about 3 in 10 of responding teachers reported they had a maximal class size of between 31 and 50 students (Table 4.4), a higher proportion of rural (30%) than township teachers (18%) reported a maximal class size less than that. However, more than half of township teachers (54%) compared to 40% of rural teachers, indicated that their maximum Physical Science class was greater than 50 students.

Forty-seven percent of rural teachers who responded to the questionnaire reported their schools having student enrolment of less than 500, and 18% of township teachers reported their schools having the same enrolment. A higher proportion of township (50%) than rural teachers (21%) reported their schools having student enrolment of at least 801 to more than 1000.

Most teachers reported that the state of resources available at their school for teaching Physical Science was poor to very poor (Table 4.4). The overwhelming majority of the respondents from rural schools reported this, and slightly more than half (55%) were from townships. Few Physical Science teachers from rural schools (9%) rated the state of resources available at their school between adequate and exceptional, whereas 45% of township teachers rated the state of their schools' resources in a similar manner.

Eighty-eight percent of rural teachers and 68% of township teachers reported the equipment supply at their schools with respect to conducting practical sessions in Physical Science as either inadequate or not available (Table 4.4). Twenty-nine percent of township teachers, compared to 10% of rural teachers, reported equipment supply at their schools to be adequate for this purpose.

INSET-related issues

This section focuses on the number of INSET workshops attended by the respondents, the barriers perceived to be greatest for not attending INSET workshops, and confirmation on when Physical Science teachers prefer to attend INSET workshops.

A great number of Physical Science teachers did not attend INSET workshops at all between January and August in the year 2000 (Table 4.5). It is disturbing to note that 67% of teachers who did not attend any INSET workshop in the above period were from rural areas. Interestingly, a high proportion of unqualified (77%) than qualified teachers did not attend INSET workshops in the first eight months of 2000. Only about one in 10 rural teachers and one in four township teachers attended one INSET workshop in the same period.

Table 4.5: Number of INSET workshops attended, greatest barrier for not attending INSET workshops, and when to attend INSET workshops.

Variable	Category	Percentage of rural	Percentage of township	Percentage o total
Number of INSET workshops attended (68)		(n=299)	(n=44)	(n=343)
	0	67	43	63
	1	11	25	13
	More than 1	22	32	24
Greatest barrier for not attending INSET work shops (50)		(n=288)	(n=42)	(n=330)
	Lack of information	46	33	45
	Poor quality of workshops offered	23	24	23
	Inconvenient time	7	29	10
	Inconvenient location	8	4	8
	Workshop fail to deal with your needs	9	5	8
	Lack of personal energy / motivation	2	5	2
	Other	5	0	4
When do you prefer to attend INSET work shops (69)		(n=296)	(n=42)	(n=338)
	During school holidays	56	38	54
	In the afternoon on school days	30	55	33
	On Saturdays	10	5	9
	Over weekends	4	2	4

Note: The STIN-NP question number from which the data were derived is given in brackets

The greatest barrier preventing many (45%) teachers to attend INSET workshops already offered or available is lack of information (Table 4.5). Twenty-three percent of responding teachers did not attend workshops as a result of the perceived poor quality of

workshops offered. Eighteen percent were restrained by either inconvenient location or timing of workshops. However, township teachers in particular reported inconvenient time as a barrier for attending INSET workshops (Table 4.5). In fact, rural and township teachers appear to prefer INSET workshops to be conducted at different times, namely, during school holidays for rural (56%) and in the afternoon on school days for township (55%) teachers (Table 4.5).

While actual proportions differ for teachers of different school context, the ranking of greatest professional needs (in order of priority) by Physical Science teachers in both rural and township schools is the same, namely, a) improving teaching skills, b) improving their content knowledge, c) improving their classroom organisation, and d) assessing learner's work (Table 4.6).

Table 4.6: Teachers' greatest professional needs.

Variable	Category	Percentage of rural	Percentage of township	Percentage of total
What is your		(n=285)	(n=41)	(n=326)
greatest	Improving teaching skills	40	61	42
professional	Improving content knowledge	26	15	25
need? (70)	Improving classroom organisation	16	14	16
	Assessing learners' work	12	10	12
	Other	6	0	5

Note: The STIN-NP question number from which the data were derived is given in brackets.

The demographic details discussed above are considered a basis for understanding the perceived INSET needs of Physical Science teachers in the Limpopo Province which are described next.

PERCEIVED INSET NEEDS

The researcher used raw data consisting of numbers of teachers who responded to each of the 47 STIN-NP items, using the five- option answers. Items 11 and 49 were excluded as they were applicable to only Mathematics and Biology teachers, respectively. Seventy-nine percent of teachers responded to all 45 items and 99% of teachers responded to at least 41 items. In fact, only four teachers in the sample of 344 completed fewer than 41 of the 45 need items. 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. The response "not familiar" was added to the response "great need" in this classification. The response "not familiar" was taken to mean "great need" rather than "no need", as the majority of Physical Science teachers in the Limpopo Province are poorly qualified (Department of Education, 2001). The selection of answer option A ("not familiar with this need") exceeded 5% on only five items, that is, items dealing with upgrading knowledge of learning to include constructivist approach, motivating learners to learn Physical Science, using hands-on teaching methods in Physical Science, and using computers to teach Physical Science. The weighting for each response was defined by 1 = no need, 2 = little need, 3 = moderate need, and 4 = great need.

Following the approach of Baird et al. (1993), 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 responding teachers, goodness-of-fit chi-square analyses were performed to measure the statistical significance of the degree of need for 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, Physical Science teachers indicated a need for all items at the $p<0.001$ level. The item "Organise a laboratory room for Physical Science" was identified as the highest need (selected by 91% of the teachers), and the need "Update your knowledge of the history of Physical Science" was identified as the lowest need (selected by only 60% of teachers).

Results of the 45 need items rank-ordered by mean score are presented in Table 4.7 below. These INSET needs 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 percentage of needs. Percentage here indicates the combined percent of teachers who responded that the item was a moderate need, a great need or not a familiar need. The original 76 items of Zurub and Rubba (1983) were organised into seven categories of science teachers' professional needs (see Chapter 3, page 7).

Table 4.7: Ranked needs of rural and township Physical Science teachers by need-category, mean, standard deviation, and percentage of need.

Rank	Item No.	Need description	Category	N	Mean	Std. Dev.	% of need
1	n43	Organise laboratory room	6	340	3.70	0.67	91
2	n44	Carry out laboratory session	6	338	3.66	0.76	90
3	n45	Provide learners' safety during laboratory	6	338	3.65	0.75	88
4	n46	Maintain laboratory equipment	6	338	3.63	0.78	88
5	n38	Use computer to help manage teaching	5	339	3.61	0.79	89
6	n35	Use computers to teach Physical Science	4	342	3.57	0.80	86
7	n30	Conduct a field trip	4	340	3.54	0.83	87
8	n34	Use audio-visual equipment	4	343	3.53	0.82	88
9	n29	Apply concept taught to daily life	4	340	3.53	0.80	87
10	n41	Select supportive material (e.g., videos)	5	338	3.52	0.81	90
11	n47	Construct practical equipment	6	337	3.52	0.83	86
12	n37	Evaluate your own teaching effectiveness	4	342	3.51	0.81	88
13	n24	Motivate learners	4	343	3.51	0.87	87
14	n42	Demonstrate concepts	5	340	3.50	0.77	88
15	n3	Develop skills in recognising and correcting common misconceptions in Physical Science	7	344	3.50	0.81	88
16	n33	Learner teaching each other approach	4	342	3.49	0.82	86
17	n20	Various forms of assessment to identify difficulties	2	341	3.48	0.81	87
18	n4	Knowledge of career opportunities for learners	7	343	3.46	0.84	86
19	n14	Identify learning objectives specifying attitudes for learners	1	344	3.45	0.75	88
20	n25	Use a discovery teaching approach	4	341	3.45	0.79	87
21	n16	Learning objectives promoting multicultural ways of learning	1	336	3.43	0.75	88
22	n15	Learning objectives specifying skills learners need	1	343	3.41	0.81	86
23	n8	Knowledge of constructivist approach	7	343	3.38	0.83	85
24	n28	Demonstrate manipulative skill	4	342	3.38	0.86	83
25	n48	Select equipment	6	335	3.38	0.81	81
26	n7	Learning in multicultural society	7	341	3.37	0.83	87
27	n40	Identify sources of free and locally available teaching materials	5	339	3.37	0.83	84

Table 4.7 continued.

Rank	Item No.	Need description	Category	N	Mean	Std. Dev.	% of need
28	n18	Develop lesson plans which integrate Physical Science with other subjects	1	344	3.32	0.87	82
29	n23	Develop own teaching material	3	342	3.32	0.85	82
30	n19	Design assessment items	2	341	3.31	0,86	85
31	n31	Concentrate on teaching Individual	4	341	3.30	0,88	85
32	n 6	Update knowledge of in society related to Physical Science	7	342	3.30	0.85	81
33	n26	Use hands-on teaching methods in Physical Science	4	339	3.30	0.92	81
34	n32	Teaching large classes	4	341	3.30	0.97	80
35	n13	Identifying learning objectives specifying knowledge	1	344	3.28	0.88	82
36	n36	Learner discipline in class	4	342	3.27	1.07	79
37	n5	Update your knowledge of effective teaching approach	7	343	3.26	0.94	77
38	n10	Update knowledge of how Physical Science is used in society	7	342	3.23	0.94	78
39	n39	Organise and manage physical space	5	339	3.21	1.00	78
40	n22	Select commercially prepared teaching material	3	342	3.19	0.97	78
41	n27	Demonstrate process skills	4	341	3.16	0.90	78
42	n9	Improve your content knowledge	7	343	3.14	1.00	78
43	n21	Develop lesson plans for topics	3	339	3.12	0.99	76
44	n17	Develop lesson plans which incorporate the history of Physical Science	1	340	2.89	1.01	64
45	n12	Update your knowledge of history of Physical Science Science	7	340	2.74	1.01	60

Note: All needs were statistically significant at the $p<0.001$ level (degree of freedom =1).

Needs which enjoyed greater importance were those dealing with practical sessions in Physical Science (category 6). such as, for example, organise laboratory room (n43), carry out laboratory session (n44), provide learners' safety (n45) and maintain laboratory (n46). Teachers also need help in delivering science instruction (category 4). They wish to use computers to teach (n35), conduct a field trip (n30), use audio-visual equipment

(n34), and apply concepts taught to daily life (n29). The least support was indicated for teachers updating their knowledge of history of Physical Science (n12).

Different teacher variables (e.g., age, sex, Physical Science teaching experience, etc.), were investigated for possible associations with each need item. Chi-square analyses did not show any statistically significant association between teachers' INSET needs and demographic variables with the exception of the type of school teachers taught at. Top- and bottom-ranked needs of teachers are therefore displayed according to the type of school in Tables 4.8 and 4.9.

The number of rural teachers in the sample is much more (i.e., 300) than the number of township teachers (i.e., 44), the trend among rural teachers largely determines what the overall (i.e., combined) trend will be like. I will therefore focus on the answers for teachers at rural and township schools.

Ten top-ranked needs

Fifty percent of rural teachers identified needs from category 6 (i.e., administering science instructional facilities and equipment), and 6 out of 10 of township teachers

Table 4.8: Ten top-ranked INSET needs by rural and township school at which teachers taught.

Rank	Rural	Township
1	n43 Organise a laboratory room (6)	n33 Approaches that make learners teach each other in Physical Science (4)
2	n44 Carry out a laboratory (i.e., practical sessions) (6)	n38 Use computer to help manage teaching (5)
3	n45 Provide for learners' safety during a laboratory session (6)	n37 Evaluate your own teaching effectiveness (4)
4	n46 Maintain laboratory equipment (6)	n35 Use computers to teach Physical Science (4)
5	n38 Use computer to help manage teaching (5)	n8 Update your knowledge of teaching to include a constructivist approach (7)
6	n47 Construct laboratory equipment (6)	n32 Teaching large classes in Physical Science (4)
7	n35 Use computers to teach Physical Science (4)	n29 Apply concept taught in Physical Science to daily life of learners (4)
8	n24 Motivate learners to learn (4)	n20 Use various forms of assessment to identify learning difficulties (2)
9	n30 Conduct a field trip (4)	n30 Conduct a field trip (4)
10	n34 Use audio-visual equipment to facilitate teaching (4)	n23 Develop own teaching materials for Physical Science (3)

Note: The number before each need- description identifies the applicable STIN-NP item number. The need category is indicated in brackets.

expressed a need for category 4 (delivering science instruction) (Table 4.8).

Rural and township teachers rank their needs differently as rural teachers need more help with categories 6, 4, and 5 whereas township teachers need more help with categories 4 (categories 2, 3, 5 and 7 being equally rated). Rural teachers express a great need for dealing with practical work in Physical Science, whereas township teachers' needs were more diverse. Rural teachers ranked the item "Employ teaching approaches for teaching large classes" (n32) in the bottom-10 ranked needs, but township teachers ranked the same item in the top-10 ranked needs.

Needs "motivate learners to learn Physical Science, and conduct laboratory equipment for Physical Science" (i.e., n24 and n47), respectively of rural top-10 are in the bottom-10 ranked needs of township teachers. Needs which are common between rural and township teachers are "conduct field trip to help learners learn Physical Science, use computers to teach Physical Science, and use computer to manage teaching Physical Science", respectively (n30, n35, and n38).

Ten bottom-ranked needs

Forty percent of rural teachers and of township teachers expressed less need for category 7 (i.e., improving one's competence as a science teacher). Other items identified as of less important by rural teachers are to "update their knowledge of how Physical Science is used in society and to update their knowledge of effective teaching approach" (i.e., n10 and n5). Township teachers rated the needs to "update their knowledge of how Physical Science is used in society and knowledge of career opportunities for learners related to Physical Science" (n10 and n4) as of less importance.

Needs which are common between rural and township teachers are "Improve your content knowledge of Physical Science", "Update your knowledge of how Physical Science is used in society", "Select commercially prepared teaching materials for Physical Science, and "Demonstrate process skills in Physical Science" (i.e., n9, n10, n22, and n27 respectively). Rural and township teachers differ in that the need to "update your knowledge of the history of Physical Science, and develop lesson plans which

incorporate the history of Physical Science" (i.e., n12 and n17) identified by rural teachers is not even statistically significant for township teachers, $\alpha = 0.05$ for these needs.

Table 4.9: Ten bottom-ranked INSET-needs by rural and township school at which teachers taught.

Rank	Rural		Township	
1	n12	Update your knowledge of the history of Physical Science (7)	n4	Knowledge of career opportunities for learners related to Physical Science (7)
2	n17	Develop lesson plans which incorporates history of Physical Science (1)	n10	Update knowledge of how Physical Science is used in society (7)
3	n21	Develop lesson plans for topics in Physical Science (3)	n36	Learners discipline in your Physical Science classes (4)
4	n9	Improve your content knowledge (7)	n 9	Improve your content knowledge (7)
5	n27	Demonstrate process skills in Physical Science (4)	n22	Select commercially prepared teaching materials (3)
6	n39	Organise and manage physical space (5)	n47	Construct laboratory equipment (6)
7	n22	Select commercially prepared teaching materials (3)	n24	Motivate learners to learn Physical Science (4)
8	n5	Update your knowledge of effective teaching approaches (7)	n27	Demonstrate process skills in Physical Science (4)
9	n10	Update knowledge of how Physical Science is used in society (7)	n7	Learners learn Physical Science in a multicultural society (7)
10	n32	Teaching large classes (methods) (4)	n31	Concentrate on teaching individuals (4)

Note: The number before each need- description identifies the applicable STIN-NP item number. The number in brackets indicates the need category.

Problems confronting Physical Science teachers and strategies they use

Detailed information from section D of STIN-NP (items 76-89) on problems confronting teachers in their classroom was obtained by collapsing the response categories. The 5-option responses were collapsed into categories, namely "Not a problem" (representing response A) and "A problem" (representing responses B to E). For the resulting 2×2 contingency tables the possible association between the variable under consideration and school context was determined by chi-square analysis.

Issues pertaining to learners' belief that Physical Science is less important than other subjects, outdated teaching materials for teaching Physical Science, teachers are inadequately prepared to teach Physical Science, class size is too large, too many lessons

to prepare for each day, and no colleaques with whom to discuss teaching problems relate to Physical Science are perceived to be a problem for most teachers, irrespective of whether teachers teach at rural or township schools (Table 4.10).

Table 4.10: Teachers' perception of issues which may be a problem for them.

Variable	Category	Percentage of rural	Percentage of township	Sign. level
Learners' belief that Physical Science is less important than other subjects (76)		(n=298)	(n=44)	p>0.05
	Not a problem	42	30	
	A problem	58	71	
Insufficient school funds for purchasing equipment (77)		(n=299)	(n=44)	p>0.05
	Not a problem	6	9	
	A problem	94	91	
Outdated teaching materials (78)		(n=298)	(n=43)	p>0.05
	Not a problem	27	35	
	A problem	73	65	
Lack of learner interest in Physical Science (79)		(n=298)	(n=44)	p>0.05
	Not a problem	13	21	
	A problem	87	78	
Lack of parental concern about their children learning Physical Science (80)		(n=299)	(n=44)	p>0.05
	Not a problem	5	7	
	A problem	95	93	
Teachers were inadequately prepared to teach Physical Science (81)		(n=299)	(n=43)	p>0.05
	Not a problem	46	47	
	A problem	54	54	
Class size large (82)		(n=298)	(n=43)	p>0.05
	Not a problem	37	44	
	A problem	63	56	
Too many lessons to prepare for each day (83)		n=294	(n=42)	p<0.05
	Not a problem	26	43	
	A problem	74	57	
No colleagues with whom to discuss teaching problems related to Physical Science (84)		(n=293)	(n=43)	p>0.05
	Not a problem	37	42	
	A problem	64	58	
Insufficient problem-solving skills on the part of learners (85)		(n=292)	(n=43)	p <0.05
	Not a problem	7	28	
	A problem	93	72	

Table 4.10: Continued

Variable	Category	Percentage of rural	Percentage of township	Sign. Level
Lack of career role model in community with respect to Physical Science (86)		n=297	(n=43)	P <0.05
	Not a problem	8	35	
	A problem	92	65	
Learners' poor language competency in English (87)		n=296	(n=42)	p<0.05
	Not a problem	8	29	
	A problem	92	71	
Insufficient number of text books in Physical Science (88)		(n=296)	(n=42)	p>0.05
	Not a problem	18	14	
	A problem	82	86	
Inadequate facilities to conduct practical in Physical Science (89)		n=291	(n=42)	p<0.05
	Not a problem	3	12	
	A problem	97	88	

Note: The STIN-NP question number from which the data were derived is given in brackets.

Issues pertaining to insufficient school funds for purchasing equipment and supplies needed in teaching Physical Science, lack of learner interest in Physical Science, lack of parental concern about their children learning Physical Science, insufficient problem-solving skills on the part of the learners, lack of career role model in the community with respect to Physical Science, learner poor language competency in English and insufficient number of textbooks in Physical Science are perceived to be a problem for actually all teachers. Moreover, a statistically significantly higher proportion of rural than township teachers perceived issues too many lessons to prepare for each day, insufficient problem solving skills on the part of learners, lack of career role model in the community with respect to Physical Sciences, learners' poor language competency in English and inadequate facilities in Physical Science to be a problem (Table 4,10).

In section E of STIN-NP (see Appendix C, page 75), item responses B (less than monthly) and C (once a month), were combined into a category indicating that this activity was done only infrequently. Similarly, item responses D (every 2 weeks) and E

(weekly) were combined into a category indicating that this activity was done frequently. Item response A (never) remained.

Table 4.11: The frequency with teachers report using activities in teaching Physical Science.

Variable	Category	Overall %
Practical activities in which almost all learners get to use apparatus / equipment (90)		(n=342)
	Never done	46
	Infrequently	40
	Frequently	13
Field trips outside school for objectives in Physical Science (91)		(n=343)
	Never done	74
	Infrequently	24
	Frequently	2
Peer teaching (i.e., learners teaching other learners) during your lessons in Physical Science (92)		(n=340)
	Never done	36
	Infrequently	42
	Frequently	22
Co-operative learning (93)		(n=339)
	Never	20
	Infrequently	48
	Frequently	32
Demonstration by teacher in Physical Science (94)		(n=333)
	Never	8
	Infrequently	43
	Frequently	49
Inquiry /discovery teaching approach in Physical Science (95)		(n=342)
	Never	21
	Infrequently	45
	Frequently	34
Teaching approach where you are able to concentrate on teaching individuals rather than the whole class in Physical Science (96)		(n=340)
	Never	20
	Infrequently	42
	Frequently	38
Problem-solving approach in Physical Science (97)		(n=334)
	Never	6
	Infrequently	31
	Frequently	63

Note: The STIN-NP question number from which the data were derived is given in brackets.

Field trips outside school for objectives in Physical Science were mostly never conducted. Practical activities in which almost all learners get to use apparatus, and peer teaching during Physical Science lessons were done only infrequently or never. Teachers who responded to the interviews indicated that co-operative learning, demonstration by teacher in Physical Science, inquiry / discovery teaching approach in Physical Science, teaching approaches where you are able to concentrate on teaching individuals rather than the whole class and problem solving approach in Physical Science were mostly done frequently or infrequently (Table 4.11).

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

There is a blank space on page 14 of the STIN-NP questionnaire (see Appendix C, page 69) which allowed teachers to give explanations for needs and / or state additional comments or suggestions with respect to professional needs not captured in the questionnaire. Fifty-five Physical Science teachers wrote comments but only 44 teachers' comments were related to Physical Science INSET needs. A summary of these teachers' comments is presented on Table 4.12.

Table 4.12: Need items from the 'free response' section of STIN-NP matched with those of the questionnaire and the frequency of teachers' responses

Item no.	Need description	Number of teachers who commented
n5	Update your knowledge of effective teaching approach in Physical Science	19
n9	Improve your content knowledge of Physical Science	6
n23	Develop own teaching materials for Physical Science	4
n24	Motivate learners to learn Physical Science	4
n40	Identify sources of free and locally available teaching materials for Physical Science	3
n41	Select supportive materials (e.g., videos) for teaching Physical Science	2
n30	Conduct a field trip to help learners learn Physical Science better	2
n32	Employ teaching approaches (i.e., methods) for teaching large classes in Physical Science	1
n36	Use computers to teach Physical Science	1
n47	Construct laboratory (i.e., practical) equipment for Physical Science	1
n19	Design assessment items (e.g., questions or tasks) which assess achievement of learning objectives (i.e., outcomes) in Physical Science	1
Total		44

The verbatim comments are available in Appendix C, page 69). Reading what teachers wrote on the page provided identified comments describing Physical Science teachers' INSET needs. These identified needs were then checked against STIN-NP need items.

All comments made in this section in regard to INSET needs were thus already listed in STIN-NP. Teachers who responded to the STIN-NP questionnaire therefore did not identify any additional needs to those listed in the STIN-NP.

QUALITATIVE DATA (INTERVIEWS)

Physical Science teachers were invited to participate in focus group interviews at six different places and times in the Limpopo Province. Physical Science teachers were defined to be those who spend most of their teaching periods teaching Physical Science in proportion to other subjects per week (Chapter 1, page 6). Teachers who attended the interviews reported that they were also teaching other subjects in different classes, such as, for example, Biology, languages, Business Economics, General Science, Technical Drawing, and so forth, in addition to Physical Science (Appendix A, page 69).

As explained in Chapter 3, interview transcripts were analysed by first identifying quotations describing INSET needs by writing them in italics in order to highlight them. The STIN-NP need item number was written in brackets next to the identified quotation. Quotations were thereafter 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 mentioned a particular issue, and extensiveness is therefore a measure of validity. Fifteen needs were identified in this way and then ranked-ordered in descending order according to their extensiveness and frequency (Table 4.13).

In focus group interviews, teachers expressed their INSET needs of developing their own teaching materials (rank 3, item 23). Typical quotations supporting this conclusion are " ... the main problem we have in Physical Science is the so-called improvisation ..." and "Practical part is more important, but the poor teacher who cannot handle some of the apparatus is very difficult". Teachers also emphasised the need to upgrade their knowledge of effective teaching approaches (rank 7, item 5). Typical quotation supporting this conclusion is "The other methods are still not working so we need ways and means of encouraging them to go and work on their own".

Teachers expressed their INSET needs of carrying out a laboratory session in Physical Science (rank 2, item 44). Typical quotations supporting this conclusion are "This type of workshop should particularly look at these aspect of the syllabus where practical is very important", and "Practical part is more important, but the poor teacher who cannot handle some of the apparatus is very difficult".

Table 4.13: Physical Science teachers' ranked needs obtained from interviews and listed by the expressed needs' frequency and extensiveness.

Rank	INSET-needs expressed during interviews	Corresponding INSET needs from STIN-NP	Category	Frequency	Extensiveness
1	Lack of textbooks to prepare and new books not supplied	(n23) Develop own teaching materials for Physical Science	3	8	6
1	Proper training in teaching the subject	(n5) Update your knowledge of effective teaching approaches (i.e., methods)	7	8	6
2	Conduct experiment	(n44) Carry out practical session	6	8	4
3	Hands-on process	(n26) Use hands on teaching methods in Physical Science	4	6	4
4	How to teach large classes	(n32) Approach for teaching large classes	4	4	3
5	How to develop apparatus	n(47) construct laboratory equipment for Physical Science	6	3	3
6	Learners without good attitudes towards science	(n14) Identify learning objectives (i.e., out-comes) which specify attitudes learners need to develop	1	5	2
7	Continuous assessment	(n19) Design assessment items	2	4	2
7	How to order (select) equipment	(n48) Select laboratory Equipment	6	4	2

Table 4.13: Continued

Rank	INSET-needs expressed during interviews	Corresponding INSET needs from STIN-NP	Category	Frequency	Extensiveness
8	Lack of knowledge and skills from the teacher	(n7) Update your knowledge learners learn Physical Science	7	3	2
9	Conduct a field trip	(n30) Conduct a field trip to help learners	4	2	2
9	Learners' assessment not enough and good	(n20) Use various forms of assessment to identify learning difficulties / or (n19) Design assessment items in Physical Science	2	2	2
9	How to discipline learners	(n36) Maintain learner Discipline	4	2	2
9	Maintain laboratory	(n46) Maintain Laboratory	6	2	2
10	Learner teaching each other	(n33) Learner teach each Other	4	2	1

The responding teachers need hands- on teaching methods in Physical Science (rank 4, item 26). Typical responses are "I remember UNIST ... teachers were taught how to handle apparatus" and "I have seen in the past workshop, we only stand there and look for the demonstrator doing things alone. Ourselves do not know".

Teachers expressed a need for an approach to teach large classes (rank 4, item 32). Typical quotation supporting this conclusion is "The problem we are experiencing at our school is overcrowding in classrooms".

All needs expressed during the interviews are in fact included in the list of needs in STIN-NP. Some top ranked interview-based needs is reflected in the bottom half of the questionnaire-based rank-ordered needs. For example, update your knowledge of effective teaching approach in Physical Science, use hands-on teaching methods in the Physical Science class, update your knowledge of issues in society related to Physical Science and develop own teaching materials.

Needs identified through interviews correspond only at the broad level with INSET needs identified through questionnaire responses.

Summary

Eighty-five percent of Physical Science teachers who responded to the questionnaire were officially qualified to teach Physical Science and held permanent appointments, and most teachers are male. Almost 3 out of 5 teachers are 40 years or younger, and about half of teachers who responded have a Physical Science teaching experience of less than 10 years. More than 3 out of 5 teachers reported having matric plus 3 years of professional training. Most Physical Science teachers in the Limpopo Province are academically poorly qualified (58% of rural and 46% of township teachers) are reported having matric. Only a few (14% of rural and 12% of township) have a degree in Physical Science. A higher percent of rural teachers compared to township teachers is responsible to teach in both junior and senior grades (54% and 44%, respectively) hence more rural complain of too many lessons to prepare for each day (Tables 4.4 and 4.10).

Three out of 10 of the responding teachers had a maximal class size of between 31 and 50 students. A greater number of township than rural teachers reported being at schools with a student enrolment of between 801 and 1000. Most teachers reported that the state of resources available at their schools for teaching Physical Science was poor. A great number of Physical Science teachers did not attend any INSET workshops between January and August 2000, and most of such teachers were from rural areas. The greatest barrier preventing teachers to attend INSET workshops already offered is lack of information and the perceived poor quality of the workshop offered. Rural and township teachers differ in terms of when workshops should be offered. Township teachers prefer workshops to be held in the afternoon on school days whereas rural teachers prefer workshops to be conducted during school holidays.

Teachers' greatest professional needs are a) improving teaching skills, b) improving their content knowledge, c) improving their classroom organisation, and d) assessing learners' work. Rural teachers expressed a great need for help with practical work in Physical Science, whereas township teachers wished to acquire skills of using computers to teach Physical Science, and skills of teaching large classes in Physical Science

Issues pertaining to learners' belief that Physical Science is less important than other subjects and outdated teaching materials for Physical Science are perceived to be a problem to most teachers, irrespective of whether teachers teach at rural or township schools. All teachers perceived issues like insufficient school funds for purchasing equipment and supplies needed in teaching Physical Science, as well as a lack of learner interest in Physical Science, is a problem. A higher proportion of rural than township teachers perceive issues like inadequate facilities to conduct practical in Physical Science to be a problem.

All needs expressed during the focus group interviews are included in the list of needs in the STIN-NP. Needs identified through interviews correspond at the broad level with INSET needs identified through the questionnaire.

In the next chapter, findings of the study will be discussed, and their implications will be considered.

Chapter Five

DISCUSSION

INTRODUCTION

In Chapter One it was indicated that the Limpopo Province is characterised by low enrolments of Physical Science students and low pass rates in this subject in matric. The state of Physical Science education in this Province is therefore characterised as poor. While many factors influence achievement in Physical Science, the quality of the teaching corps is regarded as key. An important initial response to the poor state of Physical Science education in the Limpopo Province must therefore include the establishment of effective and efficient planning of INSET activities at the provincial level. The success of such INSET activities, however, depends on INSET providers having accurate demographic information on Physical Science teachers in the Limpopo Province, and a reliable list of Physical Science teachers' perceived INSET needs. When INSET programmes are directed by what teachers perceive as their real needs and not what programme organisers think should be the teachers' needs, INSET workshops will be relevant, efficient, effective, increase teachers' interest and active participation in the workshops (Eraut, in Anderson, 1995). Unfortunately, there was no such information available for Physical Science teachers in the Limpopo Province. This study was conducted to fill this gap in knowledge about Physical Science teachers, in order to enable INSET providers to make informed decision about, the type of activities necessary for the teachers. The following research questions were addressed:

a) What is the demographic profile of Physical Science teachers in the Limpopo Province?
b) What are the perceived INSET needs of Physical Science teachers in the Limpopo Province?
c) What are the possible associations between the demographic profile and perceived INSET needs of Physical Science teachers in the Limpopo Province?

The previous chapter outlined survey results of Physical Science teachers' demographic profile and perceived INSET needs. This chapter provides a discussion of demographic profile and perceived INSET needs of Physical Science teachers, and considers the implications thereof for efficient planning and delivery of Physical Science INSET programmes.

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 result therefore represents the profile and needs of qualified Physical Science teachers in the Limpopo Province, most of whom taught at rural schools and held permanent posts.

DEMOGRAPHIC PROFILE

Age

The vast majority of both rural and township teachers are between 25 and 40 years of age, and are therefore likely to remain teaching for a long time if the Department of Education in the Limpopo Province retains them. These young teachers could be made effective in teaching by continual professional training. My findings differ with the findings of Smith (2000), who found that the majority of the teaching force of Mathematics and science teachers across the United States is older than 40 years and thus closer to retirement. INSET should pay more attention on developing and upgrading these young teachers.

Gender

The results of the demographic profiles of Physical Science teachers in the Limpopo Province revealed that most of the teachers who responded to the questionnaire were male (78% of rural and 86% of township teachers). My finding that there are few women Physical Science teachers in the Limpopo Province are similar to those of Khumalo and Naidoo's (1996) survey of Physical Science teachers in Kwazulu-Natal, one of the other nine provinces in South Africa. Khumalo and Naidoo (1996) reported that very few women participated in Physical Science at tertiary levels of education. According to Reddy (2002), historically there are very few Blacks, especially black women,

participating in science in South Africa. The finding of few women teach Physical Science, in the Limpopo Province differs with those of Baird and Rowssey (1989) from their survey of secondary science teachers in the United States. Baird and Rowsey found that 62% of science teachers in Alabama were female. Smith (2000) also found that there are more female than male science teachers in the United States in general. The difference in the gender profile of science teachers in the Limpopo Province and in, for example, the United States may thus have arisen from the fact that few women participated in tertiary science in the first place. INSET workshops could therefore focus on motivating students, teaching science in an equitable manner, and demystifying this wrong concept of considering science as a "killer" subject.

Academic and professional qualifications

A high proportion of rural and township teachers in the Limpopo Province who responded to the STIN-NP have only matric as their highest academic qualification in Physical Science, and only a few have a degree in Physical Science (Table 4.2, page 33). The findings are again similar to those of Khumalo and Naidoo (1996) who found a low percentage of Physical Science teachers with university degree (i.e., 18% of Physical Science teachers). The South African findings differ with those of Germann and Barrow (1995) in the United States on veteran and non-veteran teachers, who noted that 63% of senior secondary science teachers have Masters degrees. Smith (2000) found that about half of Chemistry teachers across the United States had a Masters'-degree, although there is no indication that this was in a science specialisation.

Physical Science teachers in the Limpopo should therefore be encouraged to further their studies in science education by offering them bursaries. It is of paramount importance for Physical Science teachers to be upgraded in the subject they specialise in as Gorton (1976) argues that teachers' effectiveness will improve concurrently with improved qualifications. Moreover, teacher quality affects learners' achievement (Darling-Hammond, 2000). The Department of Education in the Limpopo Province should urgently consider giving incentives to motivate teachers to improve their qualifications in science.

In terms of professional qualification two out of every three Physical Science teachers who responded have an M+3 diploma. Although the teachers with a M+3 are considered qualified under previous teacher regulations, the current minimum qualification for new teachers is a matric plus four years of professional training. In other words, most teachers would be considered under-qualified under current regulations. The INSET workshops should help upgrading teachers from M+3 to M + 4 (matric plus four years of professional training) e.g.,. Advanced Certificate in Education. In fact, INSET programmes should offer courses accredited at certain institutions, thus enabling teachers to be rewarded in terms of a higher salary notch for obtaining higher qualifications.

School resources

The vast majority of Physical Science teachers who participated in this survey reported that their schools were under-resourced in terms of classrooms, textbooks, and equipment (Table 4.4, page 34). Teachers also reported that the state of resources available at their schools for teaching Physical Science was poor to very poor, especially in rural schools. Physical Science requires a lot of practical work to enhance understanding of concepts, and INSET providers should therefore pay attention to improving teachers' skills of improvisation, and helping teachers to maintain laboratory equipment for future supply.

INSET- RELATED ISSUES

It is disturbing that a higher proportion of rural (67%) compared to township (43%) teachers did not attend any INSET workshop between January and August of 2000. Only 11% of rural teachers attended one INSET workshop whereas 25% of township teachers attended at least one INSET workshop in the same period (Table 4.5, page 36). As INSET activities are the major way in which teachers can improve their competence, it is imperative that workshop providers should address barriers preventing teachers from attending INSET workshops in order to maximise teachers' attendance.

The greatest barrier preventing many Physical Science teachers from attending INSET workshops is lack of information. Another reason why teachers did not attend workshops is apparently due to the poor quality of workshops offered (Table 4.4 page 34). The latter

reason is some indication that Physical Science teachers needs were not considered or that workshops did not address their needs.

When asked to select among given needs, teachers who responded to the survey rated improving teaching skills as their greatest professional need, followed by improving content knowledge, classroom organisation and assessing learners' work. The above ranking is the same for both rural and township teachers. The above ranking suggests that INSET providers should focus on improving teaching skills and content knowledge of teachers first, and only later on for example, assessment.

More than half of rural teachers (56%) prefer the workshops to be conducted during school holidays and almost equal proportion of township teachers (55%) prefer workshops to be conducted in the afternoon of school days (Table 4.5, page 7). It is important to note the contrast of workshop timing required by the two groups. From my experience as a Physical Science Curriculum Adviser, rural teachers experience great difficulties in travelling to workshop venues due to a number of reasons such as, for example, the unavailability of transport in rural areas. This is not the case for township teachers. Workshop providers should thus consider teachers' contextual factors which may pose constrains when timing the INSET workshop. Physical Science workshops in either case should avoid disrupting lesson attendance by learners. INSET providers should therefor conduct separate workshops for rural and township teachers.

The demographic details discussed above are considered as a basis for understanding the perceived INSET needs of Physical Science teachers in the Limpopo Province, which are discussed next.

PERCEIVED INSET NEEDS

Teachers indicated that their most important needs were related to organising laboratory room, carrying out a laboratory (i.e., practical) sessions, maintain laboratory equipment, using computer to help manage teaching, and evaluating their own teaching effectiveness (Table 4.8, page 41). INSET needs were not related to any demographic variables except school context or type of school. Inadequacy of equipment and lack of resources is more severe in rural schools (Table 4.4, page 34). My findings in the Limpopo Province differs

with those of Smith (2000), in that Chemistry teachers across the United State expressed a need for professional development in a number of ways, especially using instructional Technology and helping students with special needs. Weis (2000) on the other hand established that science and Mathematics teachers in North Carolina express a need to use computers or Internet in their teaching.

Practical work in Physical Science

Rural teachers expressed a great need to carry out a laboratory session in Physical Science and to maintain laboratory equipment. Township teachers need help with managing science instruction such as, for example, using computer to help manage teaching. Equipment costs a lot of money, and it is a well-known fact that the majority of the budget of the Limpopo Province goes toward teachers' salary. In other words, it is very unlikely that the department is going to supply schools with much equipment. The need for practical work is closely related to improvisation of equipment. Improvisation will help to overcome the shortage of equipment particularly in rural areas, and INSET workshops should be focused on improving Physical Science teachers' skills to improvise. According to Nkopodi's (2001) case study on science teaching in a disadvantage schools, INSET workshops for Physical Science should also give the teachers an opportunity to apply their teaching skills more efficiently with more resources in the form of low-cost equipment.

Learning and teaching support materials

The majority of teachers who responded to the survey indicated having outdated teaching materials in Physical Science (Table 4.4, page 34). A less proportion of teachers (above 80%) in both the rural and township area of the Limpopo Province claimed to be without textbooks in Physical Science (Table 4.10, page 44). INSET workshops should focus on empowering teachers to develop their own Physical Science learning and teaching materials to supplement the shortage of textbooks. During the interviews teachers expressed their frustration of teaching without the necessary textbooks (Appendix E: page 100).

Resource centres

The majority of rural teachers (88%) claim that equipment supply at their schools is either not available or inadequate and that they have no resources (e.g. museums, science centres, etc.) nearby schools (Table 4.4 page 34). The unavailability of these essential commodities, exacerbates the already impoverished rural schools and renders effective teaching difficult or impossible. A meaningful intervention providing quality education would be realised by establishing at least a few resource centres central to a cluster of schools located in rural areas. During the interviews, Physical Science teachers expressed their need for such resource centres. The following quotation illustrates science teachers' need for the resource centres. "I should think that the department should rather try to have centred laboratories (resource centres) say now in a particular region, you have one laboratory' where people can get assistance" (Appendix E, page 109). Establishment of the above resource centres will bring a great relief to the problem of inadequate or no resources, particularly at rural schools. Countries such as England recognised the importance of teacher centres for in-service education, and in-service programmes at such cenrres have been used as a major source for improving teacher practices (Flener, 1986).

Effective teaching approaches

Many Physical Science teachers wished to be helped with organising a laboratory. Teachers expressed a strong need for an approach using hands-on activities in practical sessions in Physical Science (Table 4.8 page 41). From my experience as a Physical Science Curriculum Adviser, the lack of equipment results in Physical Science teachers resorting to the chalk-and-talk method and. It is a clear fact that practical work in science can promote learner interest and understanding which might lead to better results (Betty & Woolnough, 1982). INSET workshop could therefore focus on practical work in science. The INSET workshops could further familiarise teachers with scientific apparatus and the skills needed to use it. INSET activities could also develop teachers' skills needed for the practical examinations especially for the current continuous assessment used in OBE. Teachers need to be trained not to use practical work simply to confirm data to which learners have already been exposed, but to be guided by scientific methods incorporating analysis and interpretation of data.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Limpopo Province has poor results in Physical Science national grade 12 examinations. One way of addressing the poor state of Physical Science is by improving Physical Science teachers' competency. Only well-planned INSET programmes informed by the demographic profile and perceived Physical Science teachers' INSET needs will be an effective tool in bringing about a sustainable increase in the competence of Physical Science teachers.

The research findings reveal that majority of Physical Science teachers who responded to the questionnaire are academically under qualified (as they mostly only have matric-level Physical Science), have poor resources available at school, and cannot improvise. More than 80% of Physical Science teachers in the Limpopo Province are 40 years or younger and 63% of them have less than 11 years experience in teaching Physical Science. The above mentioned science teachers are potentially having many years to serve as teachers and thus could be an asset to the Department of Education in the Limpopo Province if the Department can retain them.

Physical Science teachers who responded to this survey indicated that they need help with carrying out laboratory practicals. These teachers' limited academic knowledge and the lack of textbooks suggest that INSET providers should aim at empowering these teachers to develop improvised equipment and their own learning and teaching materials. The fact that most teachers have limited academic knowledge suggests that a suitable INSET model for them, will be Dunn's traditional model which will assist them to gain additional qualification (Nduna, 1999).

It is alarming that attendance of INSET workshops is very low indeed. There are many reasons for Physical Science teachers' failure to attend INSET workshops but the greatest barrier stated for not attending INSET workshops was poor communication of INSET activities and poor quality of workshops offered. The poor quality of workshops implies that the workshops did not meet Physical Science teachers' perceived- INSET needs.

Workshop activities should be published well in advance to ensure that information reaches all Physical Science teachers in time.

Most of the Physical Science teachers who responded to the questionnaire (67% rural & 43% township teachers failed to attend the workshops due to lack of information (Table 4. 5 page 36). INSET providers should issue a year programme in time to reach all Physical Science teachers. Physical Science, Mathematics and Biology workshops should not take place simultaneously, so that learners are not left unattended, and some teachers also teach all three subjects.

Recommendations

Teachers complained of poor quality of workshops offered, yet the main purpose of in-service training is to help teachers to present quality teaching (Rubin, 1978). I recommend the following changes, which might contribute to bringing about the required changes in the teaching of Physical Science in the Limpopo. It is suggested that the Limpopo Province Department of Education should establish science centres for continuous professional development, and that Physical Science teachers be informed of workshops well in advance. This will help to restore learners' interest and understanding of science. Establishing and staffing resource-centres in various districts will help many schools without equipment. The Department of Education in the Limpopo Province is urged to provide workshops based on practical sessions in Physical Science, and how to improvise equipment. INSET programmes for Physical Science should be guided by teachers' professional needs in order to be more appropriate, sustainable and effective. Workshops should be conducted at a convenient time and venue for teachers.

FUTHER RESEARCH

Research on the demographic profile and perceived INSET needs of Physical Science teachers should be an ongoing process. As the study was conducted only in the Limpopo I cannot conclude that the results will hold for the rest of the country. I invite other researchers to elicit perceived INSET needs of Physical Science teachers in the other eight provinces of South Africa. There is also a need to elicit the perceived needs of

urban teachers in the Limpopo, which this study did not cover. For the sake of enabling comparisons, the same instrument should be used.

Concluding remark

It is anticipated that the established demographic profile and perceived needs of Physical Science teachers in the Limpopo Province as described and stated above will provide an important, valid and reliable basis for designing effective, and sustainable programmes for Physical Science in the Limpopo Province. It is also hoped that such programmes will significantly facilitate attempts to improve Physical Science education in the Limpopo Province.

APPENDIX A

3 September, 2004

Dear ,

Improving Physical Science 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 Physical Science 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 Physical Science 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 Physical Science in the Northern Province.

The research will be conducted in part by sending questionnaires through Curriculum Advisors to Physical Science teachers in all districts 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 19 June 2000.**

Should you have any queries, please contact me on 082 722 0982.

Thank you for contributing to my study!

Yours faithfully,

DT Mabye

Dr RC Laugksch
(Supervisor)

Encl.

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 Physical 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 clearly 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 *19 June 2000.*

Thank you for your time!

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...

APPENDIX C

Northern Province
DEPARTMENT OF EDUCATION

69

101 Dorp Street
Private Bag X9489
PIETERSBURG
0700
Tel.:015 297 0110, 015 297 0590, 297 0392, 297 0386
Fax: 015 297 0885, 015 297 0872

Enq. : Mateta N.G
Tel. : (015) 297 0110
Fax. : (015) 297 0872

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

.....
Superintendent General

21/6/2000

UNIVERSITY OF THE NORTH

Private Bag X1106
Sovenga
0727
SOUTH AFRICA

Tel: (+27 15) 268-3364
Fax: (+27 15) 268-3364/2965

E-mail: Laugkschr@unin.unorth.ac.za

**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

UNIVERSITY OF THE NORTH

Private Bag X1106
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0727
SOUTH AFRICA

Tel: (+27 15) 268-3364
Fax: (+27 15) 268-3364/2965
E-mail: Laugkschr@unin.unorth.ac.za

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

18 August 2000

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.

UNIVERSITY OF THE NORTH

Department of Mathematics, Science and Technology Education

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

August 2000

Dear Teacher,

You have been selected to participate in a province-wide survey of professional needs felt by **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 few minutes from your busy schedule to help us find out what Northern Province 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 or that of your school!) The results of this survey are expected to have a positive impact on the planning and provision of suitable, effective and continued in-service 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 and any other comments you may have to your Curriculum Adviser via your Principal, who will return it to us by no later than *21 September 2000.*

Thank you for helping us to help you!

Dr RC Laugksch
(Research Project Co-ordinator)

Ms AM Rakumako
Mr DT Mabye
Mr TH Manyelo
(Researchers)

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 <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*
17.	Develop lesson plans (i.e., learning activities) which incorporate 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*
18.	Develop lesson plans (i.e., learning activities) which <u>integrate</u> 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 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*
58.	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 = 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 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*
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 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*
64.	When would you prefer to attend in-service training workshops or activities in Mathematics / Physical Science / Biology (*please mark 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*
65.	What do you feel is your greatest professional need as a teacher of Mathematics / Physical Science / Biology (*please mark 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 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 <u>Physical Science / Biology</u> 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 <u>less important</u> 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 <u>school funds</u> 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.	<u>Outdated</u> 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 <u>learner</u> 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 <u>parental</u> 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!

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**Department of Mathematics,
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The District Manager: Hlanganani District
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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 D

Appendix D

Table 5: comments, by Physical Science teachers taken from the free-response section of STIN-NP.

Questionnaire No.	Circuit	Comments
0641	Bakenburg	Un-organiesd workshops
0682	Bakenburg	Improve content knowledge (n9)
0693	Bakenurg	To be able to do practical work (n44)
0755	Bakenburg	Need prolonged INSET for upgrading of teachers (n4)
1422	Bochum	No organised Physical Science workshops (n5)
3576	Bolobedu	Experience shortage of laboratory (n47)
3576	Bolobedu	Lack of parental involvement with their children learning
4635	Bohlabela	Problem of maintaining learner discipline (n36)
5771	Bush Buck Ridge	No Physical Science workshop organised thus far though needed (5)
4718	Dennilton	Lack of equipment (n47)
3411	Giyani	How to motivate learners (n24)
3844	Hlanganani	Need equipped laboratory (47)
3845	Hlanganani	Inconvenient location i.e. far away and no accommodation
3945	Hlanganani	No workshops offered for Physical Science and OBE (n5)
3947	Hlanganani	Shortage of classes
3947	Hlanganani	There is a lack of equipment and adequate working space (n47) and (n39)
6426	Konekwena	Insufficient equipment. Only grade 12 teachers are involved. W/shops to be conducted the beginning of the year (n47)
4865	Magakala	Making learners to develop concepts through Scientific Methods
5031	Magakala	Had no Physical .Science workshops (n5)
0836	Mankweng	Need safety and, security and equipment (n45)
1857	Mankweng	Need to know how to motivate learners & need for knowledge (n24)
1857	Mankweng	Need content knowledge (n9)
0099	Mkhuhlu	There are few effective workshops (n5)
2008	Mogodumo	Need content knowledge (n9)
905	Mutale	Need to know how to conduct field work (n30)
2833	Mutale	Lack of laboratory, electricity and other resources (n47)
5068	Nebo	Workshops fail to deal with my needs because they are poorly arranged
6251	Phalaborwa	Controll of practical and assessing large classes (n20)
1039	Phalala	No resources in rural schools (n50)
1115	Phalala	How to motivate learners (n24)
2221	Polokwane	No invitation sent to us about the workshops (n5)
2241	Polokwane	Upgrade my academic qualification (n9)
2309	Polokwane	I am not qualified to teach the subject (n5) and (n9)
4097	Ritavi	Need a center for INSET workshops which are free of charge (n5)
4125	Ritavi	As a temporary Teacher I am discouraged to participate in the INSET due to lack of money. We also experience lack of equipment (n47)

Table 5: Continued

Questionnaire No.	Circuit	Comments
4127	Ritavi	Lack of financial support prevents me from attending work shops which are far
5476	Sekhukhuni	No invitation to attend workshops (n5)
5476	Sekhukhuni	How to motivate learners (n24)
5525	Sekhukhuni	No workshops (n5)
0212	Soutpansberg	Need equipment, we usually fail to do practical work due to lack of equipment and resources, (insufficient text-books i.e. 3 text-books for 85 learners) (n47)
0267	Soutpansberg	No workshops offered. My academic needs are: Electromagnetism and waves (n9)
0359	Soutpansberg	I have H.E.D. Diploma (n63), and I need training on field trips since we failed to organize a successful one this year (n30)
0371	Soutpansberg	No workshops offered in our district or no invitation sent to schools. (n5)
0419	Soutpansberg	Circulars to be issued for all learning areas, and indicating workshop contents to be addressed in the workshop. (not related to items in STIN-NP)
0426	Soutpansberg	Invitation to w/shop comes too late. There are also no equipment available at workshop centers and in our classes (n47)
1325	Soutpansberg	No invitation for workshops. We request for workshop invitation and at the beginning of the year (n5)
5926	Soutpansberg	Lower classes are not receiving any workshop. (n5)
	Soutpansberg	I need to improve both knowledge and content (n9)
5946	Soutpansberg	Do not attend workshops due to late or no invitation to attend (n5)
	Soutpansberg	We need equipment and class rooms, (pupils are taught outside class-rooms) (n47)
3142	Thohoyandou	Work shop invitation too late (n5)
3173	Thohoyandou	Do not get w/shop circulars in time (n5)
3173	Thohoyandou	Need to assess learners in practical activities and also need Science centers (n19)
3264	Vuwani	In-adequate equipment and lack of laboratory (n47)
4660	Warmbath	Lack of parental involvement with their children learning result with children neglecting their work
2472	Zebediela	I do not get workshop invitation (n5)
2542	Zebediela	No workshops offered in our district or no invitation) given to schools (n5

APPENDIX E

APPENDIX E

SCIENCE TEACHERS' INTERVIEWS

Format

The letters " T1, T2, ...Tn'' are used for teachers who responded as interviewees. In some cases teachers who responded for the interviews were so few that it was necessary for them to form one mixed group of Mathematics, Physical Science and Biology and therefore three interviewers worked together in the same group. Letters I1, I2 and I3 are thus used for the interviewee.

INTRODUCTION: (applicable to all interviews)

We are very grateful of you, that you have come here and what we would like to do to you, is to ask you what issues would you like to be addressed in the future INSET workshops?

Now in order for us to be able to analyse information obtained from you; we obviously need to record in the recording format like the tape recorder. Writing is very difficult when there are many people to keep track of who was saying what and to capture accurately what you have all being saying. So with your permission we would very much like to use a tape recorder.

BOCHUM TEACHERS' INTERVIEW

Introduction

There was one interviewer and ten interviewees comprising only Physical Science teachers as per definition of Physical Science teacher: three male and seven female teachers, all from very poor rural schools. One of the teachers was already waiting to be re-deployed and another teacher, was newly appointed. In addition to Physical Science, teachers were also teaching other subjects like Mathematics, Biology, General Science, and North Sotho from grades 8 to 12. Their school enrolment ranged from 250 to 900. Teachers were allocated numbers T1 to T10 to identify them.

I: What issues would you like to be addressed in the future INSET workshops?

T4: What we really need and we have benefited from some of the workshops that we created on our own, we have seen that the learners benefited a lot from the workshops, because we have included the learners in the workshops, not only the teachers.

I: And what were you doing in such workshops when teachers and pupils are together?

T4: Usually we group teachers only, and we give ourselves some experiments. This one conducts this experiment, and that one conducts another experiment for the pupils. That is how we run our own workshops.

I: What time do you conduct the workshops, during working hours?

T4: Usually, we request for the whole week that we can teach all these subsections during that week...Science week.

I: **Which items do you like to be addressed in the workshops, for future workshops?**

T8: I think we are very poor in practical part. I think practical is very important in Science but our schools are very poorly equipped with those apparatus. So I think this type of workshops should specifically look at these aspect of the syllabus where *practical is very important* (n26). I mean that some of us cannot even know how to conduct Ohm's Law experiment because apparatus are not there at schools.

I: So you wish (No. 8) that workshops should do more practical work?

T8: I think Physical Science is more practical, so Physical Science teachers should be more knowledgeable with this *practical work (n 26).*

T4: I think that I do agree with T8 when he says practical part is more important but for the poor teacher who *cannot handle some of the apparatus (n28),* in the future let the department arrange workshops. Firstly for the teachers, workshop for the teachers not demonstrating, but the teachers themselves must be able to do that because I have seen in the past workshops we only stand there and look for the demonstrator doing things alone. Ourselves, do not *know how to manipulate (n28) the apparatus.*

I: So, I see...We as Physical Science teachers need a hands-on experiment?

T4: Yes! -Yes!

T8: There was one programme there. I remember UNIST (University In-service Training) programme. I mean that programme was very much fruitful. So I think progamme like INSET for teachers, there we were taught how *to handle apparatus (n28)*, how to perform an experiment and it was school-based INSET, but then it just went off (discontinued). I think the government (department of education) must look into this kind of things. If it can create some more INSET-workshops for teachers, it can be very much fruitful. Teachers need to be upgraded academically.

T4: We feel that UNIST must be brought back, it does not only mean that teachers must be *academically qualified (n 9)*, but practically too because we are doing the experiment. If we get equipment, we will be able to know how to manipulate these apparatus. We also need *skills of using the apparatus(n).*

I: So, you need training of teachers to improve their academic and professional competency?

T4: Yes!

I: Think about the method part of training, managing instructions and assessment, you comfortable with that field assessing the learners?

T4: I think of that particular programme you have just introduced of continuous assessment, it could be a good thing, only if... you send us well equipped people (relevantly qualified people) to come and assess us. You find that you send a person who measured in Biblical Studies, to come and assess me and help me, a teacher of Physical Science. Now what is the use of having such a system? We appeal to the department to implement such a thing (continuous assessment). They should send well qualified people to come and do that job and it should not be only the standard 10 teachers, it should be all the classes because the

school is not only the standard 10. Sooner or later all of us will be running away from teaching the standard 10s because we are the only ones who are being targeted.

T8: That is very true! That is why that funny name, sorry to say it, which I call Gorilla [term used for officials making unexpected school visits]...(from the background...Ya!). I mean, if people are coming to our school and most of them have majored in Northern Sotho. I have seen them. They come. You give them your test books, your class work and after that they just give marks and sign them and tell you nothing. That is why some of us are chasing them away from our schools because there is absolutely no use for them to come to our schools.

T4: Because according to CAS (continuous assessment) every week we have to compile a schedule for class works, home works and assignment weekly, and having 300 kids, will that be possible for someone to do such a lot work in a week? So that is why we say that this particular CASS has to be restructured.

I: I don't know if one could relate this to the INSET, in this sense. How can the INSET intervene or help facilitate in this CASS process? Will there perhaps be a need for a workshop in which we can take assessment on board? How *do we assess large (n)* number of learners?

T4: I think such a workshop is also *needed*, definitely!

T1: I have never been to a course. That is why I can never say much about what do. Learning *how to do some experiment (n)*, will only help us here. There are no apparatus at our schools. We cannot be able to perform experiments in our school because there is no apparatus. Even though we try to *improvise (n 9)* but you can't do all, so it becomes a problem for us, like if you look at the Chemistry part. Most of the sections, they need the practical work. So if you don't have apparatus it becomes difficult for me to introduce them to learners.

I: Given the Chemistry chemicals you need and you go back to your school, will you have no problem?

T1: No!

T2: I say it is important for us teachers to know how to *handle some apparatus (n28)* because some of us, don't have any experience in handling some of the apparatus like acids, how to store apparatus like acids. In the laboratory, there must be training for us so that we can work with pupils properly

T3: I add more on what has been said by the two ladies. We are *not having apparatus (n43)*, and also *lack of laboratories (n)*. Even if we can have those apparatus, we don't know how to store it , how to put them on shelves, we don't know how are we going to store them because we are in lack of laboratories. Our pupils also don't know those apparatus even though you tell them this is a volumetric flask, he does not even have an image or an idea of what you are talking about.

T10: I think we can involve *learners to teach each other (n 33)* but when we are doing revision, and one other thing that bothers is that, I think we need to be retrained. I don't know how we can be retrained and be empowered with some skills more especially us, in the rural areas. We are faced with some kids who are not exposed to many things and I think that is the thing that lead us to failure, because even if you try to cite an example, they are not aware of what you are talking about, *they are not exposed (n 40)*. So I don't know how you can help us. Maybe just empower us with some skills, in rural areas more especially. I think learners in urban areas, are far much better. They have TVs, they have this, they have that, they attend shows but in our case... these kids ... don't know anything.

I: And the place you are from, has it got electricity?

T10: No! We don't have electricity. Some times we can't get generators. Much has been said about practical work, and immediately you do practical work, it becomes far much better for learners to understand, but just citing examples is not enough. In Chemistry where you can't do practical, it becomes difficult for them to recall these theories. They said why does Gauteng Province experience more acid rain than the Northern Province...but you can imagine a child, who has been born here, who knows nothing. He can't attempt such a question. He can't compare the two because he only knows one and the most rural one.

I: Is there any suggestion you can make?

T10: We are trying our level best but we find that it becomes difficult. Maybe we need to be equipped with the *know-how (n 5).*

T4: The problem that we are having here with these rural kids, I suggest that, for them to be exposed to these some of the adventure outside, like acid rain as you have said, we always get acid rain where coal is being mined. So the department must also assist in organising some tours for those pupils in the rural areas *to go and see those things* (n 30)

T10: That can also help us because some of the schools in the rural area are at a disadvantage. To prove this, people here are very poor they cannot afford to pay a transport from here to Witbank, but if the department assist them in meeting the pupils halfway if they go for *excursion (n 30)*, then such problems can be alleviated.

I: So, you need to arrange excursions and educational tours ?

T4: Yes !

I: Are you familiar with how to go about in arranging educational tours?

T4: Yes! Some of us are familiar, but I say the department must meet us half-way in the payments for transport. Yes, that's my request.

T5: I think the problem that we have in Science, the main thing are the so called *improvisation (n 23). W*hen it comes to experiment, I am trying my level best to improvise here and there, and the last thing is discipline. Pupils who dodge classes lack discipline, so and they need to be taught about the need for Science from the primary schools. The uses of Science I think we must start from the primary level. The school I come from is about 15 kilometer from Bochum College.

T5: I think another problem is the problem of classification of teachers. Some times at school you find that a teacher who never attended anything about Physical Science, maybe, he is teaching Physical Science. He may teach maybe standard 8 or some do not even know anything about Mathematics, and you find that another teacher who is able to teach that

subject, teaching maybe Physical Science at standard 10 and is facing very difficult problems.

I: **Do you some times find yourself teaching the subject you are not trained for?**

T5: Yes! And I think maybe the department must try to come out with something relating to classification.

T8: Maybe to add on what he says, I have got a similar problem at school, where you find that a teacher is given Physical Science or even Mathematics but that teacher has not got Mathematics and Physical Science when he was trained. Maybe he is given that in class in grate 11 and you are supposed to take that child in grade 12 and make him pass with flying colours! But when you try to complain to the principal, the principal says that he is trying to groom the teacher. You see! ... So, I think these principals need to be told that a teacher need only teach the subject that he was trained for because some of us are put in a very difficult situation. Because even now, they need our books, only grade 12 books ...Very poor work then, but where does it come from? It comes from lower levels! You see, you are up there... you are supposed to make them pass.

T7: To add to what the gentleman has just said, you find you are teaching many classes and you don't have enough time to can perform experiments. On the issue of classification of work, I am faced with a bad situation. I find myself having standard 8 learners who have been doing General Science. They do not know any thing about force, so I have to start teaching them and I cannot finish the syllabus so maybe that is one of the problem that we encounter which should be looked at so that teachers are given the work that they are trained for.

I: **Is this problem of been assigned a subject you are not trained for related to redeployment?**

T8: If I look at the situation at our school, you find that some of the teachers were very new in the field and those people who have been there for a long time most of them have not done Science and Mathematics. Now redeployment is here, is coming. So there is this LIFO (last in first out) that is if I am last I am going! Some body will tell you, I came here some years back, therefore I am remaining. So that the principal is trying by all means to tell that person

to teach the subject because he knows the roll is going down year and year. So you will be going (loose your job). That is the reason why you find that you are working as the last teacher, qualified but will be going. You cannot run away from that I mean you cannot argue it out ... The fact remains you will go! That is why you see you are used to train that teacher, who remains but not well qualified.

I: Are you happy to train that teacher in order for him to take your place?

T8: I won't be happy because I will be leaving my job. For the sake of the kids ... that is why I want to stay, that is why, we young teachers, who have done Mathematics and Science in particular, we do not remain in the field for more than five years. We teach maybe for three years after that we run away to the cooperate world. That is exactly what is happening because we are not secured.

I: You are not secured?

T8: Our jobs are not secured.

T9: What you have said, is what I have experienced. I am a new teacher. The one, who was teaching Physical Science before, got a termination letter by May. So I am having a problem.

I: On which ground was his post terminated?

T9: He was a qualified teacher but the post was terminated because of redeployment.

I: Thank you for your participation

BOKAMOSO TEACHERS' INTERVIEW

Introduction

There were six teachers involved in the interview, and all of them a pure Physical Science group as per definition of Physical Science teacher. In addition to Physical Science, they were also teaching Mathematics, Biology, General Science, and Technical drawing in grades 9-12. Their

class size range from 18-72 learners. They were all from township schools having the enrolments of between 300 and 800 learners. After answering their questions, we then started with the interview questions as stated below:

I: Is there any problem which you might require INSET workshop to address?

T3: We do have problems, when I come to this school 'X' for instance I become very much impressed when entering the laboratory. At our school we don't *have a laboratory. We only have a little room, a storeroom, where in all chemicals are packed there (n 39) and really is a problem* because when you have to perform an experiment, you have to pick up the chemicals to the classroom. It is a tough job. Sometimes they brake on the way and so on. You can imagine carrying the acids and so on and, of course performing the experiment most of the time you find yourself doing only the demonstrations, and as far as the students are concerned, to some extent of course they are deprived. Because surely it must be a hands-on process sort of, so these are some kinds of problems one is encountering up to so far. So you know I am looking forward to a situation where by at least we can find ourselves *having a laboratory (n).*

I: So you do have apparatus?

T3: Well apparatus, not enough, but the chemicals, yes we do have some chemicals, in that case is not such a problem but *equipment surely is a problem (n)*, serious problem, yes.

T1: Maybe to add on what he had just said. I think it can be nice if equipment is always in the same space or in the same location unlike moving *from one point to another (n 39).* Time and again you are making arrangement. It saves time if they are well stored, in the case of CASS (continuous assessment) you will wonder in other schools they have not even received a circular of these and you are even given a dead line that it must be submitted and so on. So it means to me, there are some schools where the progress is being frustrated whereas others not even information is given let alone the apparatus and so on.

I: Look at the nature of INSET and the role it needs to play, such as developing skills, they may be professional or academic nature. Think along those lines, the way in which one can present lessons. Do you come into a situation when a learner can teach other learners?

T1: In my case, it was not a case (no).

T2: Normally a question of having a *learner teaching other learners (n 33)...* unfortunately we normally don't practice that so much, but what we normally do is, we let them work in groups. Groupwork is what we normally concentrate so much on, but as far as a *learner teaching another learner (n)*, that one we normally don't practice. Learner teaching each is an concept that can help so much, it can help so much because I mean, I think if it is a learner teaching other learners, they are just on the same level and you know they feel free I think, when taught by a colleague. I think that they should be so much free than when one should teach them as a teacher. You may even find out that sometimes you may offer them a lesson on certain topics. You may be surprised perhaps to find that when they are taught by another learner they even understand better than when they are taught by a teacher. Surely I think that is one thing that needs to be considered so much.

T3: I don't think that there is anything wrong with that as long as you know that a learner is good enough to deliver something. I don't see anything wrong with that so of course he can share everything with them.

T2: The concept of learners teach each-other *(pear tutoring, n 33)*, to me is not clear because according to 'Outcomes- based education' it is the teacher who introduces topics. Teacher researches on the learners, their background knowledge based on the topic, but to say a learner teaching a learner, to me is just unsound because a learner has to be acquainted, had to be taught, had to be equipped with the knowledge of the topic first.

T1: At the same time, it maybe a problem of misconceptions. The learner may have his own view or her own view on the subject or the topic. Now when he presents to others he will be passing over his misconceptions. But we• are well aware that in Science we have a lot of misconceptions. It will be better if we as educators can be responsible for leading the class as a whole. Well, engaging in discussion, group discussion, I think that is better than when a learner takes over.

I: When a learner teaches other learners, what do you think of discipline, may it not impact on discipline?

T1: I don't know about other groups; from my experience like I normally walk around in the afternoon, they normally do it when they are alone. It depends on the attitude of the group as a whole. It was better among the in-groups. They did better because I am sure in the class. They have different attitudes towards each other, towards the subjects itself, so if you take all this attitudes and put them together. If they have the same attitude it is easy for them to select one and say, come and work with me. I think they did progress *as small groups;* but not the whole class. We have this problem of you find you have three groups in a class, one group will be of those who are repeating, the other group will be those who are new and a little bit lets say brighter, and we have this few groups who are average. There are gaps already. Now you try to take somebody who is a little bit brighter and new, trying to lead those who are older, who are repeating and it creates a problem unless a person has volunteered that I can work with this one. That makes it better.

T2: I think the situation can work, in as far as the learner is to be involved. The situation can work as corrective measures. That means doing some corrections, perhaps after the teacher has given some work, say home works. Learners having chosen one whom you know to be good to be given an opportunity of saying if there are sums to work them on the board. You know if it be any other form o topics other than sums, giving them a chance of debating on the topic concerned. A teacher should always be present to act as a facilitator, to give them some directions, but letting it loose, really teaching by learners teach each other may cause a very serious disciplinary problem and misconception of concepts as the speaker has just said.

I: I seem to understand that you say yes if learners are involved in presenting a lesson, it does not mean disengaging the teacher

(Yes. response by teachers)

I: What about discipline at your school? Regarding discipline, are you all right?

T1: No. We don't experience disciplinary problems.

I: Your kids are well behaved?

T1: Yes.

T4: Sometimes in grade 9 we do experience problems because the children are all ready in the adolescent stage, so the teacher has to guard against these pupils and then if they can get guidance discipline won't be a problem.

T2: Yes...perhaps one could come into this situation. My understanding is that we are driving our learners towards OBE (Curriculum 2005), based on outcomes. Presently we are offering this Science subject in a theoretical way even though we perform experiments, practically we are no longer going to deal with Physical Science as an isolated subject but Natural Sciences.

I: If we are not going to apply OBE in the near future, should INSET still embrace OBE?

T2: That is exactly what we need!

I: Thank you for participating.

HLANGANANI TEACHERS' INTERVIEWS

Introduction

There were nine teachers involved in the interview, and out of these teachers three were Physical Science, four of them were 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. After answering their questions, we then started with the interview questions as stated below:

I: What could affect the number of teachers from attending INSET workshop? You could or may explain in as much details as possible. You are all welcome, to state anything that you would like to see being offered in the workshops. In other words, as a Mathematics or Physical Science or Biology teachers that 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 a great impact when it comes to the *overall control or monitoring* of the work of the children *(n20/19).* 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 4, feel free to say what ever you wish to.

T4: Taking into consideration the area that we are being rural and also *not equipped with equipment (n47).* Textbooks usually come very late and we find ourselves sometimes unable to *improvise (n40/23).* I think in workshops methods of *improvising (n40/23)* 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 (n42).* Maybe because of *lack of proper equipment (n47).* Thus if there was an alternative *of improvising things may be found* (n40/23).

I: Do you want to learn more about improvising?

All: Yes.

I: Speaking of lack of equipment in your schools. Suppose you were to be supplied with equipment in due course, will you be comfortable in managing and utilising it?

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

I: I mean, if the department gives you equipment, so do you have the skills to use it?

T4: No, we do not have *adequate skills* to use the equipment *(n11)* and I was thinking of *improvising (n40/23),* where you find that the school does not have money and the *equipment are not available (n47),* like for example (not audible).

I: Ok, my question is whether you will 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: T5: Yes, in Biology. I can do that.

T3: Yes, generally we do have skills, but what we are *running short of are the equipment (n47).* 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 (business) and *not the things that are in the syllabus (n 36).*

T2: Not in that...(not audible). May be as teachers, something that...(not audible). Another thing is that *the classes are over-crowded* (n 32) and grouping is very difficult. 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 (n42/29).* For instance, to *relate the mole content to the pupils is difficult* (n42/29). They can not even imagine what is happening there.

I: **Could we please find out what is the most difficult aspects of teaching Physical Science if you are a Physical Science teacher or Mathematics if you are a Mathematics teacher or teaching Biology if you are a Biology 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 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 (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 can not proceed to the other standards and are *unable to apply their knowledge of Mathematics to real life* (n29). Maybe 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 can not be seen, they do not need that (n9).

T9: ...(not audible) but if may be *parent involvement*...(not audible), because if *this kids go home early they say nothing* (n36)...(not audible).

T5: I think as I see the problem is *learners are not actively involved 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* (n 7). Even if you try *to motivate our learners (n 24)* 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 because at school is very much difficult for us as they were *not motivated (n 24)* 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 de-motivated cannot get good results. Naturally they are inactive and they do not participate actively in class. 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, 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 (n24).* 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* (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 who are coming to school are sent by parents who are rich enough. Now more parents have being re-deployed, 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 some thing 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 above 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, 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 thing given to good performing learners but now nothing.

T3: What I was thinking about is teacher information and *empowerment (n22 / 47).* 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 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 should be established in all schools not one school in order to be *effective.* 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 loud.]

I: Thank you for participating.

MAHWELERENG TEACHERS' INTERVIEWS

Introduction

There was one interviewer, and five teachers involved in the interview (four male and 1 female). All interviewee were classified as Physical Science teachers (i.e., pure group). They were all from township schools with enrollment ranging from 529 to 1000 learners. These teachers reported their class size to be from 27 to 40 learners. In addition to Physical Science, these teachers were also responsible for Mathematics, Business Economics, and General Science in grades 10 to 12. After answering their questions, we then started with the interview questions as stated below:

I: Could you perhaps in greater detail, as much as possible, state what you would like to be included in a Physical Science workshop?

T1: Having being involved in a number of in-service training with teachers, I think is very important for *teacher development (n9).* Teacher development must be linked with accreditation because in many instances you may find that lack of accreditation on workshops attended by teachers, make teachers to despise those work shops. Teachers will not continue to carry on with whatever they shall have gathered. So I think it is important for this workshops to fall in perspective to be accredited some how.

I: Yes, but now which contents must the workshop address, in terms of professional or academic content?

T1: No, what I am saying is that because a teacher is an asset [Yes! from the background] whatever he does must actually built up, so that as a resourceful person he is able to be utilised. But as of now what is lacking in many workshops that we have conducted you may find out that they are methodology wise, they are in line with what is expected with the classroom arrangement and the like. Some of them are academic. The problem is when a teacher must at the same time revise that work. Something must be there to motivate those teachers, to really attach the workshop attendance with his development as a teacher. That is the point why I am saying accreditation is one factor.

I: Yes your point is quite important, and I can see that you are quite an experienced teacher. Teacher 2 is there something that you wish can be included in the workshops? Is there anything as regard to the teacher in the classroom?

T1: Another factor I think the workshop must address, is the question *of assessment (n).* Assessment is one factor, because I think it consolidates that which the teacher shall have time and again trying to archive, so the problem of assessment is one factor. You may find out that we are teaching the class of learners, we are giving the work of low standard and evaluation of low standards. In grade 12 the embarrassment of poor results comes into the picture. So I think one factor which should be brought into being is assessment. This question of *continuous assessment (n 20)* I think is one factor that must be looked into very seriously, otherwise the teacher of these days, most of them, on average, in content wise, I think they are a little bit OK. The question is the method of teaching; this is where the problem lies. The question of practical work, conducting practical work, experiments must be done in such a way that when the learner moves from the high school to the tertiary institution, that particular learner must be able to apply knowledge gained.

T4: If they call for workshops, they must also include schools in the rural areas, because according to my experience... most of the workshops conducted... we find that they do not include schools in the rural areas (i.e., invite us).

I: Could you elaborate a little? Is it that they are not being invited or do they find the contend being taught not appealing?

T4: No they are not invited, because you find that the whole year , the teachers from rural areas , like our school, you find that the whole year no one is attending the course.

I: Yes sir, but you have needs, do you have some problems, which you feel the workshop can address?

All: Yes!

I: Could you give an indication of what those problem can be?

T4: For example in urban schools, you find that they are having experienced teachers. If you compare the results, you find that they are performing well compared to the rural schools. So if maybe workshop organisers invite rural schools and the urban schools together, then I think that there can be some improvement.

I: Don't you know what problem these teachers might be experiencing which may ultimately lead to the poor results as opposed to teach in urban areas?

T4: I think discipline, not necessarily content [*how to maintain learner discipline (n 36)*].

T1: I think another need that is quite important is this thing of separation of a worksheet. In fact *design of lessons for Physical Science (n 23)* wherein a worksheet has to be prepared and learners have to be engaged into the activity of the lesson. I think this is one factor because you may find out that the textbooks that we are using are so old-fashioned that they really make it difficult, even if you are well to do methodology. You struggle very to use activities, class-work designed in those books. So I think that there is a need for a document, which really help teachers to use as a worksheet sometimes for daily lesson. The worksheets we are proposing should be in line with continuous assessment guidelines. We need that kind of document (worksheets). But then there should be workshops to make teachers orientated to the worksheets.

T5: Can I get your question very clear that I am afraid I don't want to answer a question that I do not quite understand. You are saying if workshops were organised maybe by the department or whoever, which areas must be areas of focus of the workshop, is that the question?

I: Yes! The question we want to know is what are your needs for INSET? That is, the professional, or non-professional needs of your teaching in the Physical Science classroom for INSET to address.

T5: Oh! Maybe the focus should be on the question of practical. I have observed that there is an emphasis on our dealing with the theory in Physical Science and there is no practical work. The workshops that are usually organised only concentrate on the theory part. Workshops should be focused on *performing the experiment (n 26)*. There should be resources at schools to match with what transpired at the workshop. I think that is my point.

T1: I think problems encountered by the teachers should be given before the workshops, so that during the workshops those problems should be covered. If a teacher is having a problem with a certain chapter s/he should give it and then during the workshop, if there is somebody who has got a knowledge of that could help

I: She mentioned practical?

All: Yes!.

I: During practical, what is it you need? Hands-on by teachers or demonstration by the facilitator?

T3: Not observing but being involved. Helping each other. Sometimes you find that if you are alone, some of the thing you may get problem in experimenting.

I: And suppose you have mentioned that you really need apparatus, and we don't have problem in keeping them? Maintaining them? And ordering them?

T3: It is difficult, if we have apparatus, our schools don't have a night watch. There is a lot of vandalism at our schools and sometimes we might find that they have been broken into.

I: If it were not for thieves, yourself, are you capable of handling them?

T1: Yes!

I: Ordering them?

T1: I think this is the area which I think the government must take very serious, because I think when we were with this issue of Micro Chemistry kits, when it was introduced in our area it was a problem indeed because we were told that this project must run in such a way that it is cost effectiveness aspect is also considered, so that government wants to relegate responsibility of purchasing those equipment. So it become very difficult even as of now it

becomes the burden of the parents because if you want to order materials, you must use the school fund in order to buy that.

I: The question I want to pose is this that the principal says "Yes! Here is the money. You are our Science teacher. Place an order with this money".

T5: And I don't even know the amount and estimates, I just put whatever I want just to say I want this thing and this thing. [Yes!] I don't think we shall have a difficulty in doing that.

T1: We have difficulties in the first instance, this equipment was brought by a particular NGO. We do not know from which company they come [Yes!] perhaps it was brought in the school 10 years back.

I: So in short, you mean that we must have workshops in which we must discuss these details?

T1: Exactly! I think we have a problem, like I have mentioned. We have a serious problem. Teachers want to develop.

I: Should there be INSET providers such as the University, which does offer such courses and crediting us with some degree courses in the Science?

T1: It's long overdue! We needed that a long, long time ago. I must be very honest, even Curriculum Advisers that we have were just appointed. They do not know how to perform experiments. Most of them were not orientated. We just need an institution that will organise and build up an infrastructure that will make teacher development possible.

I: In other words, we will develop the academic and the professional competency, and this must be accredited?

T1: That is true.

I: Thank you for participating.

TSHAKUMA INTERVIEWS

Introduction

There were five teachers involved in the interview, and out of these teachers two were Physical Science, one of them was Biology and two Mathematics teachers. One of the two Physical Science teachers was also teaching Mathematics grade 12 and the other, teaching Biology grade 12. A Biology teacher was teaching other subjects like Economics and General Science. The Mathematics teacher was also teaching Venda and another non-examinable subject in addition to Mathematics. They were all from rural schools having the enrolments of between 270 and 750 learners. There were three interviewers. After answering their questions, we then started with the interview questions as stated below:

I 3: So, three schools represented today?

All: [yes!]

T1: The main problem as the other teacher has already made mention of, we have a shortage of classrooms such that when it comes to say a laboratory, I think it is still going to take some years for it to be available. One finds that even though one might be having some chemicals and some apparatus, you do not have room, *you store the apparatus haphazardly (n39)* but taking the apparatus out to perform some experiment won't help. Our school is such that we still make use of ...we call them 'mokhukhu'(tin sheet structure, for Science). We also have a problem with children that do learn Science. Problem number 1; some of the children don't have aptitude for Science. (Number 2) When it comes now to equating subjects, you find a student will not be able to change the subject for the formula in Mathematics. When you give the child now a problem for arguments sake you want the volume to be the subject of the formula, that becomes very much problematic so that's why I say some children fail to equate subjects. One other thing, children are very much relaxing. You give them assignments, they don't do; you give them tests, they abscond.

I3: Do you get co-operation from learners?

T1: Just to set an example in grade 12 I have got 12 students. Let me tell you, one of the 12 students only wrote the exam which was conducted in May and June; all the other tests he

has not written. When the time for Science (Physical Science) lesson comes, he just goes out to the toilet or around the school.

I3: Do you mean that class attendance is poor?

T1: Class attendance is poor as well as the execution of the assignment that have being given to the children.

I3: Are you in a position to encourage the children to behave well?

T1: We really try to encourage them to show good of what is being done in the subject to the real environment but it does not make them. ...(not audible)

I1: In fact Teacher 1 has stated some of the problems, I think even Teacher 2 do have some problems in his teaching or classroom-teaching, so could we please listen to what Teacher 2 needs to be helped with?

T2: Our problems are more or less the same because what I am going to say now will be in line with what Teacher 1 has just said now. I am also a teacher who is offering Science (Physical Science). I also do experience the very same problems of *students not doing their work (n24).* You give them an assignment, you are going to find that, out of for example, I have got only 13, who are doing Physical Science in grade 12. Out of 13 you are going to find out that two or three have done the assignment correctly but the rest, you try to find out, only to find out that they are just lazy, there is nothing else.

I3: Have you ever punished then?

T2: No, I always tired to speak to them and show them the importance of doing things on their own. To have what we call confidence in themselves and tried to find out certain things on their own, instead of me giving information maybe giving them notes, that is spoon feeding but only to find out that they are *not motivated (n24)* at all.

T3: One of the things is that parents are not involved in the education of their children. That is why you find them (children) *not disciplined enough (n36)* and there is this issue of...'discipline go hand in hand with a sort of,, what is so called corporal punishment' and

right now the education act is not allowing, not to say that I am against it, but is the government need to find another way of trying to enforce the discipline in the school situation because students are not going to write home-work; they some times come to school with dangerous weapons inside the school premises. So if there is that problem and if that problem is not being addressed, I think that students are still going to fail the exam. That is my contribution.

T4: In my school, the results can't be good because learners know that even if I don't do the work there is nothing that can be done to me. The issue of *lack of motivation (n24)* on the part of learners we try to guide, and show them the right way but we are given the reason that even if I pass this Mathematics, I am not going to find a job. There are many reasons that learners give us. Discipline is a major factor.

I3: **You mentioned the fact that students some times write the mock exam, when you set an exam yourself, do they pass that exam and can you say with confidence that those who pass your exam, will pass the end of the year?**

T4: Some of them write the exam which are set by teachers ... some of them you will find out that a ...some may even dodge, although they know that the exam is set by the teachers. I think those who use to write tests and examination throughout the year, there is a chance for them to pass rather than a student who just aims to write the exam and goes away.

T5: The other problem we are experiencing at our school is *overcrowding in a classroom* (n32), so you find that you are teaching more than hundred children in one class. Then they don't have again the table, the chairs, you find them sitting four-four (on a desk) and again it's difficult to pay attention to all of them and then again that problem of parent involvement. Really in our school they are not involved. Even though the principal can call the meeting, they will never attend. This *problem of discipline (n 36)* maybe if the government can come with another way of disciplining these children, to motivate them to do the work because if you just speak to them, doing nothing, they themselves are relaxed.

I3: **Do you have workshops being conducted in Venda and is there something you wish these workshops to do for you?**

T5: Yes the workshops are important and unfortunately especially in Biology, there were no courses (workshops) conducted in Biology except the once which was conducted just now because they are giving the scope, otherwise from January, till now, they never have that course of Biology. The government this year we are using the new syllabus. They did not supply us with textbooks. You find that the only textbook you are using that is for the teacher. The children themselves don't have. So you (the teacher) are to make the notes for them, for every thing and those notes, they do not read.

I1: May I just ask... you have mentioned the new syllabus, what do you mean by new syllabus?

T5: The textbooks especially like in grade 8 and grade 9, they are using the, this new textbooks and then you find that mostly in our schools they did not supply us even myself the textbook I have to go to the bookshop, to look for it. But they were just sending the syllabus. The syllabus is like this and this. Then the textbook we are using, the old textbooks, maybe you find one topic, two topics then the other topics in another textbook. I mean there is one textbook with all topics.

I1: Mr. Maepa talked of workshops. You each one of you listed a number of problems that you experienced. If you think of the in-service training workshops that could be held, what kind of topics would you like those workshops to address? You are free to say whatever you like.

T3: I will talk more especially on the side of Mathematics, the kind of workshops. I will suggest that topics should be from *problem solving*, that is students should understand the question and also to understand how to solve that question. After solving that question they are suppose to do 65% of the work, because right now we as teachers are doing 90% of the work and the children are doing only 10% and that issue *of spoon-feeding is very much dangerous to our learners (n 5).*

I1: Thank you, any other topic, you suggest that people should cover?

T1: One of the things we realised is, the work-shop should rather look at the issue of ways and means of encouraging the children to have a *hands-on activity (n26)* in that I for one, have realised that the children are very, very much lazy. One of the things that make them to be

lazy is that, we as teachers do too much work, leave just bits and pieces for children to do. This is because even if we can give them 75% of the job to do, they still won't do. So if we can have ways and means of encouraging them to go and work, because at the end of the day, they are the ones who are going to be faced with the examinations, not us the teachers. We should just be there to guide them and show them the right way. With me, I am not ashamed to tell you that...as from the beginning of this year out of 12 students, only three have asked me questions or a question of some sort. The other nine, the period comes, period ends, go write tests ... failed. I explain the problem areas as regards that, no comment ... so ways and means have got to be done to ensure that we communicate. It must not only be the teacher that is on the forefront.

I1: Do you have any suggestion for encouraging the learners in the way you have just described?

T1: Yes sir, I hope that we also have to really encourage the parents to put the foot in, like say if the child comes late home, the parent should want to see work or ask questions as to why are you looking at the "Bold and the Beautiful" (TV series) instead of doing that Mathematics work because most parents have gone to school to a certain extend and they really know with subjects like Mathematics and Physical Science is not possible that the whole week might go without exercises and home work done by the children. So if the parents do not push their children on the other hand is only left to the teachers who are finding the good and bad. That is why ... in some of the workshop, some of the parents should really be called upon

T2: To make a follow up on that question, I don't have any problem concerning the issue of performing experiment. I have done most of these things when I was at training, so, the only problem is the fact that we don't have enough of those apparatus and even the exact room (laboratory) where we can do that and even the sizes of our classes. You find ... all to find that you have got *too many students (n32)* in such a way that is very much difficult to do that. Concerning the know how, of doing the experiments, no problem with that.

I3: Suppose your school is given money to purchase equipment, can you buy? Do you know where to buy?

T2: Up to so far ... I can't say exactly, but we need some assistance if we are given enough to do that! I think it can be possible for us to have such.

I1: Now equipment cost a lot of money, as you know the majority of the budget of the Northern Province goes on teachers salary. In other words it is very unlikely that the department is going to give you a lot of equipment. What do you think you can do to overcome the shortage of the equipment?

T2: There are a lot of ways to overcome that type of problem, for example while we were still at training, we were also told to do what we call *improvisation (n 23.* To use the available materials to make some of the experiment for example, if I may give you an example. I still remember teaching Physical Science grade 10 and doing that section of light: reflection, refraction, total internal reflection. I was doing this experiment of the application of total internal reflection. We tried to make our selves a periscope, made use of card-box, few mirrors and all to find that it was working, so it is very much simple to do that.

I1: As a follow up, I was saying that if a workshop was to offer skills on improvising for practical equipment that is not something to be required?

T2: I think that can also be taken into consideration. It can help us a lot because most of us, are in the schools where you don't even have a single of those apparatus.

I1: Something that you agree with or something you don't agree with? Biology teachers? Physical Science teachers? Improvisation of apparatus? Something that you might like to know more about? Or not really?

T1: I think we can learn ways of *improvising (n 23)* that will be very good because we won't go on saying I don't have this typical kind of an instrument and as such, I don't do this particular kind of an experiment. But in addition to that bearing in mind that money is scarce, I should think that the department should rather try to have centred laboratories (resource centres) say now in a particular region 'you have one laboratory' where people can get assistance. You can there after even get people from the regional office to assist in such centres.

I1: Do you mean that you require teaching approach i.e. methodology?

T1: Yes! Because people are trained in different ways. Like for instance right now, from lower level they are being taught this method of OBE *(Outcomes based-Education; n5)*. You see now, there is where we are going to need now some of the assistance.

I3: What specifically in OBE that you may be interested in?

T1: In OBE I am interested in language and literacy because if a child doesn't understand, he is not going to solve any problem. Fortunately this year the government has introduced the so-called *continuous assessment*. In continuous assessment, is the assessment that is very good when assessing the students because it is a continuous process. If we take the learner's portfolio and the teacher has his own records and is also going to involve parents, because parents are going to see what is happening in the learning.

I: Thank you for participating.

VOWANI TEACHERS' INTERVIEWS

Introduction

There were five teachers, two for Physical Science, two for Mathematics and one for Biology. A Biology teacher was also teaching Economics and General Science, one Mathematics teacher was teaching Venda (language) and other subjects not for examination; one Physical Science teacher was also teaching Mathematics in grade 12 and another Physical Science teacher was also teaching Biology in grade 12. All teachers were from rural schools. This was a mixed group (i.e., Physical Science, Mathematics, and Biology teachers together). The school enrolment ranges from 290 to 780 learners. Teachers reported their class size of about 40 learners. After they had no further questions and clarifications, the three interviewers then started asking them the interview questions as stated below.

T5: It is a rural school, our school is not so much developed, we do not have major *resources* (n22/47), 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 taken it as very difficult for them. As far as motivation, the whole subject is interesting but they are feeling *de-motivated (n24)* mainly because of the environment they are from.

I: Are you all coming from the same school?

T1: No, I come from the same school as Teacher 5, and I have said that we are often disturbed interrupted by cows and goats. Many problems are already mentioned by other teachers. 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* (n14). 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. When you give the child a problem, say for argument sake he must make the subject of the formula, and if is in other subjects then it becomes a problem. This is 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 1 has started 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 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 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 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 way of trying to solve this problem. Students are not writing home-works, and sometimes they come with dangerous weapons around the school premises, 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* (n36), even the results are poor because of discipline. If a learner knows that there is nothing that is going to be done to him, that learner will not take the work serious. Learners *lack of motivation* (n 24). *We* teachers are trying to guide them, to show them the right way. But we are de-motivated 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: When I pick up your point, is that students do not write tests, but do they write mock exam and final exam? Can you say with confidence that those who have passed mock exam will also pass the final exam?

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 5? I think you want to be a better teacher and produce 100% pass. So what are your problems? What are those things that prevent you to be a better teacher to produce better results?

T5: Maybe 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 tables and chairs. So you find it difficult to pay attention to all of them. And again that problem of parents involvement really in our *school they are not involved even though you call them to hold a meeting (n).* They will never attend. Maybe the government may come with other way 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 conducted here in Venda, is there something you wish this 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. 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. 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 textbooks, we are using do not have some topics. There is one new textbook, which has all those topics.

I: Teacher 5 talked of workshops, and each one listed the number of problems that you have. If you think of in-service training workshop, 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 question. 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 spoon-feeding 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 worksheet of 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 worksheet make too much of the work for the teachers. 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. (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 because there is *only the teacher who is talking (n5)*.

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, lets say the government provides you with those equipment that you need. Do you have some skills of using at equipment? 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 (n47).* The sizes of our classes are too small that you cannot do any *experiment in it (n46).* But concerning the know- how of the experiment we do not have any problem. Both schools need to be electrified because some experiments need electricity.

I: Given that new equipment of course cost 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 equipment. So what do you think you should do to overcome shortage of equipment?

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 (n 23).* I can also improvise some of the equipment to use the available material to make some of the experiment. 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 card-box and some few mirrors and only to find that is working and was very much useful.

I: 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 that should be taken into consideration. It will help us a lot because most of us we are from schools were *we do not have equipment to perform practical* (n47).

I: Is that something that you agree with or something that you do not agree with, Biology teachers, Mathematics 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.

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 with experiments. Say a well- centred laboratory with all apparatus accessible to a given number of schools 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 you 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 say that.**

T1: There is this problem where you find teachers teaching grade 12 are the only people you call for workshops. 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 trained (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. From there we can even invite people from the province to help us with the *approach of teaching the subjects* (n 5) because people have been trained differently 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. 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 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* (new item). When we do classification at the begining of the year, you will find that *some teachers are given subjects that they were not trained for (n9).* 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. 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).*

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 (n9). 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 practical (n44). 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 (n44).* 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 (n44).* May be if they *can be taken to the real situation* (n29) to know exactly what we are talking about. For example, if we take of inner parts and take these pupils to the hospital to see how people there operate the inner parts. Maybe they will be stimulated.

T3: Yes, I have realised that pupils are interested in things, which they can do practically 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. Let's 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 where in 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* (n29). 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 practical to make students understand* (n47).

T1: Yes, the topics are not difficult. *The problem is to unpart that knowledge to the children* (n5). For arguments sake, if you look at some of our curricula, our curricula need a child to *have insight of wide science subject knowledge* (n29) and it also goes to the general stream subjects with one science subject of which is Biology. I take it from standard 6, the child who has done General Science but when it comes to standard 7 he now have to take a special role. It quite so happened 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 *negative feelings that Science is difficult* (n14). 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 a view, tell them of *only things they make use of everyday* (n29), and at the end of the day in a lesson tell them of a soap, then they will cope with the subject. Thus there still is 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,* who had *not done 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 exam 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.

I: **Thank you for participating.**

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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 Your school's EMIS (difference) Number

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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

6727

DESIGNED BY MGX (011) 453-6560 JULY 2000 MGX341

PAGE FOR YOUR EXPLANATIONS, COMMENTS, AND/OR SUGGESTIONS

ANSWER SHEET

IMPORTANT:
- Darken the circle completely
- No stray marks on form
- Use Black or Blue pen only or Pencil. If you use pencil, please erase correctly

CORRECT MARK ● INCORRECT MARKS ⊘ ⊗ ◒ ⊙

Please start here :

SECTION A:

1 (A) (B) (C) 2 (A) (B) (C)

SECTION B:

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4 (A) (B) (C) (D) (E)
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For teachers of Physical Science / Biology only–

42 (A) (B) (C) (D) (E)
43 (A) (B) (C) (D) (E)
44 (A) (B) (C) (D) (E)
45 (A) (B) (C) (D) (E)
46 (A) (B) (C) (D) (E)
47 (A) (B) (C) (D) (E)
48 (A) (B) (C) (D) (E)

For teachers of Biology only

49 (A) (B) (C) (D) (E)

SECTION C:

50 (A) (B) (C) (D) (E) (F) (G)
51 (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) (AA) (BB) (CC) (DD) (EE)
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69 (A) (B) (C) (D)
70 (A) (B) (C) (D) (E)
71 (A) (B)
72 (A) (B) (C) (D) (E)
73 (A) (B) (C) (D) (E)

For teachers of Physical Science / Biology only

74 (A) (B) (C) (D) (E)
75 (A) (B) (C) (D) (E)

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 have had an idea 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 Langenhoven
(Research Project Co-ordinator)

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 items 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 ...

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*

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*
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*

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

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: Above completed is 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 9.

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...

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 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** = Kanekweng; **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** = Rohlabela; **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 the 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 7.

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 have

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!

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 5.

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

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!

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

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.

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 individuals 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 Principal, who will be able to supply it.*) Note: 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 all items.

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

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

Thank you for your assistance in this survey – it is greatly appreciated!